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Technology Strategies for Business Planning

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Introduction

The past decade reveals management's growing awareness of the need to incorporate technological issues within strategic decision-making. They have increasingly discovered that technology and strategy are inseparable.

Even in the literature, material relating to technological considerations to the strategic concerns of business for long have remained unanswered. However, several economics-based studies of innovation have pointed out vigorously the importance of seeing technology in strategic terms. Moreover, a large percentage of technically successful projects have turned out to be commercial failures. The answer lies in the "total process" by which technology would be incorporated within the general concerns of business. One way to achieve this is for the manager to begin to think about technology in strategic terms.

The first major effort in this direction was C.K. Prahalad's current review of the work by R.K. Rosenbloom's "Technological Innovations in Firms and Industries." These few viewpoints are also at the centerfold of the overwhelming message of the past decade's business research.

Methodology

This "Technology Strategies in Business Planning investigation is accomplished in three parts; the first two consist of two separate tasks. The interrelationship of these parts and tasks is illustrated in Figure 1.

In Part I, the basic planning model is described; in addition, an approach is formulated to insert technology management issues into overall planning processes. Part II identifies the stages of the planning model which are impacted by technology considerations. The technology management issues at this stage are interfaced with the planning procedure by properly identifying the ties of each process at each step. Part III integrates the two approaches in developing an overall planning model.

Overall Planning Process Modification

Business planning is defined as a rational process which requires anticipated future circumstances, both external (environmental) and internal (company), and developing within the context of that future, a company mission, objectives, guidelines for action (policies), implementation plans, an organization and controls designed to achieve the objective. This process is illustrated in Figure 2.

The purpose of business planning is to determine the most profitable manner of allocating limited resources among competing alternative profit opportunities. The technique for technology strategies insertion into the overall planning starts by defining the company's technology profile. This is an overall company assessment of current products, R & D investment, and organization. Next, an internal and external scan of technology environment is undertaken, which goes beyond the limits of the traditional business cycle. It is followed by technology directions and incoporates these effects into future scenarios, to enable a complete evaluation of the company's operations in a time frame considering other factors, such as economic and environmental ones. This exercise sets the stage for identifying and systematically analyzing key corporate technology alternatives and technology priorities. This is followed by integrating the previously developed technology portfolio into the overall corporate strategy thus assuring consistent objectives and effective implemen-

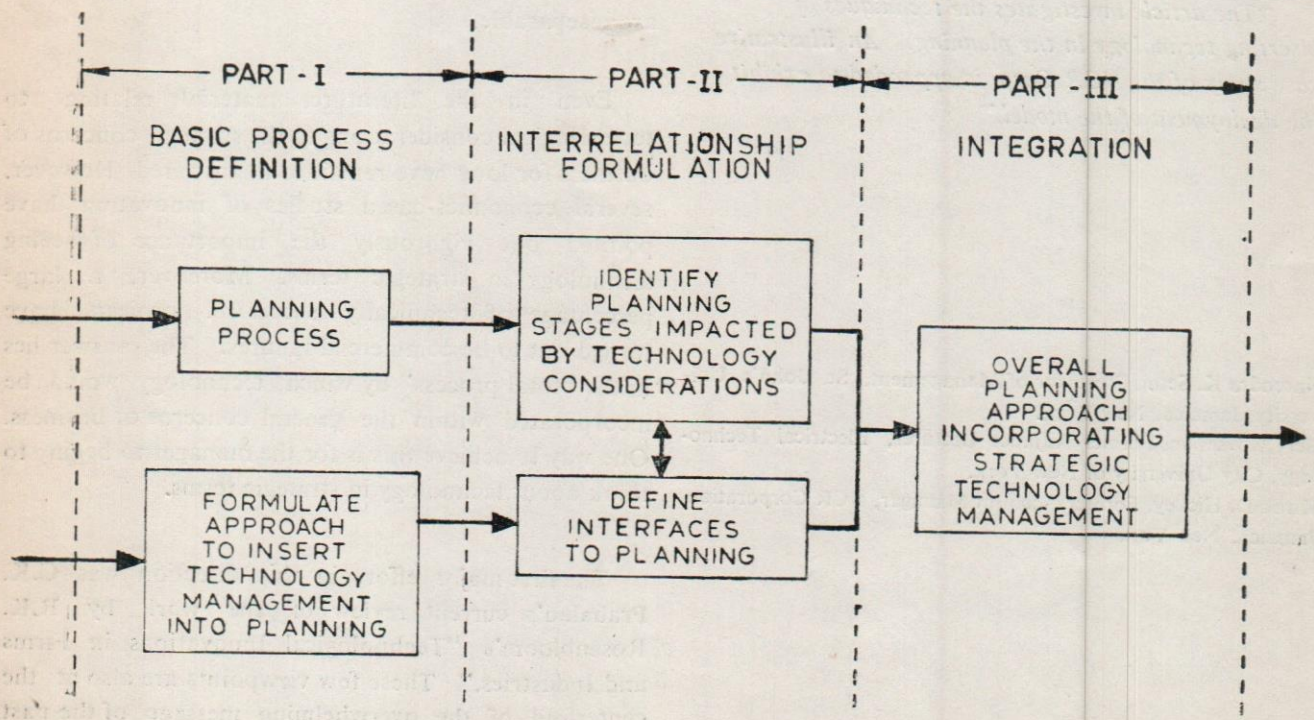

Fig. 1 : Methodology

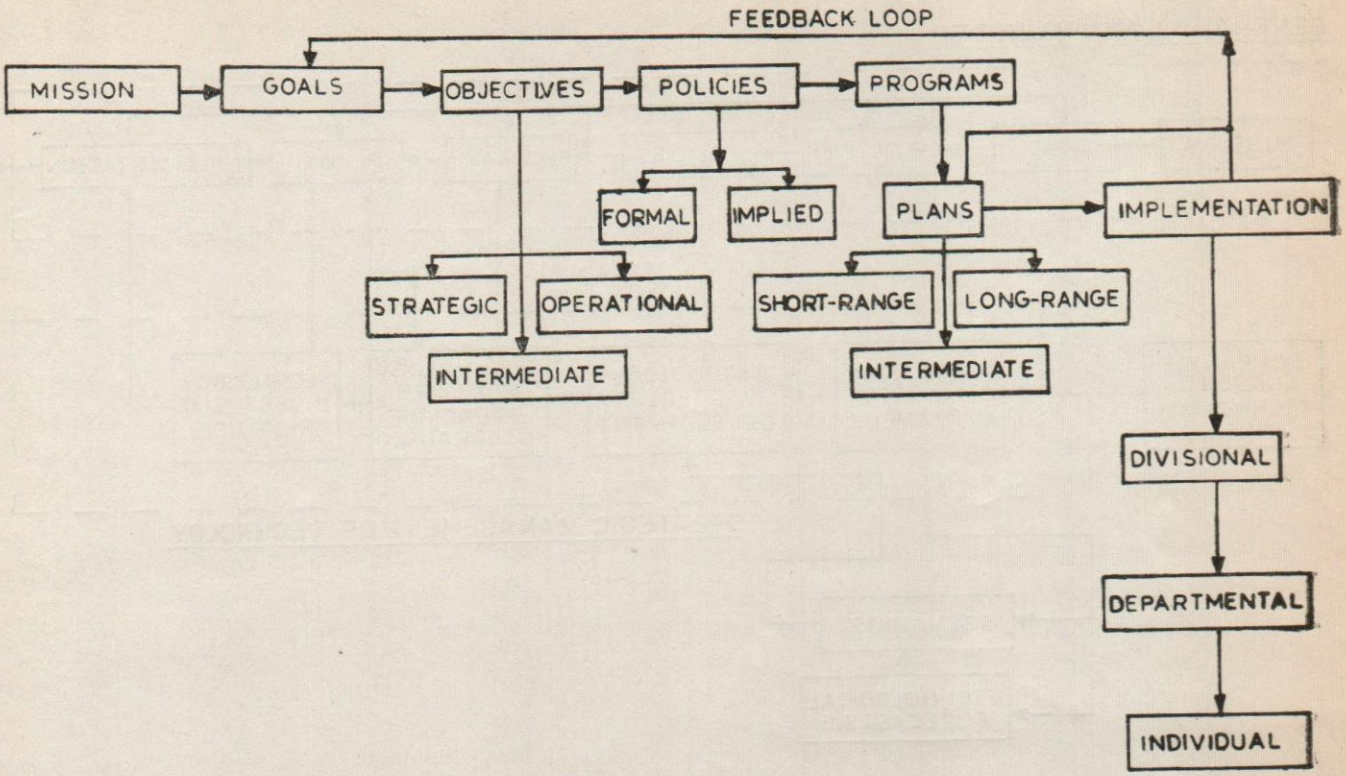

Fig. 2 : Planning Model Process

tation. During the last stage, technology investment priorities are determined assuring fulfilment of objectives.

Considerations for Technology Insertion into Planning

One means of formulating a technological strategy is to analyze what might be termed a company's technological profile. Analysis carried out in recent years across a wide range of industries indicated, however, that the management processes of technology-based companies are particularly sensitive to certain key variables. Observations suggest that technology-based firms recognize and identify these variables, and seek to exploit their implications, are more likely to excel in their competitive performance.

In this section, the characteristic parameters of technologically-intensive businesses will be considered. Their observed impact on management processes and decisions will be described, and some of their important implications discussed :

Business Strategy—Is our R & D investment consistent with our corporate strategy ? Should we invest in the same technologies as our competitors, or into different ones ?

Organization—How can we maximize the flexibility of the organization in the face of rapid technological change? How can technology best be transferred from R & D to manufacturing and marketing ?

Planning and Control—How should we formulate and specify research objectives ? Should we control research differently from development ? How can project planning and control be integrated with periodic functional reporting ?

Marketing—What kind of product/market strategy should we follow ? What technical advantages in our products (at what cost and investment level) will be needed to give us a substantial competitive advantage ?

The technological parameters that are examined are the research and development (R & D) mix, the degree of down-stream coupling, the shape of the product life

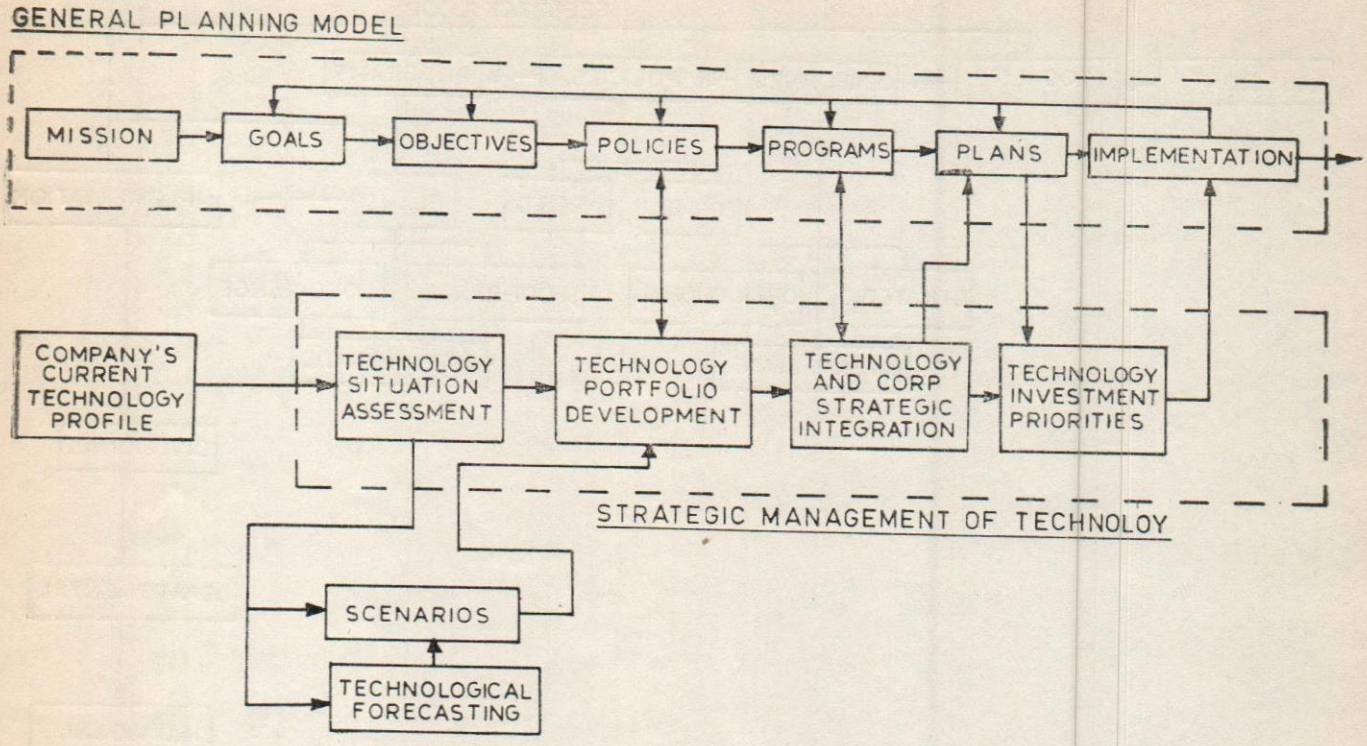

Fig. 3 : **Modified General Planning Model**

cycle (PLC), the R&D investment/expense ratio, the proximity of the state-of-the-art, as illustrated in Figure 4.

Research and Development

The two concepts of 'research' and 'development' have become so closely inter-twined that important differences between them are ofen ignored in executive decision-making. The terms 'R-intensive' and 'D-intensive' will be used to denote a tendency toward basic and experimental investigations on one hand, or toward commercial product design on the other. Most companies, of course, fall somewhere in between, but they can best be described in terms of the two extremes.

The 'R-intensive' firms have six characteristics :

1. Work with indefinite design specifications;
2. Tend to broadcast objectives and market data among technical people, rather than channel specific kinds of information to individuals;
3. They tend to be non-directive in work assignments;
4. They maintain a continuing project evaluation and selection process;
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1. Well-defined design specifications;
2. Highly – directive supervision;
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4. Vulnerability to disruption by change.

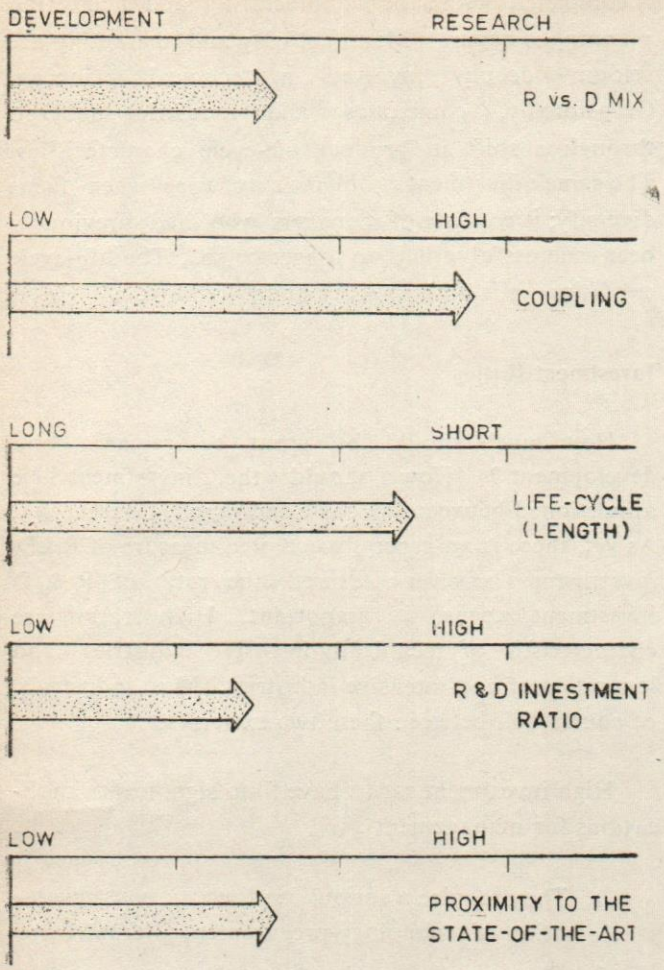

Fig. 4 : Technological Profile

Given these different characteristics, the hazards of managing a D-intensive organization with management concepts and controls suited to the R-intensive company should be apparent.

Downstream Coupling

A second important characteristic of high-technology businesses is the degree of downstream coupling, as shown in Figure 5. The success of the company's product introduction process depends on communication and cooperation between R & D and the manufacturing and marketing functions, which are further 'downstream', toward the customer. Clearly, industries differ in their downstream coupling capability. It is useful to distinguish three degrees of coupling as shown in Figure 5 : High, Moderate and Low.

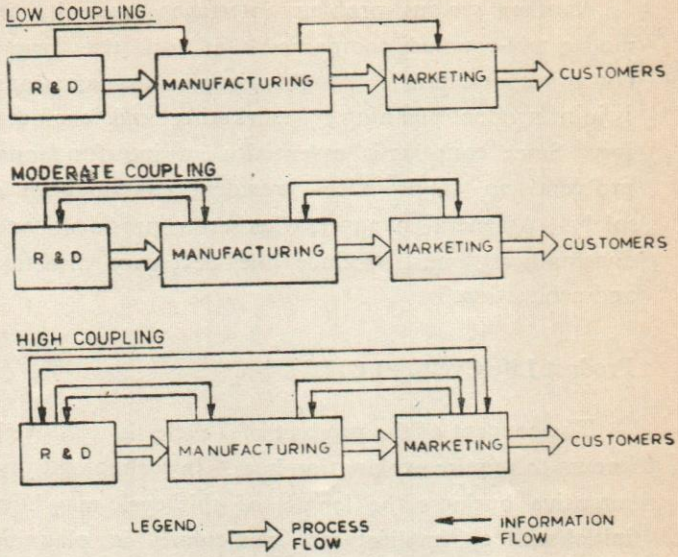

Fig. 5 : Degrees of Downstream Coupling

High-coupling requires close interaction among the technical, manufacturing and marketing functions of the business. Accurate and detailed market information is essential to adequate product line planning. The selection of R & D projects is heavily influenced by manufacturing costs, availability of raw materials, abilities of the marketing organization and countermoves by competition. Many industries require exceptionally high coupling. Significant increases in the product coupling process have made necessary corresponding increases in the management coupling of R & D with the departments downstream. In a highly-coupled organization, correct balance among these three technically-competent functions is dynamic, rather than static.

Interfunctional Control

In a highly-coupled organization, functional dividing lines may create serious problems, since objectives on either side of the marketing-engineering interface can, and often do, drift apart. Some sort of results-oriented interfunctional control is needed to keep pulling them back together. Although this interfunctional responsibility may narrow the gaps between the functions, it cannot eliminate interfunctional boundaries or the impacts that occur across them. Care must be taken to assess the impact in advance.

Another serious problem interface, especially in moderately-coupled companies that lack the formal controls characteristic of highly-coupled organizations is joint product planning by marketing and engineering. Since coupling is essentially an interfunctional problem, no single vice president can manage it solely. A general manager, whether a president or a division head, must produce the necessary direction and arbitration.

Product Life Cycle (PLC)

The concept of the product life cycle is too well-known to require explanation here. In technologically-intensive business the length of this cycle may have initial strategy implications, particularly in planning and control. Cycles can be dichotomized as short or long, each requiring a different strategic approach.

Short Cycle—Speedy management action and response, high concurrency of activities in product introduction, and approximate, rather than precise, technical objectives. Business success requires competitive intelligence for early appraisal of competitive moves. An alert company should plan to be among the first to introduce a new product, or break into a new market, since competition will generally force prices down quickly, in turn depressing profit margins and return on investment (ROI).

Short cycle companies need close coupling between product marketing specialists and technical staff. Marketing managers tend to be more knowledgeable about technological trends and contribute substantially to product definition and development.

Long-Cycle—In this type of business, the converse is true. With adequate time to learn about competitive market developments, and to plan to counter them, there is little need for unusual market sensitivity. In the long-cycle company emphasis is on established procedure and routine. Organization is usually functional; managerial decisions usually favour economy and efficiency at the expense of rapid response.

Moreover, planning is sequential; detailed R & D is completed before the manufacturing and marketing planning is begun. Manufacturing and marketing are seldom deeply involved in technical planning. Occasionally, companies and industries undergo through a shift in product life-cycle characteristics. The same adjustment problem may arise when firms diversify; it consists of managers who had previously been successful could no longer be so. The life-cycle conditioning is both an asset and a liability.

Investment Ratios

How much should be spent on research and development ? How should the investment be apportioned between the basic and applied research ? As yet, there is no generally-accepted measure of R&D investment : however measured, the ratio of R & D investment/expense is important. High ratios are characteristic of technically-intensive industries, and low ratios of non-intensive industries. Most industries, of course, fall between these two extremes.

High investment ratios have four significant implications for management :

1. They require a serious and continuous evaluation of technology-procurement alternatives;
2. They usually accelerate product and process change;
3. They usually mean a dynamic product market;
4. They require closer supervision of technical efforts.

In general, the effects of low R & D investment/expense ratios are the converse of those described above. Organization structure need not be highly adaptive; since technical developments are evolutionary, only occasional changes in functional structure will be needed.

The level of R & D investment is not easy to pinpoint, but it may be located in a general way by examining the technical results of competitors. Has a given company developed successful commercial products ? How long did it lag behind the industry leader in developing competitive technology ? What is

its record of innovation? How old is the current product line?

These questions are further complicated by the factor of quality. Since high-quality research personnel can generate a return out of proportion to their number, quality as well as quantity can affect the research results.

State-of-the-art

For most managers, the term 'state-of-the-art' denotes the frontier of technology. Inside this boundary, but not beyond it, reliable and tested technical solutions are available.

However, state-of-the-art has different implications in research and development. For research, it denotes the frontier at which investigators seek to discover new phenomena, or to devise a solution to known problems. For development, it implies the less rarefied zone where the validity of theory or solution has already proven to be, but a successful commercial application remains to be achieved.

How close a company's technology is to the state-of-the-art has implications to management planning and decision-making. These implications may be considered under three areas: stability, predictability, and precedent.

Stability—A function of distance from the state-of-the-art. A company working near the state-of-the-art boundary must keep trying for rapid advances like those through which it achieved its current position. At the same time, it must be alert to possible breakthroughs by competitors resulting in either a major advance in product performance or a major reduction in costs; its market position is perpetually in jeopardy from all competitors working in the same technical area.

Predictability—This is low for companies near the State-of-the-art boundary. Since their researchers are working in areas of partial knowledge, the nature, and even more, the timing of results are difficult to foresee. Unless the implications of low predictability are understood and allowed for, company plans can be hardly more than guesses.

Precedent—It is sparse near the state-of-the-art boundary. Past experience supplies little guidance to help managers to judge whether people are doing a sound job, whether capital should be committed to a particular project, and whether the product has a commercial life.

The implications of stability, predictability and precedent are substantial in the areas of planning and control. Near the state-of-the-art a company must settle for more approximation and less precision in goals and standards; planning and control systems must be tailored accordingly.

Besides the company's distance from the boundary, the rate of advance in the state-of-the-art itself must be considered. Since this is largely a function of the investment, heavier R & D expenditures are the rule when the boundary is rapidly moving. It is important, however, to remember that in view of the differences between research and development, total resources invested are not an adequate clue to the effectiveness of a particular company's investment. Development budgets normally tend to be much larger than research budgets; but a large development input, unless balanced by an equally strong research component, is of little use when the boundary is fluid.

Marketing Strategy

The strategic issue of the timing of the technologically-intensive firm's entry into an emerging market is of great importance. The alternatives may usefully be grouped into four major marketing strategies, recognizing that most companies will (or should) adopt a blend of these, according to the requirements of their different markets or product lines.

1. *First to Market*: This risky, but potentially rewarding strategy has a number of important ramifications throughout the business: (a) a research-intensive effort, supported by major development resources; (b) close downstream coupling in product planning, and moderately close coupling thereafter; (c) high proximity to the state-of-the-art; (d) high R & D investment ratio; and (e) a high risk of failure for individual products.

2. *Follow the Leader* : This marketing strategy implies : (a) D-intensive technical effort; (b) moderate competence across the spectrum of relevant technologies; (c) exceptionally rapid response time in product development and marketing on the basis of finished research; (d) high downstream coupling of R & D with marketing and manufacturing; and (e) superior competitive intelligence.

3. *Application Engineering* : This strategy requires: (a) substantial product design and engineering resources but not research and little 'real' investment in development; (b) ready access to product users within customer companies; (c) technically-perceptive salesmen and sales engineers who work closely with product designers; (d) good product-line control to prevent deciding what applications to develop; (f) an efficiency-oriented manufacturing organization, and (g) a flair for minimizing development and manufacturing cost by using the same parts or elements in many different applications.

4. '*Me-Too*' : This strategy, which has flourished in the past decade as never before, is distinguished by : (a) no research or development; (b) strong manufacturing function, dominating product design; (c) strong price and delivery performance; and (d) ability to copy new designs quickly, modifying them only to reduce production costs.

Competing on price, taking a low margin, but avoiding all development expense, a firm that has adopted this strategy can create turmoil among the competitors following the first-to-market or follow-the-leader strategies. The 'me-too' strategy, effectively pursued, shortens the profitability after market introduction; it requires a 'low-overhead' approach to manufacturing and administration, and direct 'hard sell' on price and delivery to the customer.

Technology Futuring

Planning for the changes of tomorrow is risky, but is a potentially more rewarding challenge to those who want to succeed in the near future and excel in the long-term. Simply, a company must look into the future and attempt to determine the kinds of technology it will need to meet its future business objectives.

The simplest manner or making quantitative estimates of what the future holds is to extrapolate from current and past data. This will not result in a poor estimate; however, this does not anticipate significant shifts or changes, and there are many occasions when the future is not a linear extrapolation of the past.

The look into the future necessitates the uncovering of broad directional indicators, besides making specific predictions or outcomes. This necessitates a two-part process.

First, broad scenarios should be developed about what the situation will look like in ten or twenty years. Rather than focusing on technological possibilities, this exercise would examine public, political, economic and environmental issues, and would identify potential impacts. In the second part, the emphasis would shift to technology and would focus on technology issues within this future context. Essentially then, technology futuring would combine scenario building and the technological forecasting process.

Scenario development

A scenario can present future conditions in two different ways. It can describe a snapshot in time, that is, conditions at some particular instant in the future. Alternatively, a scenario can describe the evolution of events from now to some point in time in the future: in effect, it can present a 'future history'. The latter is generally preferred by those engaged in policy analysis and choosing strategy, since it provides cause-and-effect information.

The steps in preparing scenarios include :

1. Selecting the Basic Characteristics : the few conditions most important to shaping the system or market place;
2. Setting the range of values that will be studied for the basic characteristics, if possible, in quantified terms;

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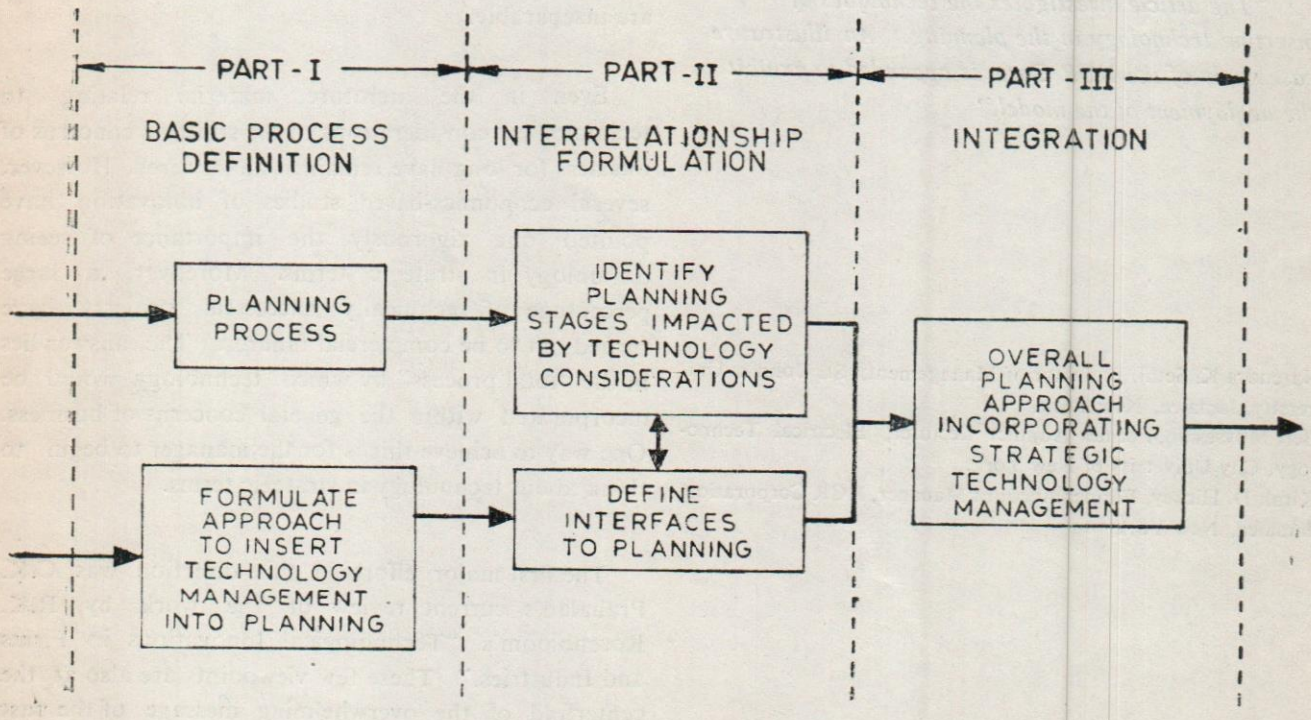

Fig. 1 : Methodology

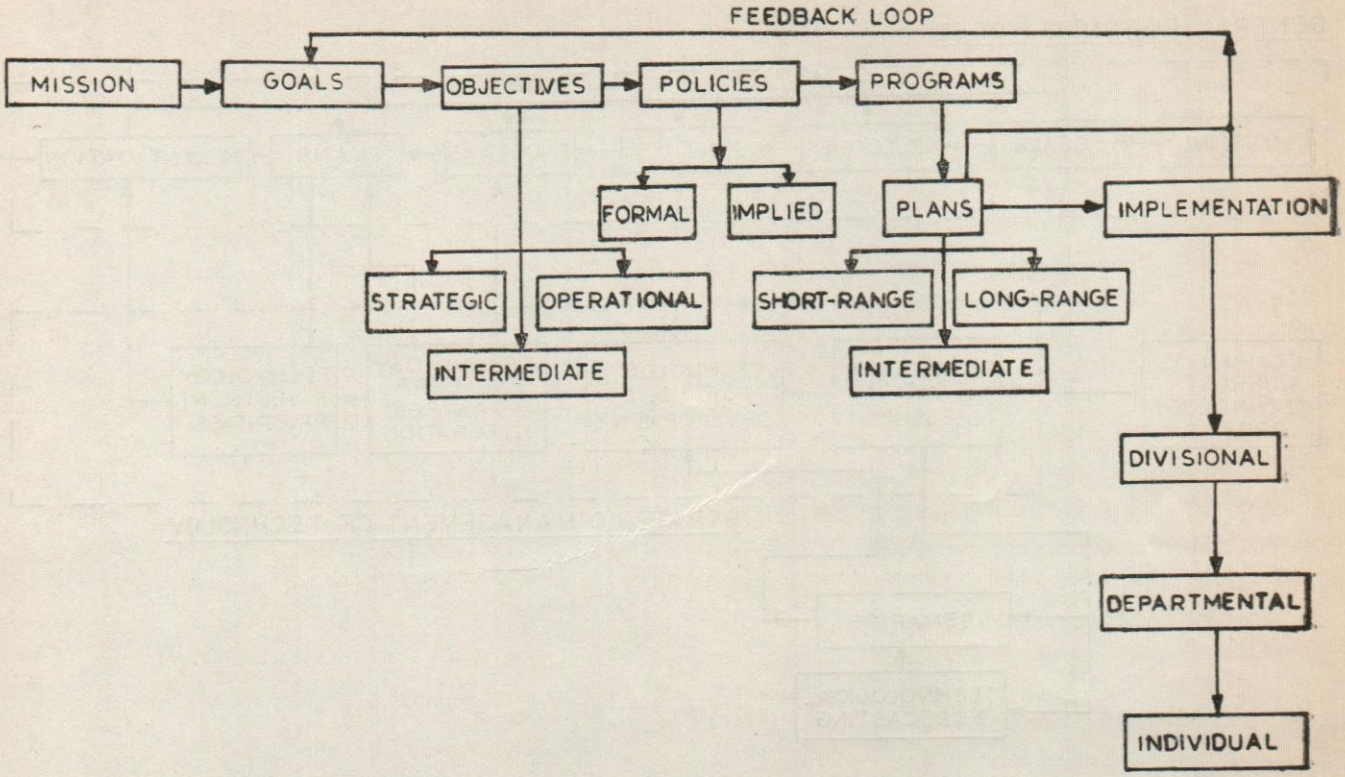

Fig. 2 : Planning Model Process

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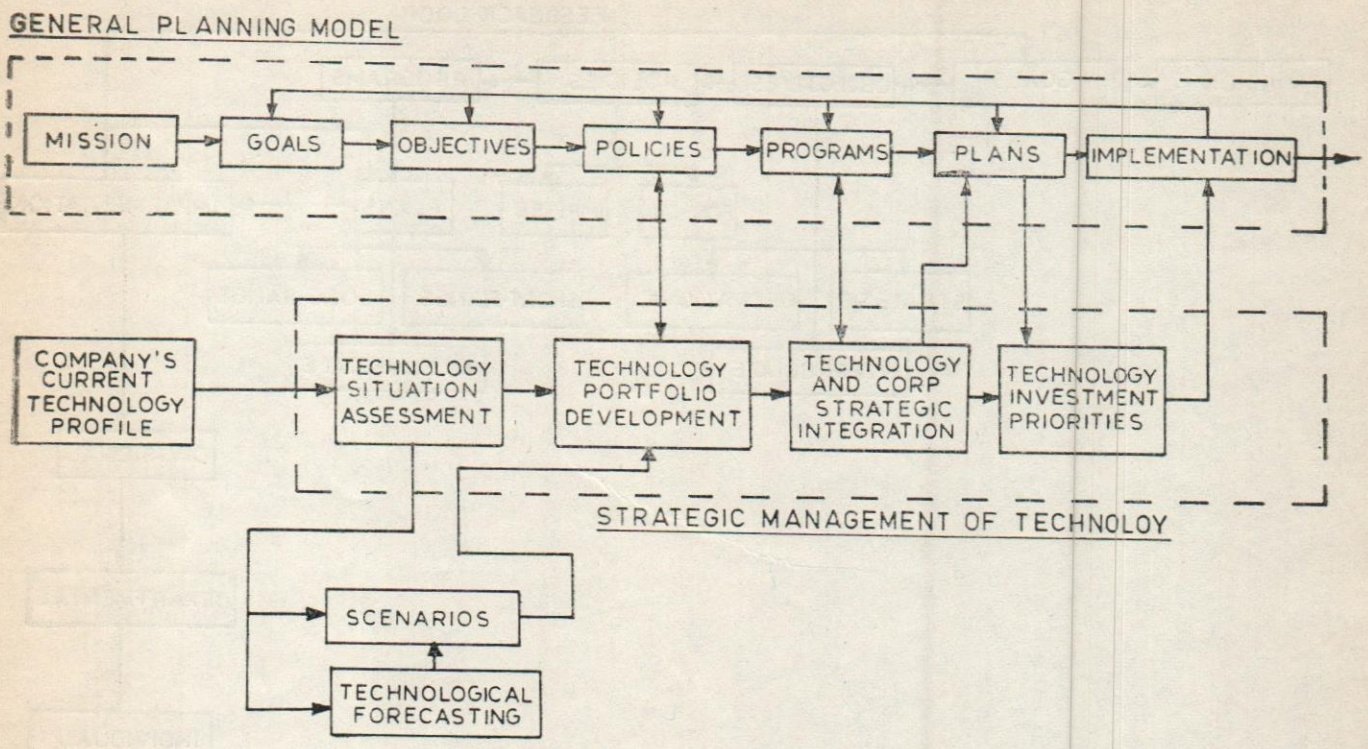

Fig. 3 : **Modified General Planning Model**

cycle (PLC), the R&D investment/expense ratio, the proximity of the state-of-the-art, as illustrated in Figure 4.

Research and Development

The two concepts of 'research' and 'development' have become so closely inter-twined that important differences between them are ofen ignored in executive decision-making. The terms 'R-intensive' and 'D-intensive' will be used to denote a tendency toward basic and experimental investigations on one hand, or toward commercial product design on the other. Most companies, of course, fall somewhere in between, but they can best be described in terms of the two extremes.

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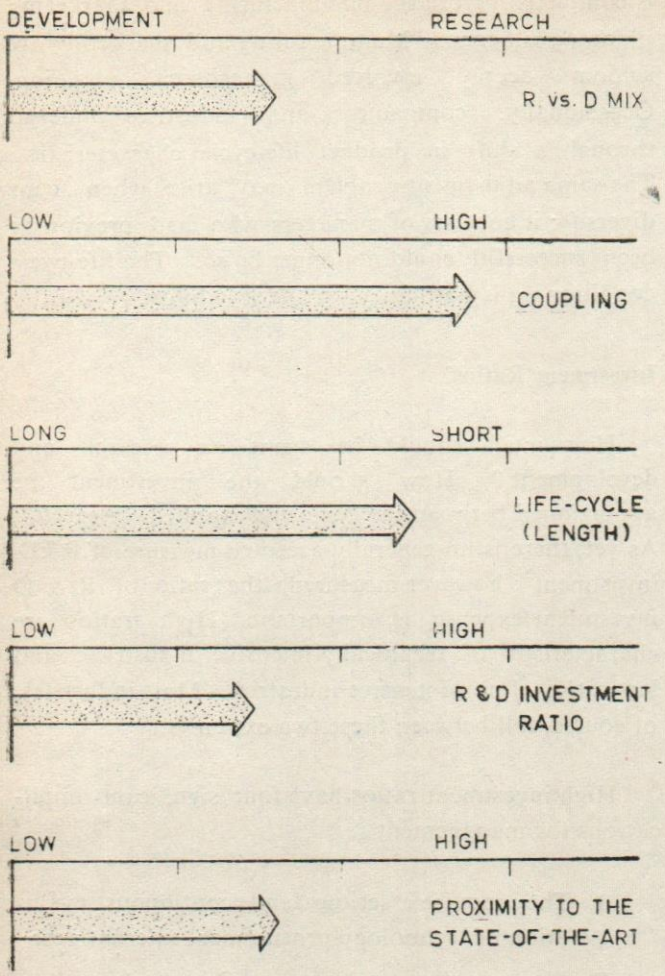

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Given these different characteristics, the hazards of managing a D-intensive organization with management concepts and controls suited to the R-intensive company should be apparent.

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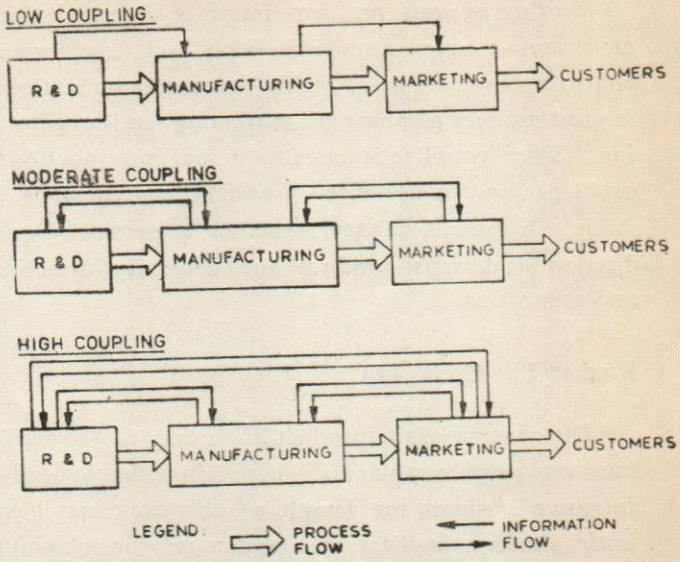

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How close a company's technology is to the state-of-the-art has implications to management planning and decision-making. These implications may be considered under three areas: stability, predictability, and precedent.

Stability—A function of distance from the state-of-the-art. A company working near the state-of-the-art boundary must keep trying for rapid advances like those through which it achieved its current position. At the same time, it must be alert to possible breakthroughs by competitors resulting in either a major advance in product performance or a major reduction in costs; its market position is perpetually in jeopardy from all competitors working in the same technical area.

Predictability—This is low for companies near the State-of-the-art boundary. Since their researchers are working in areas of partial knowledge, the nature, and even more, the timing of results are difficult to foresee. Unless the implications of low predictability are understood and allowed for, company plans can be hardly more than guesses.

Precedent—It is sparse near the state-of-the-art boundary. Past experience supplies little guidance to help managers to judge whether people are doing a sound job, whether capital should be committed to a particular project, and whether the product has a commercial life.

The implications of stability, predictability and precedent are substantial in the areas of planning and control. Near the state-of-the-art a company must settle for more approximation and less precision in goals and standards; planning and control systems must be tailored accordingly.

Besides the company's distance from the boundary, the rate of advance in the state-of-the-art itself must be considered. Since this is largely a function of the investment, heavier R & D expenditures are the rule when the boundary is rapidly moving. It is important, however, to remember that in view of the differences between research and development, total resources invested are not an adequate clue to the effectiveness of a particular company's investment. Development budgets normally tend to be much larger than research budgets; but a large development input, unless balanced by an equally strong research component, is of little use when the boundary is fluid.

Marketing Strategy

The strategic issue of the timing of the technologically-intensive firm's entry into an emerging market is of great importance. The alternatives may usefully be grouped into four major marketing strategies, recognizing that most companies will (or should) adopt a blend of these, according to the requirements of their different markets or product lines.

1. *First to Market*: This risky, but potentially rewarding strategy has a number of important ramifications throughout the business: (a) a research-intensive effort, supported by major development resources; (b) close downstream coupling in product planning, and moderately close coupling thereafter; (c) high proximity to the state-of-the-art; (d) high R & D investment ratio; and (e) a high risk of failure for individual products.

2. *Follow the Leader* : This marketing strategy implies : (a) D-intensive technical effort; (b) moderate competence across the spectrum of relevant technologies; (c) exceptionally rapid response time in product development and marketing on the basis of finished research; (d) high downstream coupling of R & D with marketing and manufacturing; and (e) superior competitive intelligence.

3. *Application Engineering* : This strategy requires: (a) substantial product design and engineering resources but not research and little 'real' investment in development; (b) ready access to product users within customer companies; (c) technically-perceptive salesmen and sales engineers who work closely with product designers; (d) good product-line control to prevent deciding what applications to develop; (f) an efficiency-oriented manufacturing organization, and (g) a flair for minimizing development and manufacturing cost by using the same parts or elements in many different applications.

4. '*Me-Too*' : This strategy, which has flourished in the past decade as never before, is distinguished by : (a) no research or development; (b) strong manufacturing function, dominating product design; (c) strong price and delivery performance; and (d) ability to copy new designs quickly, modifying them only to reduce production costs.

Competing on price, taking a low margin, but avoiding all development expense, a firm that has adopted this strategy can create turmoil among the competitors following the first-to-market or follow-the-leader strategies. The 'me-too' strategy, effectively pursued, shortens the profitability after market introduction; it requires a 'low-overhead' approach to manufacturing and administration, and direct 'hard sell' on price and delivery to the customer.

Technology Futuring

Planning for the changes of tomorrow is risky, but is a potentially more rewarding challenge to those who want to succeed in the near future and excel in the long-term. Simply, a company must look into the future and attempt to determine the kinds of technology it will need to meet its future business objectives.

The simplest manner or making quantitative estimates of what the future holds is to extrapolate from current and past data. This will not result in a poor estimate; however, this does not anticipate significant shifts or changes, and there are many occasions when the future is not a linear extrapolation of the past.

The look into the future necessitates the uncovering of broad directional indicators, besides making specific predictions or outcomes. This necessitates a two-part process.

First, broad scenarios should be developed about what the situation will look like in ten or twenty years. Rather than focusing on technological possibilities, this exercise would examine public, political, economic and environmental issues, and would identify potential impacts. In the second part, the emphasis would shift to technology and would focus on technology issues within this future context. Essentially then, technology futuring would combine scenario building and the technological forecasting process.

Scenario development

A scenario can present future conditions in two different ways. It can describe a snapshot in time, that is, conditions at some particular instant in the future. Alternatively, a scenario can describe the evolution of events from now to some point in time in the future: in effect, it can present a 'future history'. The latter is generally preferred by those engaged in policy analysis and choosing strategy, since it provides cause-and-effect information.

The steps in preparing scenarios include :

1. Selecting the Basic Characteristics : the few conditions most important to shaping the system or market place;
2. Setting the range of values that will be studied for the basic characteristics, if possible, in quantified terms;

3. Selecting the number of scenarios to be studied;
4. Designating the indicators and trends that will be treated in each scenario;
5. Listing all important events : Developments necessary for the conditions of each scenario to come about and those important to shaping the indicators and trends;
6. Estimating the probabilities of each event in each scecario and impacts of each on the indicators; likelihood of occurence, and influence upon each indicator;
7. Projecting the indicators : quantified values versus times;
8. Preparing narratives : Describe the evolution of conditions in each scenario spotlighting key events/developments, important trends, implications for the system or marketplace, and where possible, implications for strategies, policies, and actions.

Technology Forecasting

This is a multi-disciplinary procedure used to develop an idea of 'possible' and 'likely' futures. It is a long-range thinking process designed to identify future needs and opportunities of a group or category. Technology forecasting studies a multitude of variables, such as the immediate plans and strategies of a particular group and developments in high technology areas. In simplest terms, technology forecasting estimates future technology needs, opportunities and threats, so that appropriate planning and scheduling can be developed. Within these broad guidelines, however, technology forecasting can be approached in a variety of ways. Techniques that are currently used include dynamic modeling, correlation methods, curve-fitting models, and managing expert opinion.

The Strategic Management of Technology

When properly managed, technology complements business strategy in mature companies, drives business strategy in high-technology companies, and in most industries, can be leveraged to achieve a sustainable, competitive advantage in the marketplace. The key here lies in repositioning technology as a strategic resource by elevating its importance in the business planning process. Planning a technology strategy is a complex, four-step process involving the following:

1. Technology Situation Assessment—Here an internal and external scan of technology environment beyond the limits of the traditional business profile is undertaken. First, a product or business area is defined broadly. Then it is broken down into its components, until a detailed, technology-by-technology analysis for each business is established. As a next step, the specific technologies employed in each of the firm's businesses, products and processes are analyzed. The importance of each technology to specific products or businesses determines which technologies are shared among them, and which are derived from purchased parts and materials. Next, the priorities dictating past and current technology investments are reviewed.

Finally, the external competitive environment is scanned to pinpoint the investment patterns of competitors on the product and process side for each of the firm's vital technologies.

2. Technology Portfolio Development—This is a tool that can be used to identify and analyze key corporate technology alternatives and to set technology priorities.

At this point a 'technology portfolio' is developed by creating a quadrant grid similar to that used in business strategy analysis, as illustrated in Figure 6. 'Technology Importance' is based on criteria that include value added, rates of change, and potential markets and their attractiveness. 'Relative technology' position is determined by assessing current and future position in a given technology, and its expected future development. Some quantitative criteria used to determine these are previous results, as demonstrated by patents, product history and cost; human resource strengths, and technology expenditures, current and projected.

If one finds oneself in the 'Bet' quadrant, then one is in an excellant position technologically in a business segment where that technology is important—and

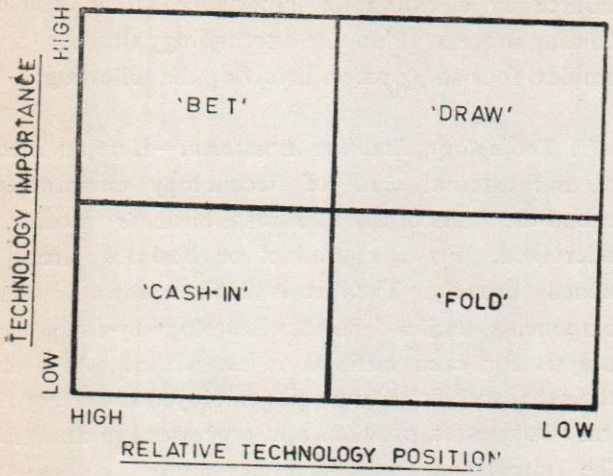

Fig. 6 : Developing the Technology Portfolio

one's objectives should be high to sustain and increase competitive advantage. This is the business where one must commit the newest equipment, as the risk is low.

If one is in the 'Draw' quadrant, one is in a borderline position. One needs to make one of two decisions: either bet against the competition, and invest to attain a leadership position, or develop a plan to disengage from, or even abandon, that technology and invest in more lucrative areas.

In the 'Cash In' quadrant, one is in a strong position technologically, but the technology one excels in is not really important in marketplace terms. This situation occurs most often in a rapidly-changing industry, such as electronics or engineered plastics, where existing technology is continually being supplanted by new techniques. Technologies underlying aging product families—ferquently a company's original product lines—tend to lie in this quadrant too.

If one is in the 'Fold' quadrant, one is weak technologically in an unimportant field. If one has invested heavily, one may have to view those dollars as a sunk cost. If not, than a financial redeployment strategy is essential—and the sooner the better.

3. Technology and Corporate Strategy Integration—Integrating the technology portfolio into overall corporate strategy assures consistent objectives and effective implementation.

Generally, a business portfolio is product-oriented; it measures a firm's product lines in terms of market position and importance. By contrast, the technology portfolio is technology-based, and defines the firm's relative product and process technologies in terms of marketplace position and their importance to the basic business of the corporation as illustrated in Fig. 7.

Though the business and technology portfolio provide fundamentally different perspective, they must

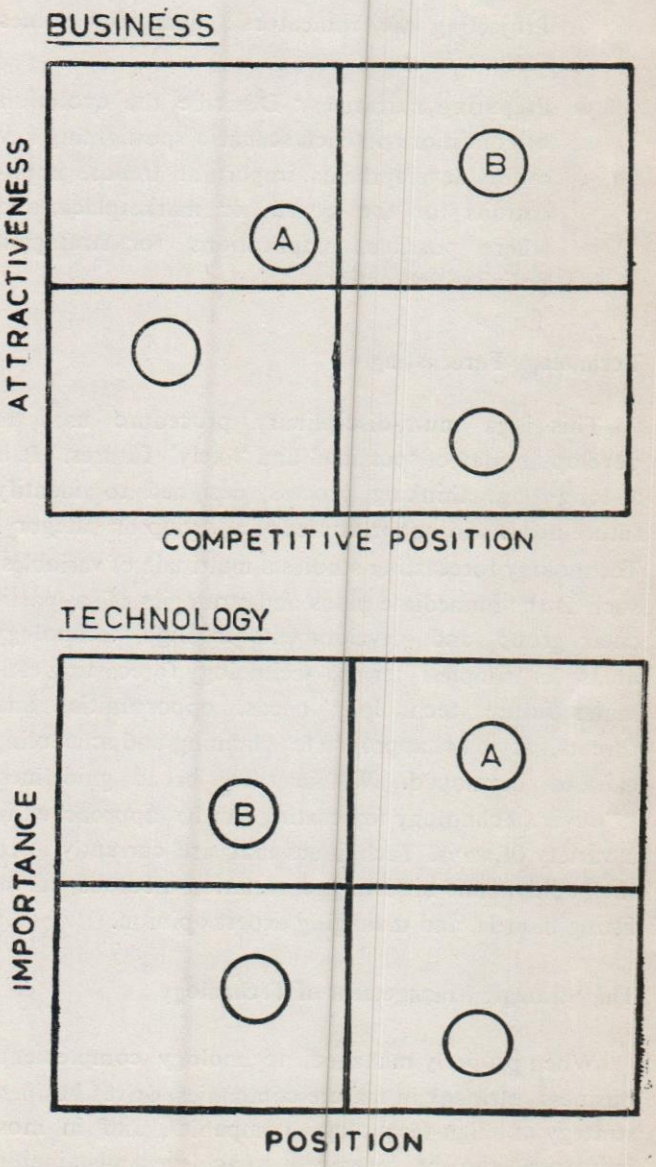

Fig 7 : Matching Business and Technology Portfolio

be compatible, if one expects to gain advantage in a technology-related business. In other words, a technology portfolio will be effective only if it is consistent with the strategy implied by a company's business portfolio. Such consistency, however, is frequently the exception than the rule; far from complementing each other, the two portfolios often conflict.

A technology portfolio, when viewed in conjunction with the business portfolio, serves a number of purposes:

(a) It establishes a common planning base for all priority technologies;

(b) Provides an overview of the corporation's technological position, and a method for timing corporate technological investments in 'synch' with its business plan;

(c) It identifies positions of strength to be leveraged and technology requirements to be strengthened or acquired to achieve corporate objectives;

(d) Established a basis for focusing on high-potential, new business opportunities that could be built on current technological strengths.

4. Technology Investment Priorities—At this stage a specific technology strategy, critical to the survival and success of each business unit is developed.

A technology investment matrix of strategic plays versus relative technology expenditures can be developed from the technology portfolio analysis, as illustrated in Figure 8.

The matrix is a convenient tool for summarizing a company's strategy options and initiatives from an investment standpoint. It can be used to describe individual technologies, or the technological content of individual businesses with units or products that make up the overall corporote portfolio.

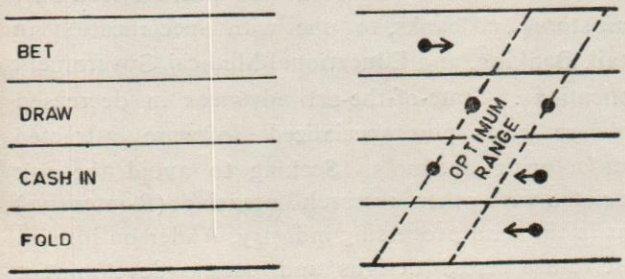

Fig. 8 : Technology Investment Priorities

It is clear that for a technology in the 'Bet' quadrant, spending should be high relative to the leader—in fact, a company should concentrate on becoming the leader. In the 'Draw' category, with a weak position in a technology, one needs to increase expenditures (i.e., move to 'Bet'), pull back if one cannot make that increase, or perhaps continue to play until another round ('Draw') with your current hand until a future date. With technologies in the 'Cash-In' and 'Fold' positions, one generally needs to reduce or terminate investment and concentrate on one's recaptured resources on technologies with higher leverage.

Conclusions

Mark Shepherd, the chief executive officer of Texas Instruments, has called technology the 'lifeblood of competitive leadership'.

In the business environment of the 1980's, it is believed that technology-based issues will underlie nearly every important decision that top management will be forced to make. Crucial to those decisions will be the ability to approach technology planning, both analytically and strategically.

It is also believed that technology can be planned and managed using formal techniques similar to those used in business and capital investment planning. An effective technology strategy is built on a penetrating analysis of technology strengths and weaknesses, and assessment of the relative importance of these technologies to overall corporate strategy. Together with business strategy, the technology strategy defines how resources can be used most effectively to achieve a sustainable competitive advantage.

Application of Technology Strategies

Herein is how a former Account Manager (AM) of NCR's Retail Systems Marketing Division viewed the

company's technology strategies. Many of the changes that NCR had undergone were the result of the installation of a new CEO, William S. Anderson. In the beginning of the 1970's, management became aware that electronics were being utilized in competitive equipment providing functions not available with the then-present electro-mechanical equipment. Although the former were not recognized as an alternative means of storing and gathering information, company management failed to mobilize development of electronic point-of-sale equipment for several years. By 1972, the newly appointed CEO, Mr. Anderson, recognized that NCR's dependence on the past was not sufficient for it's future. It became clearly apparant that NCR's development must closely co-exist with research, or that research be highly controlled and monitored, if performed beyond the resources of the company itself.

Traditional Structure

Since its inception in 1882, the company performed its functional tasks in the Classical tradition : Production, Engineering, and Marketing divisions operated independently and autonomously. In addition, each sales/service office outside of its headquarters in Dayton, Ohio were operated in a like manner. Each "Branch" was commanded by a Branch Manager, who reported directly to the president. The firm at that time was a leading manufacturer and marketer of business equipment, with its strengths in retail and financial applications. The bulk of the business consisted of electro-mechanically driven devices where NCR's superiority left its's competitors slim opportunities for growth. Such competitors in the retail market includes Singer, Friden and the well-known Sweda (presently a unit of Litton Industries).

Nonetheless market and industry forces, influenced by the quickly-energing, very-large-scale-intergration (VLSI) of computer components had dramatic effects on the future sales of electronic business equipment. At NCR the effects included dramatic drops in market shares, plummeting stock prices, and the beginning of the end.

The Metamorphosis

Poor financial health created widespread dissention among management and Wall Street. It was clear now that the once mighty NCR (National Cash Register) company was in desperate straits. The afore-mentioned Mr. Anderson came to the rescue, leaving his post as president of NCR Japan Limited and concluded that major surgery was needed. This included writing off millions of dollars of inventories, plan and equipment, and initiating the largest reduction-in-force (RIF) in personnel in company history. New manufacturing facilities were urgently needed and new design personnel were aggressively recruited. Mr. Anderson recognized the importance of multiple suppliers, just as NCR's customers generally review several computer vendors prior to their purchases. This process not only improves available choices but also provides independence from any source. This decision was a result of the lengthy strike by United Auto Workers (UAW) in Dayton, Ohio plants several years before. Dayton formerly was the source and destination of all product's manufacture and services. This was no longer so. As Mr. Anderson knew from the Japanese operation, multiple sources of supply provided components closer to the state-of-the-art, due to their competitive bidding postures.

Another innovation installed during the first of several years after the 1973 turnaround was the improvement of corporate communications. It was deemed necessary that each NCR branch (sales-service office) in the US and Canada have telecommunications with any other NCR site, as well as corporate headquarters in Dayton. By that time the corporate culture had changed such that NCR recognized itself not as a leader in several markets but one competitor among many. The computer industry as a whole began aggressively developing numerous medical, government; and educational accounts. The re-organizational in 974 modified the firm from one that serviced only retail stores and banks, to one with specialization in Retail, Banking, and Educational/Medical/Government applications. State-of-the-art advances in decreased hardware costs plus specialized software attracted manufacturing accounts. Seeking to avoid the risk associated with other research intensive (R-intensive) firms in the data processing industry, Anderson instead chose to use tested designs and pursue development intensive (D-intensive) strategies.

NCR's technological profile (see Fig. 4 page 199) was changing dramatically. Development was strong, with target markets selected early in developing appropriate products. For example, NCR's management realized that supermarket retailers' equipment was aging, and that their information needs were rapidly increasing. General economic conditions presented the need for greater automation at grocery check stands. High labor costs and low productivity were hand-in-hand problems of the trade. Optical scanning equipment was widely received and thanks to NCR's wise allocation of resources was adequately developed. Department stores also displayed a need for sales, inventory and productivity information, available from only equipment with electronic memories. Their needs also included updating accounts receivable and inventory control at the stock keeping unit (SKU) level. Input from the sales field indicated NCR's independence or its high degree of coupling, in order to bring about successful products. On the other hand, the technological explosion in data processing equipment considerable shortened the PLC (product life cycle). For example, the NCR model 22 cash register was introduced in 1922 and was sold virtually unchanged for 50 years. Conversely, the NCR company introduced its general purpose 250 register in 1974 only to discontinue production seven years later. Other subsequent retail products have witnessed clearly shorter lives, due to the technological innovation.

In total, the R & D investment ratio soared as the number of equipment operator systems and software packages increased. One piece of equipment formally served many customers; software became the tool for customization. This incidently decreased finished products inventory. For example, one hardware device could become either a terminal for a hospital floor, a retail point of sale, or a production floor terminal, depending on specialized software and operating systems installed.

As typical of high investment ratios, the company quickly sought technology procurement alternatives and this required the acceleration of product and process changes. Closer supervision of technical efforts gives rise to highly-coupled organizations and tighter interfunctional control.

A New Management Style

NCR's conservative approach to developing products for unknown markets is a function of the three factors : Stability, Predictability, and Precedent. Its state-of-the-art proximity responds to competitive actions, and plans must often be revised. In effect, for high-technology firms there is short lived stability, low predictability and due to the dynamic nature of the information processing industry, there is little precedent. Competitive information became increasingly more important, especially as more competitors entered the market.

Not only must NCR conceptualize future products and services, but it must also plan for the resources that will be required for such development. The short span of time places pressure on each allocation decision. Planning has become increasing important.

NCR remains close to the technological frontier but thanks to the Anderson's philosophy of decentralization in manufacturing, much R and D talent is "farmed-out", and many former R-intensive shops are now subsidaries of the company. For example, COMTEN began as a leading telecommunications design firm which NCR purchased from; it was subsequently acquired by NCR in 1980. NCR's continued committment to that technology is a result of COMTEN's engineering, research, and NCR's effective development programs.

NCR's R and D activities in house are also decentralized, with designs emarating from distant Rancho Bernardo, CA, Millsboro, DL, and Itchaca, NY. The corporate structure substituted District Manager (DM) for the former Branch Managers. These new individual report to their respective regional directors, who report to divisional VP's. The profit center approach to management shifted the responsibility of decision making. Source of supply are likewise disparate : the part center in Peachtree, GA it quite distant from the cable division in Sparks, NV. Overseas manufacturing, particularly from Japan, is

more common place than ever. In an effort to effectively compete with the large number of high quality state-of-the-art equipment from Japan, NCR has found it necessary to develop their systems in that country. It is estimated that the future of Data Processing equipment will be shared by the US and Japan, with the latter holding an ace. It is therefore clear that in an innovative industry, such high technology required high degree of interfunctional coupling, high speed communications, and a drawing board at the technological frontier.

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Flexible Manufacturing Systems : Implications

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The author in this paper discusses the role of the flexible manufacturing system in the organisation and presents precautions one should take while managing the FMS.

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The Organisational Implications of Flexible Manufacturing Systems

The flexible manufacturing system can be described as a production arrangement whereby transport system, handling devices, and automatic storage and retrieval system are linked and controlled by a computer, for automatically producing conponents. A flexible manufacturing system is schematically depicted in Fig. 1.

Flexible manufacturing systems vary in their design and degree of technical sophistication. They are usually built to satisfy individual company production requirement and, as such, there appears to be no ideal design. The generalised flexible manufacturing system manufactures parts in random order, moving them between discrete machines with automatic material handling system. Fig. 2 shows the components of a flexible manufacturing system.

The basic objective of the flexible manufacturing concept is to achieve the efficiency and utilization levels of mass production while retaining the flexibility of manually operated jobs shops.

The change from the functional method of metal cutting batch production to integrated manufacturing systems appears to be a significant development which may change the traditional approach to component

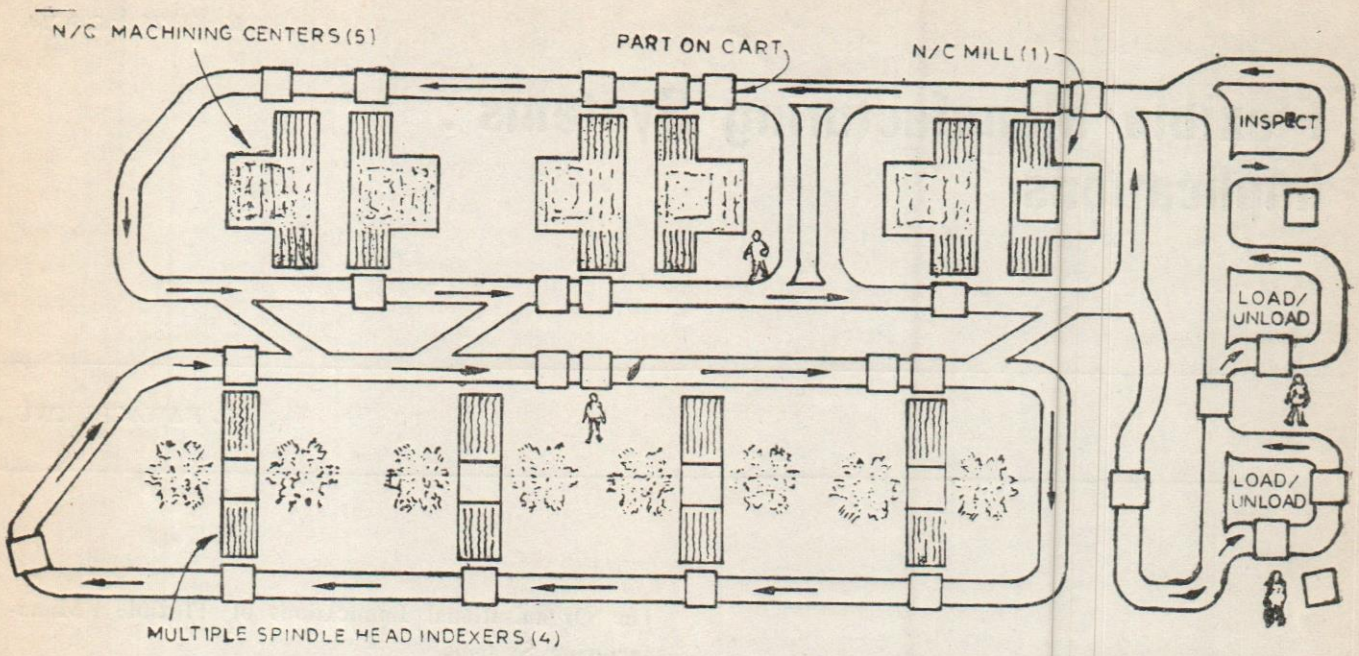

Fig. 1 : An Example of a Flexible Manufacturing System (Source Kemimia 1980)

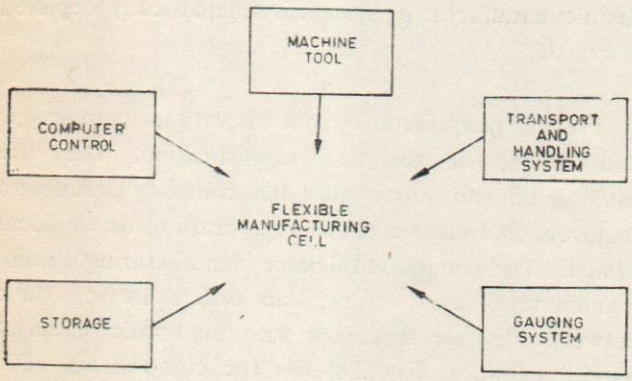

Fig. 2 : Components of a Flexible Manufacturing Cell

production in industry. The benefits which this new concept of manufacturing purports to bring may not be realised unless the organisational implications are thoroughly analysed and understood. Organisational issues which might be affected by the introduction of flexible manufacturing systems include system maintenance, quality control and assurance, cost accounting, work group structure, motivation and morale of shopfloor workers, training and re-training of personnel, managerial attitude and organisational structure.

System Maintenance

Flexible manufacturing systems are complex and highly computerised machining systems and as such efficiency depends on the reliability of its component parts. These systems appear to have potentially low reliability since technical down time tends to rise with increasing complexity (Fig. 3). The maintenance function becomes crucial in any such system.

In traditional manufacturing systems with several 'stand alone' machines, maintenance scheduling is easier since individual machines are serviced as scheduled. Preventive maintenance or repair of flexible manufacturing systems may disrupt production because of the integrated nature of the systems. Disruption

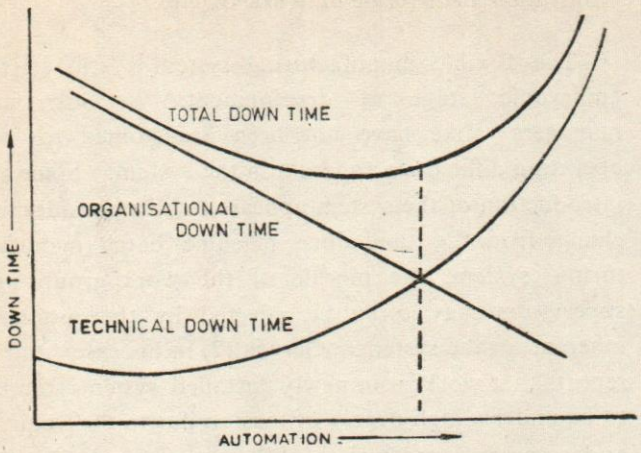

Fig. 3 : Technical and Organisational Down Times of Manufacturing Systems

can be avoided by providing redundant equipment which of course adds more to the invested capital. The complex nature of the system suggests that technicians with multiple skill in maintenance will be needed for the monitoring and repairing of the entire installation. This implies that companies preparing to install flexible manufacturing systems must first of all train and re-train maintenance technicians.

Quality Control

In traditional machining systems, despite the effort to build quality in the product at the design stage of machine and components, emphasis is often laid on the maintenance of product quality throughout the production stages. This emphasis is even more critical in flexible manufacturing systems since the parts ranges to be machined tend to be complex and often have low work tolerances.

In flexible manufacturing systems, production facilities are inter-linked and, therefore, any misalignment or defect of one subsystem may cause defects in components worked in different work stations; and because of the highly complex technical sophistication of the system, there are many malfunctional variables which cause failure.

Diagnosing causes of defects in such a system tends to be difficult and not easy to establish.

A monitoring system can be established to check component parameters, tool wear and coolant temperature. Such monitoring action can be programmed into the machine tool processes—that is, a pause after the completion of a machining process may enable the monitoring function to take place. A special procedure for determining the monitoring frequency should be developed since traditional procedure may not be adequate. The equipment to be used for assuring the product quality must be adapted to the degree of automation of the production facilities and must lend themselves to integration within the material and handling information flow system.

The above approach would no doubt affect the organisation of quality control. Inspection personnel may have to acquire skill in the use of computer assisted quality control. There would be a tendency towards 100 per cent inspection rather than sampling procedures. The above approach may also mean that inspection personnel may have to interact with shop, design, marketing and maintenance personnel. Such interaction will call for a high level of interpersonal skills on the part of the inspectors.

Cost Accounting

In traditional metal working batch production, the cost of a component is computed by adding together the cost of direct labour, materials and overheads based on a percentage of direct labour costs. This approach cannot be logically employed in a flexible manufacturing system since the cost of labour contributes a very small part to the cost of machining. This means that a new approach to cost accounting must be developed. The development of a new system might lead to the adoption of two accounting systems in one manufacturing company and thus create confusion and much more difficulty in making cost comparison between the system and other machining strategies.

The introduction of a new accounting system for flexible manufacturing system operations can lead to misunderstanding among manufacturing managers who may have been accustomed to the traditional standard costing. In Gerwin's (1) case study of operating flexible manufacturing systems in the United States, it was

observed that accountants whose experiences were in traditional cost accounting had some initial difficulties in coming to terms with the new concept; while manufacturing managers had some difficulty in understanding the meaning and significance of new calculations. Such misunderstandings would tend to create communication gaps which may have some disruptive effects. However, the problem of cost accounting can be resolved by basing component costs on machine hours rather than on direct labour.

Work Group Structure

Although flexible manufacturing systems are often highly automated, skilled and unskilled labour are still required to set tools, unload or load pallets, monitor tool wear and alignment, inspect components, repair and maintain the system. The personnel who perform these functions may include the foreman, machine operators, loaders, washers, inspectors, deburrers and maintenance men. These porsonnel from a work group for each complete flexible manufacturing system installation and, since the system is a self contained manufacturing cell with interlinked functions, the advantages of group technology work group structure can be utilised here.

The work group could be made semi-autonomous with the responsibility to make certain operating decisions. Members of the group could be trained in various skills required in the system, so that jobs may be rotated in order to give members experience in all aspects of the system. Job rotation with its opportunity for learning more skills is probably an insurance against emergencies which may result from absenteeism and other factors. Job rotation may be resisted by trade union practices and procedures.

Since production of parts can only be attributed to the group as a whole, production bonus cannot be based on individual performance. A bonus scheme based on group incentive can only be appropriate, but, such approach may be resisted by the better skilled members of the group. This conflict can be resolved by sharing out bonus according to the skill levels of members.

Motivation and Morale of Work Groups

The flexible manufacturing system is still in the embryonic stage of development. Workers and managers alike have not been accustomed to the operating difficulties apparent in the system. Since the introduction of the system appears to be a considerable change from the stand alone machine batch manufacturing system, the morale of the work groups and supervisors may often be affected by the problems inherent in the system. Gerwin (2) in his case studies reports that workers in newly installed systems tended to be under a high degree of tension due to the frequent and complex operating problems that arise. He also reported that most of the fiexible manufacturing system workers were dissatisfied with their job comfort, job challenge, co-workers relationships, resource adequacy, promotion opportunities and financial rewards. Fromen in the Gerwin study were reported to have been fairly satisfied with the above facets of job satisfaction, but tool setters, operators and loaders were not happy with the work situations. This result indicates that problems are going to be more readily expected from the lower end of the organisation structure.

These results were probably the first findings in a flexible manufacturing system case study and involved only a few companies, and therefore cannot be generalised. But, on the other hand, if these findings were to be repeated in further studies, then the new machining concept must be a case for thorough research in work design.

Under the functional batch manufacturing systems, more personnel are often required to man the many stand alone machines and, as a result supervisors tend to spend a high proportion of their time on man-management. But under flexible manufacturing systems, supervisory direction would tend to be de-emphasesed. Managers in conventional batch manufacturing strive to control events but under the new systems their actions would tend to be constrained and regimented by events in the system—they would no longer rely on informal procedures. A more regimented form of management characteristics where they are dependent on the host computer for a predetermined operating routine would emerge.

Training and Re-training of Production Personnel

The traditional batch manufacturing systems tend to be labour intensive due to many stand alone machines and complex material handling and communication systems. The installation of a flexible system in a company may greatly reduce the number of direct labour. There have been cases where direct labour requirement has been reduced by up to 50 per cent (3). Although the need for direct labour would generally decrease, the need for highly skilled jobs will increase. There will be more need for computer programmers, tool setters, multi-skilled maintenance technicians and system co-ordinators. There would also be a need to re-train machine operators who will be displaced by the new system; inspectors would need to be trained in the operation of computer assisted quality diagnosis.

Manufacturing managers and foremen would need some training in the application of computers in production activities. Their training must be broad enough to convey information to explain a basic understanding of the functional aspects of the computer. A mere appreciation course may not be adequate for grasping the intricacies of flexible manufacturing system.

Organisational Structure

In conventional metal cutting batch production shops the traditional structure of organisation is characterised by the Scalar principle which emphasises vertical communication channels, the design of work methods and procedures which conform to the limitations imposed by the autonomous nature of line and staff department and the assumption that managements for information can be adequately met by major reliance upon the chain of command.

This type of structure which grew out of the need of mass production technology may not be suitable for an integrated system where rapid communication between managers, supervisors, maintenance technicians and operators is essential for effective functioning of all the subunits.

The interrelatedness of activities in integrated manufacturing systems means that information can flow both vertically and horizontally. Such flow network of information may not interact efficiently in a traditional structure. A more flexible structure which would allow an unrestricted flow of information may be appropriate for the system. This new concept in batch manufacturing can be seen as a system approach in production organisation. The system concept of organisation considers the functioning of the organisation as a whole and is concerned with developing a total information system which transcends the existing structure of organisation and encompasses all channels of communication which support the information requirement of the organisation.

The influence structure or mode in a production department of any organisation may be affected by the change from conventional to flexible manufacturing systems. In a computer integrated manufacturing system, the effectiveness of the production function would tend to depend on the thoroughness of production planning since production operations tend to be highly programmed. This means that the production planners will gain greater access to more information and could carry out their task with a tool (computer) that may be too complicated and too inaccessible to line managers. In such systems, production planners will also be computer application specialists.

By virtue of their job, production planners would tend to pre-programme the work of line manager; such a situation may create a condition in which the dominant role of the line could be questioned and changed. This development could see the end of the "regime of the works managers" since the supervision of people which gave the managers their dominating role appears to be a less strategic function.

Since production operations in a flexible manufacturing system tend to be planned in such a way that only a supervisor or foreman and a number of operators and technicians are needed to operate the unit, the need for extra line managers other than the production executive may be questioned. The hierarchical levels in the production function may be reduced.

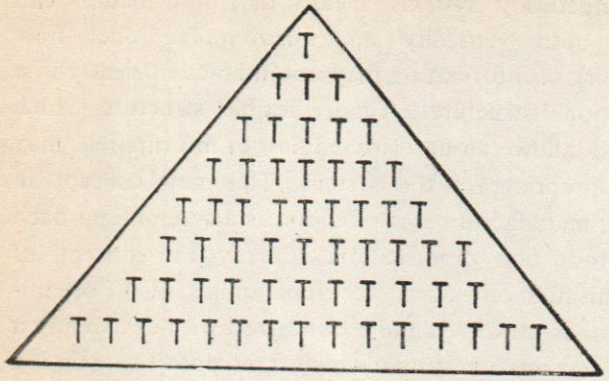

Fig. 3a : The shape of organisational structure in a traditional manufacturing organisation

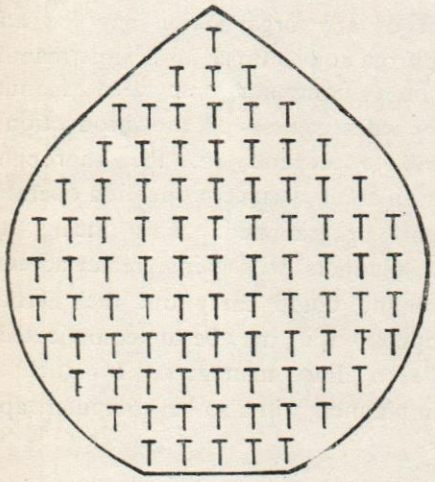

Fig. 3b : The probable shape of organisational structure in a highly automated and computerised manufacturing company

The introduction of computer integrated manufacturing systems may result in less number of operatives on the shopfloor and an increasing number of highly skilled technicians at the middle level of management. This suggests that the traditional shape of organisational structure will change from the well known pyramidal shape to something like figure 3 b.

The organisational implications discussed above have shown that, although flexible manufacturing systems can improve productivity and reduce costs, its introduction needs careful long term planning and well defined manufacturing strategies. Its introduction would tend to change both the skill structure and the organisational climate of any firm committed to its adoption. Some functions such as maintenance and quality control would tend to become critical and would need extra emphasis in any new system.

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Industrial Relations in Japan

SHIN-ICHI TAKEZAWA

This paper provides a comprehensive overview of industrial relations in Japan over the nearly forty years since the end of World War II. Four aspects are identified, which in succession emerged to the fory and have since been assimilated as integral parts of the industrial relations picture as we find it today. Namely, the present pattern of industrial relations should be best understood as an historical, cumulative product of several layers of joint efforts of the Japanese labour and management involved. Discussions will focus on the private sector where shifting emphasis can be most clearly identified. Figure 1 shows the correspondence between such evolving features and their chronological time sequence.

The significance of such a developmental view of industrial relations cannot be over emphasized. This view acknowledges the fact that an active, problem-solving process of labour and management is the essence of industrial relations, where the actors, while inheriting constraints from the past, must seek to work together for accommodation and cooperation in order to obtain satisfactory future results in the face of changing environmental challenges and opportunities. The present cannot exist without the past, and the future can only emerge from the present. Japanese labour and management have learned that only through their joint efforts can they learn the ways and means to satisfy their respective nees. Their flexible, future-oriented responsiveness to changing environmental forces even beyond national boundaries seems to best characterize the industrial relations of Japan.

The Author in this paper shows how the variety of ideologies, policies and practices have influenced Industrial Relations in Japan since 1945 in a very lucid manner.

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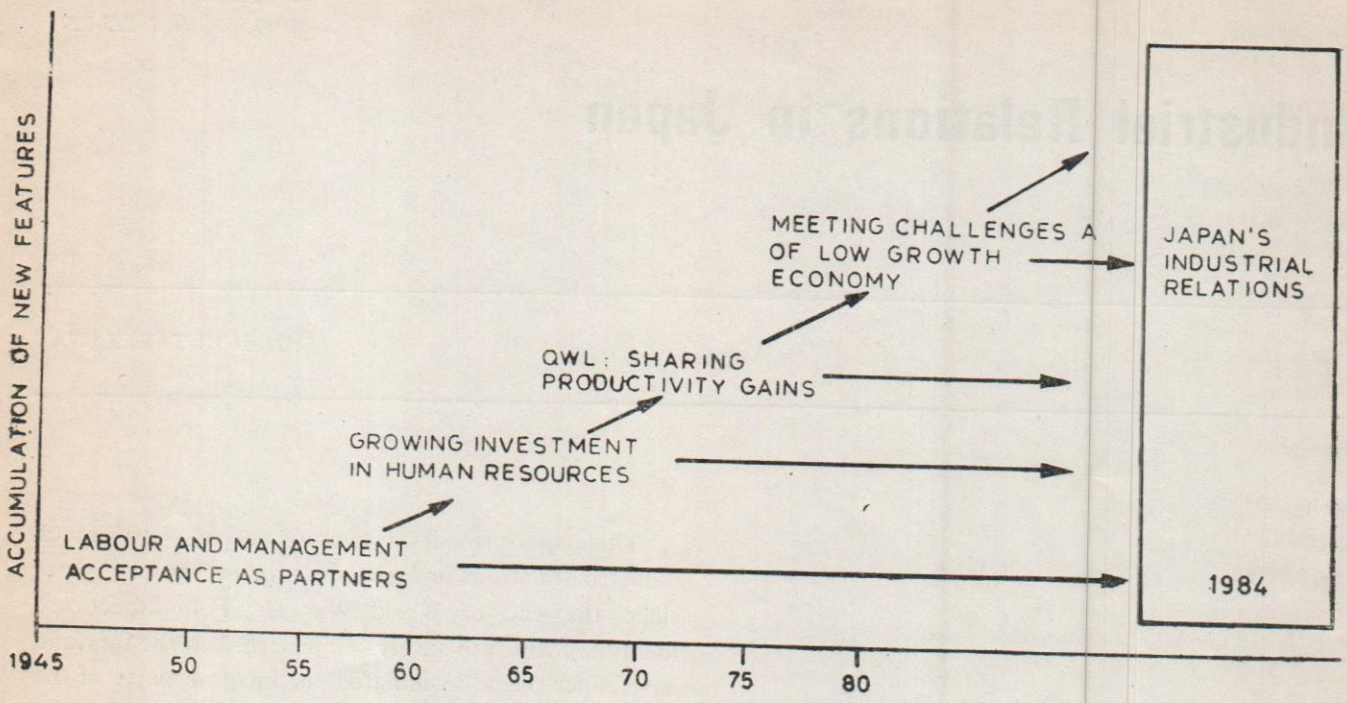

Fig. 1 : Development of Industrial Relations, 1945-1983

As to be seen in the succeeding paragraphs, however. the path to the present has not necessarily been smooth for either labour or management. Both have committed many mistakes, sometimes by clinging to obsolete ideologies or by grabbing seemingly fashionable management gimmicks of the day. Such mistakes shall also be reviewed as they also make up significant pages of the past, and even the present, of our industrial relations. We have also learned from our mistakes, and without them, perhaps we would not have even the modest success of today.

1. Labour and Management : Acceptance as Partners

When Japan lost the devastating war in 1945, the search for new goals and means inevitably caused a turmoil among citizens. Extreme scarcity of food and shelter characterized the life of most people; industrial production capacity was largely lost and the farm soil nearly exploited to the full. In fact, for the year 1945, the rice yield was only 40 per cent of the normal crop, and in hunger and cold, people cursed the war, the military, and authority in general. It was in this context that trade unionism, which had been banned for nearly ten years during the war, was revived with the blessing of the Occupation Forces. At the outset, the hegemony in the fast growing trade unionism was held by ardent supporters of the Marxism-Leninism doctorine, which even to rank-and-file members appeared to perfectly account for the militaristic expansionist footsteps of the past Japan which had brought so much misery to her as well as to her neighbours.

Workers and even managers organized themselves into unions one company after another. Union membership, which stood at nil at the end of war, scared to nearly six million within two years. Militant union leaders convincingly agitated that capitalist was an irreconcilable foe of labour, that capitalism was the cause of war and misery and that only state ownership of capital could bring a dreamland to the working class.

The year 1949 was a year of labour unrest under the so-called Dodge Plan and its extreme disinflationary measures. Records show that more than 170,000 public servants and 370,000 private sector workers lost their jobs during the year as a result of widespread mass layoffs (Yoshimura, 1976 : 88). Communistic

were expelled from union leadership positions. Violence characterized many of the labour disputes during the year and the one that followed. On July 5, 1949, Mr. Sadanori Shimoyama, President of the Japanese National Railways was reported missing. The following day, he was found dead, his corpse lying on railway tracks with prints of steel wheels

Normalization of union-management relations began to take shape first in the private sector where both labour and management had to face the sheer economic reality that their continued existence depended on their firm's survival in the competitive market game. Through the so-called Democratization Movement, union leadership was gradually replaced by less militant and more business-minded unionists. The first sign of such transition may be found in the early 1950's, but most of the major private sector unions took at least the entire decade for this transformation. The main stream philosophy of Japanese trade unionism as found today in the private sector dates back to this era when, after a painstaking process of persuasion, the "democratic" elements eventually won the leadership in major enterprise unions.

At the Toyota Motor Company, for example, management had to lay off workers in 1950 in an inevitable breach of a contract signed with the local chapter of the All-Japan Auto Worker' Union. This incident entailed and prolonged labour disputes and profound distrust developed between management and the workers. The following episode illustrates how much stoic effort was necessary for management to recover the confidence of workers once lost. Mr. Keimi Yamamoto. personnel manager, and his superior, began a pilgrimage in 1952 to talk with employees in small discussion groups at their homes after work hours in an attempt to reestablish mutual dialogue. On an average, they made three visits a night, coming home after nine o'clock, six days a week. At first only abusive language greeted them. It took several years before friendly gestures and listening attitudes emerged. The two managers had to continue their itinerary for ten years before they were convinced that their mission was finally completed. (Tanaka, 1982).

Through such years of trial and error, management and labour came to learn how to live and work with each other. The lessons gained were then handed down to their respective successors. This transfer was not too difficult as neither side was normally overturned by a sudden and large-scale change in composition. Major heritage that have since been maintained up to now include the following :—

1. Both management and the worker must genuinely believe that they make up the two wheels of a cart. But for one or the other, and but for a proper balance between the two, the cart would not make a move forward. Both parties must wholeheartedly accept each other as an indispensable, equal partner.
2. An enterprise must have competent, devoted and unselfish management, which the worker should support. Workers of an enterprise should be entitled to have a union to represent their fair interests and bargain collectively with management on working conditions and other matters of their immediate concern.
3. Workers of an enterprise possess many interests in common as members of the same organization. Therefore, all the production employees, low-echelon supervisors, clerical workers, engineers, technicians, and management trainees should share membership in the same union organised on the basis of the enterprise boundaries.
4. Successful economic performance is essential to the coninuation of an enterprise as a going and growing concern. This success of the company is vital to the security and welfare of employees, and should be accepted as a common goal of management and the workers.
5. Within an enterprise, management and worker representatives should maintain a continuous dialogue, in addition to collective bargaining. Good labour-management relations can best develop only through continuous care and attention rendered by both parties. The art of cultivating sound labour-management relations is similar to that of growing healthy plants.
6. Labour and management should not be hesitant

to take up any matters for discussion while paying due respect to the other's legitimate role and function. As mutual trust develops, communication is likely to expand in both scope and depth. Frequent meetings are essential to the development of mutual confidence.

7. Security of employment and income is of utmost importance to those whose livelihood depends solely on wage and salary earnings. Maximization of employment security should be the highest social responsibility of those who are entrusted with the task of top corporate management.
8. Mass layoff must be accepted by management as a clear sign of its own failure. When mass layoff is enforced without voluntary consent of the workers involved and without prior consultation with the union, management must assume the total responsibility for all its consequences.
9. Union members elect their representatives from among their most competent colleagues. As the union executives thus elected generally possess high leadership potential, some of them are likely to be appointed later to management positions after they have left their elected posts. This further tends to facilitate communication between the management, the union, and the worker.[1]

The Japanese phenomenon of enterprise unionism with its roots deeply imbedded in the longe term employment of permanent personnel emerged this way during the immediate postwar period. An enterprise union (an accepted technical term in industrial relations) is not synonymous with a company union, which implies manipulation of a quasi-labour organisation by upper-handed management. As seen from the above long-term employment, another "pillar" of Japanese industrial relations, is neither a product of benevolent, paternalistic, arbitrary, nor authoritarian management. Continuity from the pre-war tradition is not entirely negligible in this development. But most importantly, its necessity was learned by heart by both labour and management primarily from the harsh confrontations which characterized a period of industrial relations in war-stricken Japan.

A very natural question that may be raised here is how career employment security of all the key personnel can be compatible with the logic of organizational efficiency. Is not excessive security likely to weaken work motivation and lead to satiation and idleness ? The answer seems yes and no, but certainly in the private sector, indulgence in idleness has not been the case for most employees as will be discussed in the next section.

2. Growing Investment in Human Resources

Since the later half of the 1950's the size of total employed labour force in Japan has generally followed a continuous upward trend as a result of her sustained economic growth. Only with minor fluctuations, the labour force continued to expand even rapidly until the time of the OPEC shock came a quarter-century later. The economic growth, first triggered by the sudden burst of demand for "special procurement" goods and services during the war in Korea, began to continue in the latter half of the 1950's with long needed renovation of obsolete production facilities and introduction of advanced technology from abroad. Then, export expansion followed and brought about demand for a further increase of production capacity. Accompanying rising wages and slaries also entailed a new consumption boom of electrical appliances and other household goods. All these developments added impetus to the expanding economy.

Rapid technological change was accepted by labour rather early, first on the basis of the hard-right, yet unwritten, agreement of guaranteed employment security which had resulted from bloody confrontations

1. A study conducted by the Nikkeiren (Japan Federation of Employers' Associations) in 1978 disclosed that among the 352 firms studied, 235 had more than one board member who had once before served on a union's executive board. The study also revealed that 15.7 per cent of the present board members of those companies had previously had union leadership experience. This, Nikkeiren interprets, is another proof of close interdependence between labour and management in Japanese corporations.

in the preceding period. When the Japan Productivity Centre spelled out in its initial guidelines that productivity improvement should not result in manpower reduction, both management and labour accepted this philosophy without much quarrelling. The need for filling the international gap in technology was apparently well recognized not only by management but by labour already around 1960.[2]

The late 1950's also witnessed another boom in Japan, namely a "Management Study Boom", which clearly showed a change in the social climate. A little paperback entitled *Introduction to Management* (Sakamoto, 1958) suddenly became a million seller. It was read widely by managers, workers, students and housewives. The essence of its contents boils down to a brief study of management functions and techniques as taught in American business schools around that time. Likewise the Japan Productivity Center kept sending study teams to the United States.

This keen appetitte for American wisdom was also shared by many personnel directors of mrjor corporations. Although some of them were skeptical of the value of such a fad, many practitioners believed that the American approach basad on job-centered, short-term rationalism had to be borrowed in order to "modernize" personnel administration in Japanese industry.

Somewhat amusingly, this appetite for the American ideal model was most largest firms, where ironically, career employment, seniority wages and enterprise unionism were mostly firmly practiced. This is probably another illustration of the known truth that costly mental exercises are privilege of the wealthy class. But in all fairness, there was also a substantive necessity for such a cultural struggle. Namely, because of the increasing total compensation as a function of seniority pay and rising starting wages, management of the largest firms had every reason to flatten the wage curve. And the job-wage concept seemed to provide the best weapon to counter the union's insistence on living wages in terms of both theories and management techniqes. Smaller, progressive companies, however, did not follow suit.

As employment commitment became a matter of fact, management of larger firms quickly devised ways to make up the lost flexibility and even to make the maximum of the new situation. One policy, to which unions objected only half-heartedly, was to make use of non-permanent work force such as temporary workers and seasonal workers as a buffer. Another was to make heavy use of sub-contracting, which, though not 100 per cent, made possible to adopt a businesslike approach, if necessary, to business fluctuations. Still another was the heavy reliance on overtime at peak times, while maintaining the organization somewhat understaffed most of the time.

As for staffing, the implied long-term employment commitment necessitated recruitment of only the first class employees in terms of basic calibre. Immediate possession of specific skills and knowledge was of less relevance when compared with the potentiality for growth and motivation for new learning. On this basis, most large firms quickly discontinued their previous practice of giving employees' relatives and friends some priority in hiring. The labour market for new school graduates, particularly those of the best schools, soon became open and competitive throughout the nation. Large companies were, of course, not reluctant to mid-career hiring when it was absolutely necessary. But it was done only very sparingly.

This confinement of hiring primarily to the best available new graduates made much logical sense to larger companies as they enjoyed a higher prestige in the labour market. As labour shortages set in, starting wages began to rise, first for middle school graduates for whom demand first exceeded the supply. Quickly,

2. An early US-Japan comparative study revealed that in 1960 Japanese production workers were found more receptive than US workers toward technological changes (Whitehill and Takezawa, 1968: 120-124). The gap was found somewhat narrowed in 1976. (Takezawa and Whitehill, 1981 : 80-83), The Institute for Social Problems in Asia showed in a recent study that West German workers were highly skeptical of the value of technological innovations to them, presenting a striking contrast with an enthusiastic support expressed by their Japanese counterparts. (Institute for Social Problems in Asia, 1982),

education-based starting wage differentials narrowed, and so did the starting wage difference between large and small firms. Nonetheless, large employers where able to secure the best potential candidates because of their superior career working conditions. To the "dual structure" of working conditions and of the labour market, unions made no small contribution as unionization was mostly confined to larger companies.

In the era of innovation and expansion of the 1960's, investment in yong school graduates paid off easily. They were highly adaptive to newly technology. Their labour cost was less expensive than that of older workers. And from among those firms that had gone through a particularly fast growth process, there emerged a group of companies then known as *noryokushugi no kigyo* or meritocratic enterprises. Some of the best known names such as Matsushita, Honda and Sony belonged to this group, all having experienced very fast growth during the late 1950's and throughout the 60's. Most of them were relatively unknown in the previous period, when the former *Zaibutsu* based firms tended to dominate as pattern-setters in the ffeld of industrial relations. Most of the so-called meritocratic enterprises also inherited such "traditional" features as career employment and enterprise unionism, but these features were positively put into use so that the best utilization of human resources could be achieved in the face of the changing environment. At the same time, negative aspects of the legacy were challenged and successfully modified. Likewise, efforts were made to minimize the ill effects of older practices. Some of the new features of industrial relations that emerged in the 1960's along these lines are summarized below :

1. Union-management relations must include positive aspects of cooperation in addition to peaceful resolution of conflicts. From this point of view, the most important mutual concern should be continuous corporate growth, which is the only legitimate source of improving employee's welfare.

2. Throughout the company, there must prevail a spirit of dynamic search for growth opportunities for the company and for individual employees. Both are to grow in parallel, and without the growth of one, there will be no growth for the other.

3. "Technical" considerations should precede "social" considerations in human resource management, and for this an appropriate organizational climate shcuild be cuitivated. For example, automatic wage raises and promotions based on educational background or seniority should be discouraged in favour of those based on ability and performance.

4. Provisions must be made to encourage and facilitate the growth of every employee from hiring until retirement. Although on-the-job training is the central key to his growth investment must be made for career-oriented, organized training programmes. (Figures 2 shows as an illustration Toyota Motor's training programmes in summary).

5. Particularly, young workers should be given opportunities to try out ideas and to grow by making mistakes. Individual growth depends much on on-the-job coaching based on careful appraisal and guidance. Systematic appraisals on all employees must be made and maintained throughout the organization. (Unions first opposed but later acquiesced).

6. Ceilings should be removed for the sake of promotion from previously discriminated employees groups such as production workers. In fact, the dividing line between blue and white-collar employees should be eliminated.

7. Managers and supervisors should be appointed on the basis of merit. Managerial skills should be given a higher priority than human relations skills as a promotional criterion. Here management is defined as the creation of an environment leading to self-motivation, autonomous control and self-development conducive to best organizational results.

8. Traditional divisions based on skills and trades should be eliminated. Instead, employees are to be encouraged to move beyond job boundaries to take up new assignments. Apprentice training in skilled trades has been discontinued.

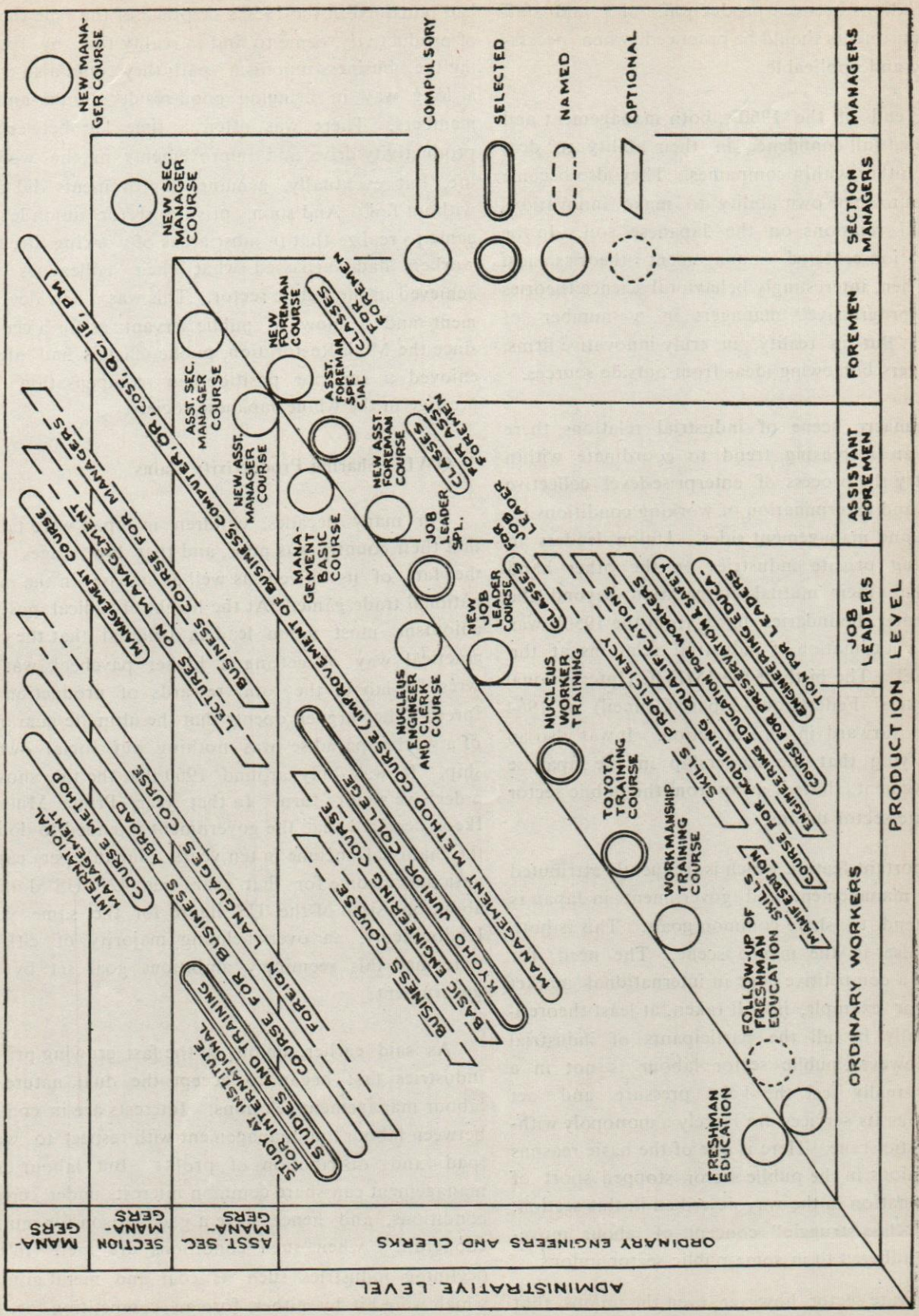

Fig. 2 : System of Education and Training at Toyota

Relations between production, sales and staff departments should be practiced when necessary and applicable.

By the end of the 1960's, both management and unions gained full confidence in their ability to deal with each other within companies. They also became confident as to their own ability to make innovations in industrial relations on the Japanese soil. In the meantime, job-centered management theories lost support. Then, interestingly behavioral science theories attracted "progressive" managers in a number of companies. But in reality, in truly innovative firms, both managers borrowing ideas from outside sources.

In the macro scene of industrial relations, there developed an increasing trend to coordinate within each industry the process of enterprise-level collective bargaining and determination of working conditions on both union and management sides. Union leaders in fast growing private industries on the other hand realized that their mutual cooperation beyond the national center boundaries fixed from the 1950's was vital to the coordination of industrial relations at the national level. The birth of the IMF-JC (International Metal Workers' Federation—Japan Council) in 1964 was a step farward in this direction. It was also an event signifying that the leadership in the Japanese layout movement shifted away from the public sector to the private sector unions.

One important feature which is frequently attributed to labour' management and government in Japan is that they tend to share common goals. This is both true and false in the macro scene. The need for maintaining a competitive edge in international market economy, for example, is well taken, at least theoretically, virtually by all the participants of industrial relations. However, public sector labour is not in a position to really feel the keen pressure and act accordingly, as its services are largely a monopoly within the domestic scene. Here is one of the basic reasons why most unions in the public sector stopped short of self-transformation in the way described in this section. In fact, the "class struggle" concept of labour movement is still adhered to in some public sector unions.

In the private sector, however, even the unions that had remained in the 1950's skeptical of the "pie theory' of productivity, came to find in reality that by following the "business unionism" path they could also travel a long way in bringing good results to rank-and-file members. There was often a time lag between the productivity drive and improvements in the working life, but eventually, genuine improvements did come without fail. And soon, private sector union leaders came to realize that in most areas of working life, their workers had surpassed what their colleagues had achieved in the public sector. This was a new development and a blow to public servants as for a century since the Meiji Restoration, public officials had always enjoyed a superior position in compensation and prestige in the whole Japanese society.

3. QWL—Sharing Productivity Gains

For many decades, children in Japan were taught that their country was poor, and that low wages were the fate of its citizens as well as an asset in the international trade game. At the height of radical postwar unionism, most union leaders believed that the only practical way of getting a higher paycheck was to wrest for labour the total rewards of production by force. They argued openly that the ultimate guarantee of a worker paradise was nothing but social ownership. It was only around 1960 that the tide showed a decisive sign of turn. In that year, Prime Minister Ikeda declared that the government intended to double the national income in ten years. Japan's per capita national income for that year was 421 US dollars, about one-sixth of the US figure for the same year. Undoubtedly, an overwhelming majority of citizens welcomed this seemingly ambitious goal set by the government.

As said earlier, unions in the fast growing private industries first began to accept the dual nature of labour management relations. Interests are in conflict between labour and management with respect to work load and distribution of profits. But labour and management can share common interests under certain conditions, and hence have a good reason for mutual cooperation when such conditions are met. In the declining industries such as coal and metal mining, which were hit by either foreign competition or the

"energy revolution", conflicts inevitably predominated on the industrial relations scene even during the high growth period. But in most other private industries, the need for genuine cooperation for higher productivity became firmly accepted by both leaders and members of unions, on the one hand. Union also made it clear that the unions should fight for a fair share for labour at the time of *Shunto* (Spring Offensives). For many years, since the inauguration of *Shunto* in 1955, the unions major target was across-the-board wage increases referred to as "base-ups".

Between 1960 and 1973, nominal wages compounded at the yearly rate of 13.2 per cent.[3] Even in real terms, wages increased during the period at 7.1 per cent per annum. In other words, average real wages increased by 150 per cent during the period. The actually "felt" income gain of an ordinary male worker already in employment at the beginning of the period may have been greater. First, he had additional annual increments based on his accumulated length of service excluded from "base-ups". Secondly, his childhood experience of poverty must have made his sense of achievement all the more significant to him. Thirdly, he was likely to be experiencing promotions in the organizational hierarchy with added responsibilities and an increasing larger number of junior colleagues working for him. Fourthly, he must have been witnessing the growth of his own company in size, fame, reputation and prestige in society. And finally, he though only having completed a compulsory education of six to eight years, was now most probably a proud father with his children attending high schools and colleges.[4]

From the unions' point of view, the primary vehicle to feedback information to their members on the success achieved in collective bargaining was the size of cash wage increase. The "percentage increase plus alpha" figure became a common denominator used for discussing success or failure of a particular *Shunto* within each company. It was then a small wonder that representatives of the union side proposed to take up wage increases as the first topic in a study of the quality of working life in Japan (Takezawa et al., 1982). The study dealt with improvements in the quality of working life in three Japanese industries, with study committee participants drawn from both unions and management. Parenthetically, but perhaps equally important in the context of the present paper was the fact that union and management representatives had few disagreements in committee discussions on the evaluation of the improvements made in working conditions during the preceding decade. Both sides were apparently pleased to share a pride in their joint achievements.

Throughout the 1960's, one social phenomenon attracted the widespread concern of management and labour leaders. It was the unfolding change in value system of workers under the influence of rapid transformation of socio-economic realities. The "affluence syndrome" was particularly prevalent among young workers who held a competitive edge over older colleagues in the expanding labour market. Generational value gaps became a popular subject in union assemblies and management conferences. Opinion and attitude surveys were widely used to assess the changing values of different age groups.

Table 1 shows for example, the results of an extensive survey conducted by the Ministry of Labour. On the basis of such studies, the Ministry even spelled out a three-pillar policy, each pillar designed to meet the specific needs of a different age group :

> Younger generation—Reduction in working hours and work redesign
>
> Intermediate generation—Assistance towards home ownership and property formation, and
>
> Older generation—Extension of compulsory retirement age.

3. Unless otherwise noted, figures are quoted from the publication which is used widely by labour and management throughout Japan as a common reference book. (Japan Productivity Center, 1983).

4. In 1960, 38.6 per cent of junior high graduates (9 years of schooling) took up jobs directly after graduation, and so did 61.3 per cent of senior high graduates after 12 years of formal education. The corresponding percentages dwindled to only 4.0 and 42.9 respectively in 1982. In 1982, 20.9 per cent of senior high graduates chose to go into higher education. (Japan Productivity Center, 1983 : 120).

TABLE 1

Generational Differences in Improvement Preferences : Japan 1971
17,251 Male Wage and Salary Earners

	Less Than 19	20-24	25-29	30-34	35-39	40-44	45-54	55-64	65 and Over	(Percent) Average
5-day week, shorter work week	49.0	42.5	37.1	34.6	32.3	29.6	24.5	28.8	30.4	35.0
Jobs compatible with ability and personality	19.9	24.4	23.7	17.4	17.3	14.5	14.4	14 9	10.4	19.2
Provisions for career training and education	12.7	16.4	15.6	15.0	11.9	10.3	9.9	6.3	7.4	13.4
Assistance towards property and house ownership	12.2	17.5	23.7	27.9	27.5	26.4	22.7	20.2	15.2	23.2
General compensation increases	63.8	63.1	65.7	66.9	67.8	65.9	60.8	51.7	42.4	64.4
Improved safety, work environment	13.1	8.9	8.0	8.4	10.6	13.4	14.7	14.2	12.8	10.4
Extension of compulsory retirement age	3.1	3.0	4.5	7 4	11.3	18.0	32.8	30.0	27.2	11.4
Improved employee benefits and services	14.0	15.3	12.0	12.5	10.9	0.9	9.4	18.1	33.6	12.6
Others	7.1	3.8	3.9	4.0	3.5	4.4	4.1	6.4	77.2	4.2

Source : Ministry of Labour, *Study of Worker Attitudes* (in Japans), 1972. Presentation rearranged by the present author. Two choices were allowed. Each column adds Up to 200% with the No Answers not listed here

Major trends of personnel policy changes, which were made on the basis of perceived changes of workers' needs, are to follow. Only those changes are listed here which carry a continuing effect on the present human resource management, as some of the change of a more experimental nature introduced prior to the oil crisis of 1973 have since been discontinued during the succeeding period of austerity :

1. Egalitarianism, on the one hand, increasingly characterizes the system of compensation levels at the macro scene. Most companies have a single monthly salary system for all employees. Occupational and seniority salary system for all employees. Occupational and seniority salary differences decreased during the labour short high-growth period, and the results have remained relatively intact since then.
2. Fringe items other than regular cash salaries and bonuses increasingly sought as important elements of good working conditions as a result of changing aspirations. Individual value orientations of workers are also becoming increasingly diversified. Personnel policies must be able to meet much individual differentiation in aspiration and preference.
3. Workers' concern with family life, or "my-home-ism", is no longer frowned upon within the corporate culture. Most married male workers begin building homes in their late 20's or early 30's. There is a presistent need for home ownership assisstance, and companies unions also take part in helping young workers.
4. Reduction in working hours, which made some progress until the first oil crisis and was then interrupted, is now again in slow but steady

progress. Nowadays, some forms of fiveday work week are practiced by a majority of larger firms. Three holiday belts, scattered throughout the year, are also coming to be a common practice.

5. Extension of compulsory retirement age, formerly set at around 55, is now in progress again. The shift, achieved at the union demand in the late 1960's in some industries, did not diffuse during the oil shock period. Nowadays, a near majority of large firms set their retirement age at 60.

6. New features are also being introduced into traditional fringe benefit areas in response to the changing needs of workers. Examples include autonomous recreational programmes, single occupancy of dormitory rooms, a wider selection of food in cafeteria, assisstance to handicapped workers, and group tours abroad.

7. Considerations are being given to work design in order to prevent work monotony and alienation, to eliminate heavy manual work, and to facilitate work for the aging work force. Job rotation is a common feature of factory work so that workers can continue to learn new jobs.

In 1973, important revisions were made in the National Welfare Person Insurance Scheme. The amount of annuity was substantially increased so that a retiring worker could now expect a payment equal to about 40 percent of average prevailing wages. This is anticipated to have a profound effect on corporate fringe benefits programmes, as workers will become less dependent on them. The same year, however, witnessed another dramatic incident, namely the oil embargo by OPEC countries announced on November 5. This triggered an abrupt change in the world economy and began also to bring about serious consequences on industrial relations in Japan.

4. Meeting the Challenges of a Low Growth Economy

The first oil crisis accelerated the inflationary trend that had already started a little earlier. During 1974, consumer prices increased by 24.5 per cent and wages by 26.2 per cent. In other words, the income lost to OPEC countries was shouldered largely by corporations. As a consequence, industrial production declined by 4.0 per cent in 1974 and 11.0 per cent the following year. Corporations, which had been so much accustomed to continuous high growth, suddenly faced an acute need for "weight reduction" measures.

The slimming operation had two major target areas borrowed capital and employed labour. As for employment, the secondary industry in Japan had experienced a continued expansion for nearly a quarter century. During 1974, however, Japan's manufacturing sector registered a net loss of 260 thousand in employed labour, and 600 thousand the following year. Hasty journalists even declared the death of Japanese management, reflecting the mounting pessimism over the future of "career employment".

One extensive survey (Sangyo Rodo Chosasho, 1978) revealed that 185 (74 per cent) of the 250 largest companies experienced net employment loss during the four years between April 1974 and March 1978. These 250 firms had a total of 2.32 million employees on their payrolls in April 1974. The total workforce dropped to 2.14 million, or by 7.5 per cent, with a net loss of 211,000.

The procedure followed for personnel reduction was more or less the same as the one that had envolved in the 1950's through union-management negotiation. Since then the pattern was followed occasionally by the companies where employment curtailment became absolutely inevitable. Steps normally begin with reduction of overtime work, and proceed successively to reduction of sub-contracting, non-renewal of contracts for temporary, seasonal and part-time workers, attrition and non-hiring of new school graduates. Next comes the stage where negotiation begins with the union on the quota of voluntary retires to be invited and special conditions to be provided for such retirement. Individually designated discharges are seldom undertaken as unions are strongly opposed to the practice in fear of arbitrary discrimination by management.

One new feature was added this time, namely the

introduction of early retirement systems. Prior to the change, mid-career resignations were practically discouraged by a penalty deduction made in the lumpsum retirement allowance which otherwise would generally amount to a month's salary for a year's service. The only exceptions were resignations to be made by open invitation for voluntary retires. The new scheme lessened this penalty feature so that employees beyond age 40, for example, could take full advantage of severance benefits. This scheme, however, did not in realty succeed well in inducing early retirement from among the bulge generation of lower-level middle managers.

The most serious predicament faced by management was the policy decision on the older employees group which was already increasing in size. On the one hand, QWL considerations would call for retention of older, long-service employees, particularly in the face of a new trend for retirement age extension. On the other, they were the most costly employees whose efficiency was bound to decline further by aging, and hence, should probably be considered first for termination of employment. During the period which immediately followed the first oil crisis, most companies tended to combine both paths by informally encouraging those less qualified employees to take advantage of early retirement benefits, including a number of older employees.

This weight reduction naturally left an undesirable impact on the morale of Japanese workers. In an international perspective, however, the dent made on industrial relations by the oil crisis and the recession that followed was apparently less damaging in Japan than in most other industrial nations. To begin with, the drop in employment and resulting unemployment have been less serious than in other countries. Apparently, formal confrontations, Japanese labour and managers have adopted their version of "work sharing", as unemployment has never since gone up beyond 2.5 per cent.

Japan did have a fairly bad inflationary period between 1972 and 1977, during which consumer prices went up at an annual rate of 13.4 per cent. Having learnt a lesson from this, however, labour and management in Japan behaved differently at the second oil crisis. The oil price increase was shared also by labour this time in the form of a cut in real wages, which successfully prevented an inflationary spiral. As wages did not rise so much, corporations managed to keep business under control, and were not forced to undertake another employment reduction. Here also, a defacto "incomes policy" seems to have worked.

The greatest lesson learned by labour and management from the two oil crisis, however, is probably the shared recognition that corporations must continuously strive in order to survive in the competitive world market. Particularly after the first oil crisis, both labour and management fought together frantically in an economic climate described as one of zero visibility. Rationalization efforts were extended even to penny-pinching saving of raw materials, energy, manpower and every other conceivable resource. Research and development, marketing production technology and procurement activities were thoroughly reviewed for possible improvements. When the skies cleared, many Japanese companies found even to their own surprise that their competitive capability had been substantially strengthened in the world economy as a result.

The "sound" search for optimum efficiency and effective human resource management is no longer a monopoly of manufacturing firms in the export sector. Gradually, such efforts are being extended throughout the nation. For example, Nippon Steel Corporation reduced its production employees from 59,550 to 47,600 between 1973 and 1981. The Tobu Railroad Company in the service sector likewise reduced employees from 17,276 in 1970 to 12,112 in 1980. Before, the union of this railroad company had long been known for its stance of militant opposition to any rationalization schemes. Now the reform is about to reach the public sector where the labour unions, and probably management, too, have seemingly preserved many of the immediate postwar ideologies.

It should be made clear, however, that in the most hard striving sector, pursuit of improved productivity is not being made only for its own sake. Higher productivity is sought also as a legitimate source of continuous improvements to be made in the quality of

working life. Here, the best of the legacies have been handed down from the period which preceded the oil crisis. Also alive are some of the traditions established even earlier.

Communications between management and the union, for example, have inevitably increased since the first oil crisis for many of the unions surveyed in 1981 (the Japan Industrial Relations Research Association, 1983 : 33). This survey was participated in by 682 union leaders throughout the country. Sixty-five per cent of the respondents admitted that "the frequency of talks between both parties on such topics as management policy, planning and performance of production and sales and business operation" had actually "increased" at the enterprise level after the first oil crisis. Sixty-six per cent likewise agreed that information supply from management on such matters had increased. Seventy-one per cent of the labour leaders then agreed that their voice given on such matters also had increased.

Some of the contemporary developments in industrial relations and human resource management are summarized as follows :

1. Manpower economization is now recognized as a legitimate organizational goal, not only by management but by labour, if it does not affect employment. Intensive use is being made of new, labour saving production technology. Introduction of microelectronics for factory and office automation is one clear new development along this line. Another case is the increasing acceptance of industrial engineering methods designed for labour saving purposes. Some indigenous techniques are also becoming diffused.

2. Improvements are continuously sought in the use of human resources. Effective utilization of women, particularly as part-time workers is one example. Widespread use of QC Circles and other schemes of small group participation clearly has dual purposes: improved quality of working life and effective human resource utilization.

3. Extension of the retirement age in favour of long-term employment security is again under way. Major companies are moving in that direction even in the industries where developments were slow, such as the iron and steel industry. Sixty-five years of age is likely to be the next target of retirement age extension.

4. Modification of compensation schemes is under way with the union consent to further reduce the role of age and length of service in individual salary dtermination. Beyond the age 50, the wage curves are to flatten out, if not descend, for most ordinary employees.

5. In anticipation of the rising future expenditure, the lump-sum retirement allowance fund is being transformed into private pension funds, at least in part. Retiring employees have an option to choose between a lump-sum payment and annuities for a fixed period. Supplementary corporate pensions for an indefinite period are also being introduced in selected companies.

6. Meritocracy is being strengthened for the promotion decision of middle managers. Accordingly, line managers and staff managers are being differentiated with accompanying changes made in manager classification and organizational setup. Selective promotion is also expected to affect lower managers and supervisors more extensively.

7. There is a current concern over the productivity in whitecollar work. On the other hand, office automation is likely to bring about continuing changes in organization, staffing, training and promotion of managerial and staff personnel.

8. "Low" capital productivity is being proposed as a baffling problem, as may be observed from Table 2. This table at surface shows that the high labour productivity of Japanese industries stems from heavy per capita capital investment, and not from hard labour. But when related to per capita capital investment, and not from hard labour. But when related to per capita capital outlay, the argument goes, the labour

TABLE 2

Labour Productivity and Capital Outlay in Selected Japanese Industries (1977)

(1,000 yen per employee)

Industry	Country	Labour Productivity	Capital Outlay
Ordinary Steel	Japan	8,914	20,102
	U.S.	8,028 (1975)	8,907
	W. Germany	5,652	
General Electrical Machinery	Japan	5,633	2,555
	U.S.	5,441 (1974)	2,427
	W. Germany	3,651 (1974)	1,600
Four-Wheeled Automobile	Japan	9,212	6,377
	U.S.	8,481	2,272
	W. Germany	6,183	1,421
Automobile Parts	Japan	6,445	3,427
	U.S.	3,837 (1974)	1,550
	W. Germany	—	1,076
General Chemical Products	Japan	11,743	26,269
	U.S.	10,151	7,861
	W. Germany	7,318	5,801

Source: Economic Planning Agency, Economic White Paper, 1980, p. 193.

productivity proves to be excessively low.[5] Thus, the drive for higher productivity is likely to continue.

6. Conclusions

This paper has presented Japan's industrial relations as an historical process of trial and error of labour and management in the face of changing political, economic and social realities. Japan's industrial relations are not a system that has been built after a grandiose design. In fact, industrial relations in Japan are not even a solid single system, as industrial relations functions as a social entity made up of an interwoven network of diversified institutions and actors.

Japan's industrial relations can hardly be called a model, as this paper has tried to show. There have been chronological changes. A variety of ideologies, policies and practices characterize Japan's industrial relations of today. There are also time lags; legacies and innovations are always found abundantly, and few of us can tell one from the other as we know little about what the future will bring. To say the least, Japan's industrial relations are not a set of technique.

If we have to single our one unique feature of Japan's industrial relations vis-a-vis experience of western countries, it is likely to be related to the fact and spirit that each economic organization must behave as a center of wealth generation, and that of distribution of the wealth thus generated, at the same time. And for best results, this dual function must be performed in a competitive climate, always in coordination with the changing economic reality of the organization and national and world economics. Other aspects of industrial relation, although not unimportant, are then to be worked out by those who represent respective interests within the organisation and outside.

As this feature is an historical consequence, it has its own shortcoming when seen from other frames of reference. Criticisms advanced by international friends and observers inevitably reflect their own historical and cultural backgrounds. Yet, open-minded leaders in management and labour camps in Japan are realizing the need to take valid criticisms well, as Japan's industrial relations are to increasingly share an interface with the outer world. Both directly and indirectly, Japan's industrial relations will have to face the need for "internationalization".

5. Akira Totoki, President, Japan Management Association, is a well-known spokesman of this school, and he has many supporters in industry. (Japan Management Association, 1982 : 29-55). If the current "low" capital productivity continues, would it invite a mass departure of Japanese capital to other countries ?

Also in the domestic perspective, many problems are foreseen for the future. Some problems are better defined than others and are likely to be solved soon through the joint efforts of labour and manangement. Care taken in the introduction of robots may be one example of such joint effort.[6] In many other cases, however, the parties involved do not yet agree on how to define the problems. For example, most top companies have not yet accepted university trained women as management trainees. Such companies apparently do not look at the problem in the same way as most feminist groups do. Other controversial issues include equally long-range predicaments such as the dual structure of the labour market, the employment of foreign labour, work-hour reduction and productivity, civil service reforms, and the macro effect of high technology on employment.

Whatever the future may bring, the labour, management and government of Japan are not likely to run out of intriguing problems, and hence opportunities to produce innovations.

6. On March 1, 1983, Nissan's management and union representative signed a new agreement covering the issue of new technology with a special accent placed on microelectronics. This document spells out the acceptance of technological advancements by both parties and the way to cooperate on the smooth introduction of new technology. Both sides agree to have prior joint consultation. The agreement also specifies management responsibility for employment security, working conditions, transfer and retraining, and safety and health.

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Technology—Productivity—Employment

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The author in this paper discusses the interfaces between technology, productivity and employment. He says that induction of new technologies is a contemporary economic necessity to avoid stagnation in the economy. The public policy according to the author should focus on offsetting the job income losses to enable the economy to keep moving.

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Some Conceptual Issues

It would not be wrong to infer that 'technology' is not an 'end' by itself; nor is it entirely 'neutral'. Or to put it another way if permitted to hypothesise, it can be stated that consequences of technical changes are influenced at least as much by the objectives that are sought to be achieved (by the Government or the corporate sector as the case may be) in introducing the new technology. Obviously, conceptual clarity is required to underscore what these mean or may imply.

Technology

While discussing technology is it Automation, Rationalisation or both being discussed ? Implications would vary accordingly. Then which are the identified areas/sectors/activities likely to be exposed to technological revolution hence to analyse Productivity : Employment interface ? This, mostly, is spelled-out in very general terms including the Seventh Plan. Therefore, the suggestion to attempt specification by thrust areas (by industrial activity) somewhat on the following lines (merely to illustrate) :

...Service Sector : Banking—Insurance—Professional Services;

: Communication and Telecommunications;

: Information Technology Sector including office jobs.

Office jobs outside the Service Sector including public administration.

...Marketing and Distribution.	: Producer services (those firm which sell intermediate services such as consultancy, and legal advice to other producer, etc.), Sales and Distribution, Retailing etc.
...Leisure Time Industries	: Entertainment; personal services of various kinds; Recreation and craft activities including Tourism etc.
...Manufacturing Sector	: Categorised like Chemicals, Fertilizers; Synthetic Fibre; Food Processing; Printing; Metal Working etc.
...Exploitative Sector	: Agriculture (exclusive of agro-business); Minerals and Mining etc.

Unless the word 'new technology' is defined with precision and reference to the context, what it consists of and which sector—process, and to what extent, is to receive the impact first in its absence (See : Seventh Plan, Vol. II, p. 170-204) any debate is likely to be vague.

Ever since the dawn of Industrial Revolution there has been a deluge of technological developments resulting into newer horizons and economic regimes; of course some developments seem to have bypassed this nation. What distiguishes the sunrise technologies is its reduced diffusion rate with far reaching effects not fully understood or envisioned. While India was, and is, struggling to bring the 'entire' country into steam—electricity circuit; the electronic revolution representing the second generation has been left behind and the world has entered the Third Revolution represented by micro-processor: information technology (information processing) revolution. Without imbibing the ethos and discipline of the First revolution, jumping into the fray for the Third has wide ramification, both in terms of equity and growth. The level of society's technology is set by the will-power and ability of its members to absorb, add to and apply the existing stock of world knowledge of science and industrial techniques.

Given the state of information, it can be said that it is difficult to isolate change in jobs structure in the last decade that have taken place due to technology. May be the technologies in vogue were not sharp enough to outline this influence. Nevertheless, forecasting the future, in the vaguely defined 'technology' (Seventh Plan) is all the more hazardous.

Productivity

This is another term that deserves careful adaptation. Economic theory, adopted by the ILO views productivity in terms of input divided by output and reducing it to 'per person' or 'per unit' of total input (TFP). Traditionally, productivity growth is considered, therefore, largely the product of change in macro variables such as capital investment, demographics, and education etc. It failed to explain : why within the same location/Industry/group making more or less the same product using the same manufacturing process would show, widely differing levels of 'productivity', 'growth' and 'profitability' ? As a result the following phenomena have remained unexplained.

—Does this concept include product quality and the firms capacity to expand technical capabilities ? It is common knowledge that America's foreign competitors gained ascendency in the last decade more from their straight forward ability to improve product quality, reduce cost, and by substanially expanding their technical capabilities.

—Does it mean absolute rise or rise in comparative productivity/efficiency ?

—Should "successful" firm be 'innovative' as well as 'efficient' (using Schumpeter and Veblen's definition) ? It is relevant to examine the statement of Professor William Abernathy, in his 1978 book. THE PRODUCTIVITY DILEMMA; he argued ; "Stated generally, to achieve gains in productivity there must be attendant losses in innovative capacity; or, conversely, the conditions needed for rapid innovative changes are much different from those that support high levels of production efficiency".

It is widely accepted that it was precisely the partial view of productivity premise that lead to the failure of Western economies in 1960s and 1970s. As long as markets are growing, and competition was limited, the traditional notion of productivity helped. The incompleteness of established macro-economic models to shed light on the nature and causes of productivity growth and technological change, as also to explore sources of productivity differences at the unit level, is apparent.

It would be complacent, therefore, to argue that rapid technological change and associated increase in productivity will by itself be sufficient to set us on the virtuous circle of high output, low unit costs and high employment. What can be safely concluded is that for unemployment to be reduced output has to grow faster than the combined rate of growth of productivity and labour force. Mere rise in productivity would be an inadequate approach to achieve near full employment least of all full-employment. Perusal of Seventh Plan 1985-90, does not reveal an appreciation of these aspects. The plan does not provide an insight about break-up of, expected productivity, gains via 'new technology'. Mostwhere targets are in terms of 'capacity' and 'production' (See : Seventh Plan, Vol. II, pp. 170-172; 175-204).

Employment

In view of the foregoing elements it is all the more difficult to forecast prospective employment trends under hitherto unknown technologies. The second best alternative is, apparently, to analyse the past and present employment implications for some of the powerful emerging technologies by sectors, elsewhere, and draw relevant inferences for India for public policy.

The Seventh Plan

Recapitulating the approach and strategies of the Seventh Plan (1985-90) is relevant. In conclusion the Plan approach dealing with technology is more or less to take the following path :

1. To consolidate the gains that ought to emerge from large investments already made : calling for efficient use of already committed resources.
2. To further strengthen endeavours to shift from traditional industries to basic metals, fertilizers and industrial manufacturers with an(to quote the plan) : "increasing share for the emerging technology intensive industries" (Self : Identities not specified).
3. To "evolve" an industrial structure and policy framework for "sunries" industries. And the Plan identifies characteristics of such industries as high technology, high value added "per-se" knowledge based industries like electronics, advanced machine tools and telecommunications.

What is to be inferred from the above, is that :

(a) Sector and sub-sector levels break-up of technology—productivity link is to be expected but not quantified. Much would depend upon decisions concerning the relative weight to be given to the infusion of different technologies.

(b) Try hard as we may, between 1985-90, the 'sunries' industries though expected to contribute more and more to the GNP/GDP but the share would still be insignificant hence of limited consequence to overall employment scenario, Nevertheless, the fact remains, that does require further examination at a later stage in this paper, that commitment to enter the Third Industrial Revolution has been taken; incidence would surface later; lag effect.

(c) Notwithstanding the terminological hair-splitting in the plan between "wage-employment" and "self-employment", it has been recognised that (to quote plan pp. 112) :

> "In formulating the employment strategy, a key role has to be assigned to the growth of agricultural sector. A steady growth in agricultural production through the expansion of irrigation, increases in cropping intensity

and the extension of new agricultural technologies to low productivity regions could create a large volume of additional employment because these means have a high potential for labour absorption. However, the agricultural sector alone cannot be expected to eliminate the backlog of unemployment and absorb the additions to the labour force .....However, as experience has shown, even a high rate of Industrial growth would not be able to create additional employment to absorb more than a fraction[1] of the unemployed and under -employed labour force in the organised industrial sector".

Placed as we are the real and true effects of hi-tech industrial policy may be visible by the terminal year of the Plan. Cascading effects i.e. secondary and tertiary effects, the number and sequencing of a number of compensating effects, may take more time to surface i.e. beyond Seventh Plan.

EMERGING RELATIONSHIP

(Technology : Productivity : Employment)

Over-all Scenario

Discussion here will be mainly confined to sunrise industries.

The relationship between productivity and employment or unemploymenr in the whole economy is difficult to identify. Therefore, the discussion better be about technology and employment in different industrial activities. First presentation is about the over-all pattern than for eaeh of the Hi-Tech. areas, by industrial segment.

By looking at histrical data (Table-1). one can see a pattern of high productivity growth being associated with high output growth, accompanied by good overseas trading performance (Japan - West Germany etc.) and, in consequence steady or rising employment. Results of another study relevant for this discussion is the one conducted by the Institute of Labour Market and Research, FRG in which it analysed 3000 technical changes sub-divided into four categories (Table-2) in 1600 enterprises. Had it not been for the 'expansion' factor the total employment effect of technological change would have been negative.

What deserves to be highligted is the *concurrency regime* viz : higher productivity-steady growth in productivity-high growth in output and expanding market (a function of relative productivity and quality) *to contain unemployment*. As hypothesised earlier, technology induced high productivity alone may not be adequate for containing unemployment, or to create more employment, whichever way one may like to look at the problem.

Technology : Employment Patterns

Notwithstanding the difference of opinion regarding the quantum, a pattern is discernible between the new technologies[2] and their likely employment effects, if one is to infer from the experiences of others. More prominent implications, among the many, have been summarised below :

Firstly, decline of traditional manufacturing industries is apparent. Between 1970 and 1981 European countries lost 5.5 million people; in early 1980's the more seriously effected are the heavy and material processing or processing industries. 'Light' product and processes seem to be the emerging preference becoming an era of 'process' invention than 'product' invention leading to the reduction of labour force.

1. Seventh Plan, Vol. II,Chapter V, para 5.3, makes an interesting reading in contradiction. In brief it stipulates, say recognised, that neither the agricultural sector nor the organised industrial sector will be an answer to the nation's problem of unemployment. Then what is left about is the unorganised industrial segment and service sector. Would those be able to cope up with the crying needs for employment ?

   How the new technology will affect employment generation in the service sector, therefore, deserves a detailed examination.

2. Study of USA suggests a pattern : new plants with new technology are in historically non-union or anti-union states; areas of traditional union strength are left with a ging, obsolescent plants.

TABLE 1

Structure of Civilian Employment : Woman and Salary Earners
(in percentages)

Country (within brackets= % Growth of % GDP per worker/% Growth of GDP	Agriculture			Industry			Services			Women			Wage and Salary Earner		
	1960	1971	1981	1960	1971	1981	1960	1971	1981	1960	1971	1981	1960	1971	1981
A-High Growth															
West Germany (4.7/5.7)	14.0	7.5	5.9	48.8	47.5	44.1	37.3	45.0	49.9	37.8	37.2	38.7	77.2	84.2	86.2
France (4.8/5.0)	22.4	11.4	8.6	37.8	39.7	35.2	39.8	48.9	56.2‡	35.2	36.0	38.0†	69.5	80.7	82.9
Italy (4.6/5.1)	32.8	18.3	13.4	36.9	39.2	37.5	30.2	42.5	49.2	30.1	28.7	32.3	58.4	69.4	71.5
Japan (8.0/9.5)	30.2	13.4	10.0	28.5	37.2	35.3	41.3	49.3	54.7	40.7	38.5	38.7	53.4	68.7	71.7
B-Lower Growth															
U.S.A. (2.0/3.7)	8.3	4.2	3.5	33.6	33.2	30.1	58.1	62.6	66.4	33.3	38.5	42.8	83.9	90.3	90.6
Canada (2.2/4.6)	13.3	6.5	5.5	33.2	30.6	28.3	53.5	62.8	65.2	26.8	35.2	39.7	81.2	90.1	90.1
U.K. (2.5/2.7)	4.1	2.9	2.8	48.8	42.6	36.3	47.0	54.5	60.9	34.4	37.6	40.3	92.7	92.1	89.8
Denmark (3.3/4.2)	18.2	9.5	8.3*	36.9	33.8	30.0*	44.8	56.7	61.7*	31.8	41.1	43.6*	76.4	81.5	83.9*

: But for Japan, West Germany and France average unemployment rates were more than 3% and J. Corn Well (1977) : Modern Capitalism. Its Growth and Trnsformation.
: Based on ILO Definitions and Reproduced in World Labour Report, 1984, ILO, Geneva. 1984.
: * = 1977; † = 1980; ‡ = 1968.

TABLE 2

Employment Effects of Four Types of Economic Change in FRG

Year	Activity	Innovation	Rationalisation	Expansion	Reduction	Total
1970	Synthetic Material	+ 1.01	− 0.05	+ 2.07	− 0.20	+ 2.83
1971	Wood	+ 0.81	+ 0.09	+ 0 54	− 0.21	+ 1.23
1972	Food Processing	− 0.06	− 0.74	+ 0.92	− 0.31	− 0.19
1973	Metal Working	+ 0.43	− 0.09	+ 1.40	− 0.15	+ 1.59
1975	Printing	− 0.38	− 0.37	+ 0.24	− 0.39	− 0.90
1977	Retail Trading	+ 0.21	− 0.37	+ 2.16	− 0.34	+ 1.70
Average		+ 0 34	− 0.26	+ 1.22	− 0.27	+ 1.30

—Innovation : Research results in new products or processes (new energy source or electronic data processing).
—Rationalisation : Producing conventional products more efficiently while use of production factors remains equal or diminishes.
—Expansion or Reduction of Activities : Without a change in technology or products.
Source : W. Dastal : Bildung and Beschaftigung in technischen Wandel referred to by Colin Gill.

Secondly, unemployment induced by new technology will affect not only the quantitative aspects but more critically the qualitative aspect (in terms of skill-educational background) of the labour force. Further more, those displaced would be different set/group of workers then those who come in. Beneficiaries are most likely not be the same set of people who have been directly affected by displacement/deskilling effects. Possibility of regional problems (job locations) arising out of stagnation/decline of tradionally established industrial belts may emerge calling for a special sort of public policy for manpower rehabilitation and adjustment.

Thirdiy, occupational changes in the short-term may be different than those in the long term. For example, as telecommunications becomes increasingly linked to computerised information systems and devices; occupations like secretaries/typists/ administration employees/Bank & Insurance etc., may get reduced due to facilities for text processing in the short-run and later due to automated administration with linked decentralised systems (automated-computerised machines with CNC etc.); Electrical fitters/a Technical draughtsman/laboratory technicians and technicians by automatic assembly units/automatic analysers and in the long-run by CAD/CAM and programmed machine tools etc. More intense and widespread effects have been observed in service occupations and public administration. Earlier workers got adjusted to modernisation easily because the transformation in skill required was marginal. Not so now.

In short skill differentiation for manpower at different stages are likely to be in sharp focus. This would call for a very heavy input of training and retraining. In other words these technologies will have shorter life, diffusion process[3] will be shorter unlike the previous techs.

Fourthly, primary effect of the tecnnology on employment may be negative; the secondary and tertiary may tend to be positive. Overall effect would depend on how soon the later effects are consolidated (time lag?). To illustrate : new telecommunications, computing and information storage technologies are bound to affect adversely employment in traditional service sector. But these losses can be evened-up provided endeavours succeed to use these as throughputs in enlarging education, medical services, entertainment, and by expending in width the commend of traditional service sector. In this reckoning it may be suggested that employment of 'hired service' being replaced by 'self-service' (final service function) should be counted as addition to employment.[4] This concept needs careful consideration by economists-statisticians both.

Fifthly, though much would depend on the way industrial structure is altered, one fact outstands that sunrise technologies have for wider impact on products, markets, distribution and on the choices open to entrepreneur; stakes due to international competition will be very high. Diffusion rate of some of the sunrise technologies is known to be much shorter than the previous major technologies (steam-electricity), in consequence, technology induced 'frictional unemployment' will stay with us—'automatic balancing' of those displaced provided with new jobs may remain a myth in times to come ?

Sixthly, and finally. a perceptible change in social

3. This transition may neither be smooth nor stable. For example the technological thrust of any major invention moves in wages, time interval would depend on many exogamous socio-economic variables; cascading effects of such inventions are supposed to extend over decades. Take the case of steam-power/electrical power that produced an economic spurt for decades—resulting in expansion of activities and massive demand for labour. Likewise the present inventions may remain dominant for some time; may lead to some new products.

4. Examples are : Instead of using hired vehicles more people using self-driven vehicle for work; instead of hired cleaning to use domestic cleaning gadgets and the like. Hours on those displace wage employment and reflect 'self-employment' :

See : (a) J. Gershuny, After Industrial Society ? : The emerging self-service economy (Macmillan, London, 1978)

(b) J. Gershuny and I. Miles, The New Service Economy : the transformation of employment in industrial societies (Frances Pinter, London, 1983).

attitude towards employment work life i.e. part-time working, multiple-employer working, and towards homeworking, will be involved. Part-time employment, homeworking, or to work for many employers (reflecting a sort of unemployment or permanent employment) carried a guilt psychology; certain types of work have not been socially acknowledged.[5] With some of the new technologies widespread dispersal of producing 'units' have become a reality: much of the monotonous and repetitive jobs need not be done by human beings (earlier preferred as women job), and possibilities thrown open due to small batch engineering are immense.

To these reasons, and others, some industrial societies wish, may wish, to slow down the induction of such technologies unless certain of employment consequences.

Let us now take some of the economic activities, industry-by-industry, exposed to sunrise technologies and the likely employment work effects that those have engendered.

This in no way purports to be an exhaustive inventory of areas exposed to new technology. Neverthless, it does cover such industrial/economic activities where primary impact is more likely to be felt in India by end of the Seventh Plan. Experience of others is, therefore, worthy of studied review :

A. Automation in Manufacturing Process : Primary impact have been observed in : machining, assembly, materials hadling, quality control, stock control and and design. Numerically controlled (NC) and Computer Numerically Controlled (CNC) machines for machining; automated Warehouse; use of mini-computer systems in materials-stock management (use of Robots in India may be a far cry) are some of the entry points.

Researchers[6] from the University of Michigan, and Society of Manufacturing Engineers predicted (about U.S.A.) that :

...by 1985 20% of the workers currently employed in assembly would be replaced by automated systems; 20% of industrial jobs would be redesigned:

.. by 1985 50% of the labour force employed in assembling would have been replaced;

...80% of manual work (in auto industry) would be automated by the year 2000 which, at present working hours, would amount to the elimination of 20 million jobs from the present total of 25 million.

...Forecast for the manufacturing employment for the major OECD countries, prepared for an Inter-Governmental Conference on "Employment Growth" (February, 1984) was :

Employment gains/losses

	Optimistic scenario	Pessimistic Scenario
Japan	+ 3.35 and 5.69	+ 0.37 and + 0.99
U.K.	— 0.48 and — 0.86	— 1.28 and — 1.97
U.S.A.	— 0.31 and + 0.47	— 1.56 and — 1.70

(Job losses in offices and in the service sectors not taken into account).

Continuing level of unemployment in U.K. since 1979 is an established fact; maximum entry of the new technologies has been in the manufacturing sector. One may continue to debate as to the share to be aportioned to the new technology and to other trade reasons in demanning/unemployment or for slackening growth of employment.

B. Office Sector—Service Sector : Office employment in general and mostwhere, eversince the Second

5. To illustrate (indicative of future openings) : performance of community and personal service activities such as baby sitting, nurse maiding, restaurants, house keeping, appliance servicing, vocation management, maintenance of civic amenities are some.

6. (a) Quoted in A. Gorz, Farewell to the Working Class (Pluto Press, London, 1982)

(b) European Trade Union Institute (ETUI). The Impact of Micro-electronics on Employment in Western Europe in the 1980s (Brussels, 1979).

World War, increased substantially. Will it be so in the future? While the possibility to carry-on office[7] work from home, in India, may be a far cry, the following effects are obvious :

.. In France, a special study undertaken in 1978 for the French President estimate that there would be a 30% displacement not only in dismissals but also in the form of jobless growth of office workers in banking and insurance companies whereas it had previously increased by 5—10% a year. This pattern has profound meaning for female employment; be it France or India.

...Conceiving the office as an information processing system, use of word processors, automatic cashiers and by phasing-out routine nature of civil service work (group decision making, in person-to-person dealing, file retrievel are some examples) to computers and through visual display units etc., *have immense productivity potential* (to service more and faster) but job losses are apparent: in U.K. by 1985 itself, according to one estimate, some 21,000 typing and secretarial jobs would have been reduced; by 1990 some17% would be lost. The picture is similar in FRG where, for example, the number of jobs in financial field declined by 6% in 1976 despite an increase in volume of business. Some pattern was observed in U.K. etc. To quote Rada: "Two simultaneous employment effects of the introduction of the new technology are labour displacement and a loss of job creation potential; they lead to an over-all decrease in the labour requirements of the economy" (p.105).

...According to one estimate, in the FRG, out of 2.7 million office jobs, 43% of those could be standardised and 25.30% automated. The potential job losses would differ according to sector; in public administration it would be more as compared to the private sector.

...Rada's[7] assessment of effects an office work deserves extensive mention to highlight probable and in a general way the extent of employment: productivity effects (quote. pp.31-35 op.cit.): "In the future it is expected that the office worker will be supported by equipment equivalent to five times the present value and that most of it will be computer based.....Increased office productivity (underline by SELF) will contribute to over-all company productivity *and thus to its competitiveness*, in some cases it will bring greater returns than equivalent increases in manufacturing operations..... (*SELF*. Table omitted)..... Past evidence shows a decrease in jobs or a loss of potential job creation as a result.....Indeed the Post Offiee (*SELF*: FRG U.K.—France) has already taken the first step towards the introduction of electronic mail service.....It is not possible to provide a detailed forecast of labour displacement in the office for a given country..... However, it is clear from the existing evidence that office automation will have a substantial effect on employment levels over the next four to eight years (*SELF*: much depend on the pace and pattern of adoption). "Extra-polation based on past trend at this stage may be hazardous as the multifarious uses, leading to spate of secondary and tertiary effects of these technologies continue to open-up newer vistas".

...Retailing is another area which grew in the post-War years phenomenonally. Indications are that there will be decrease in sales force/representatives. Possibilities of some service sectors moving towards concentration is more a reality. In France, in 1977, in printing industry significant dismissals were predicated (Rada. op.cit. p.35.)

(*3*). *Other Fields* :Three other fields may be briefly mentioned. First expansion of jobs in the entertainment

7. (a) J. Child, New Technology and Development in Management Organisation, OMEGA, Vol. 12, No. 3, 1984, p. 218.

(b) I. Baron and R. Currow, The Future with Microelectronics (Frances Pinter, London, 1979).

(c) J. Rada, The Impact of Micro-electronics—a tentative appraisal of information technology (ILO, Geneva, 1980).

sector-repairs, maintenance of household gadgets (consumer hardware) is certain. Second, application in agriculture is very hazy (but for farm mechanisation) but possibilities in livestock farming, crop control, weather forecasting, and in natural resources maping and development can be foreseen. Thirdly, printing[8]—architects/designers work are other effected work where computer-aided design techniques and estimates may substitute manual exercises.

Conspectus

For the economy to service and to grow, within the framework of a competitive social order, the question is *not* whether to modernise or to adopt sunrise technologies; if that is *the* issue then the answer is 'we must'. Concurrently, and more importantly, issues and aspects worthy of consideration are : how and at what pace to go about it? To forsee likely effects, both beneficial and negative; to take necessary corrective measures. And, in this exercise it is not the aggregate approach, the more seeming side, that should enamour us but the micro level/group-individual based dynamics that should be the core of the development approach. Furthermore, the discussion on technology-productivity, in India has, hithered all the manifestations of 'leap frog' approach; whether intended or apparent is a most point. Do we really mean and consider that feasible? Or, what is being really envisaged is a *step-by-step* approach albit putting forward steps in accordance with the social objectives and in the desired direction, one wonder.!

Having scanned the horizon for the more likely implications of technology on productivity and employment, the following deserve particular mention in conclusion :

(i) Radical technological change caste a long shadow before it. Satisfaction of having technological marvel is accompanied by dangers, both to society and the way work is organised. It need not necessarily follow any predetermined direction, nevertheless, experiences would be worth looking into.

(ii) Application of computer and information technologies have often lead to deskilling, unemployment and resistence to change, as well as to radical improvements in productivity and competitiveness. These effects do not depend on the technology alone. The consequences of technical change are influenced at least as much by the objectives that the management seek to achieve in inducing change.

(iii) To avoid demanning and/or unemployment the three conditions have to be concurrently met : (a) output has to grow faster than the combined rate of growth of productivity and labour force; (b) the market has to continuously expand (competitiveness of the product in the international market must be maintained), and of skill upgradation.

(iv) Managerial response to, and choices for, sunrise technologies is equally if not more critical for achieving growth and productivity. Whether organisations are prepared to promote and assimilate change; to change their organisation structure and style would be critical importance. In this context it is relevant to examine the adequacy of the traditional economic models using aggregate data to provide an adequate explanation of the productivity slow down, or for not realising the productivity potential of the given technologies. Understanding factors that influence productivity at

8. Following quote is to illustrate on such work dimension : "Eddie Shah's Newspaper TODAY, got off to a great start. . . Shah's operation is latest in high technology. I called into the office to write a small article for the second issue. No one could find me a typewriter...a paper. . . . Reporters carry small word-processors in their briefcases. When they have got their story, they sit down somewhere quiet, put the story into the word-processor (it runs on torch batteries), hook the word-processor into an ordinary telephone with a thing called a modum, word-processor into an ordinary telephone with a thing called a modum, and their stories feed in seconds into the main computer at the Shah headquarters . . . . When a page has been made-up and is ready for the printer, the operator presses a button and off goes the page, several hundred miles in one cases, to the print house" (*Indian Express*, ENTER THE 21st CENTURY, TODAY; March 24, 1986.

the firm or unit level is very important; so is the managerial response to sunrise technologies.

(v) A related dimension is concerning the 'wage employee'. Traditionally labour has been considered as a variable factor of production albeit productivity analysis. Technologically 'yes'; otherwise 'no'. This fixity is not confined to labour, or to direct labour input, alone but should include all other categories of employees whose number is pre-set by the size of the firm and not by the level of activity. Productivity analysis should reckon with this frame and not to the ideal type where labour is invariably taken as a variable input.

In this context the *whole gamut of labour laws* in India deserve review; would require substantial changes; may be rewriting the labour laws as such. It is pertinent to raise the question: whether under the existing framework of the labour laws the full potential of the technology for productivity can smoothly be carried through and in time ? A reference to "8-Point Charter of Demands" by the National Federation of Petroleum Workers (INTUC) submitted to Minister for Petroleum, Govt. of India and the issues (at times crisis) being raised by trade unions connected with the modernisation programme of the Birla Cotton Spinning and Weaving Mills Ltd., will illustrate the enigmatic situation.

(vi) There is ample empirical evidence, elsewhere, to suggest lesser dependence on conventional pattern of permanent employment; rather the new technologies utilised more of part-time staff; capacity to achieve the same or even higher output levels with decreasing inputs of labour; reduction in working hours generally leading to increased productivity.

(vii) To assume that Technology—Productivity—Employment (displacement : New jobs) processes would automatically be in balance would be an over-simplification of a highly complex process; an incomplete premise fraught with dangers. The argument that deserves studies attention is *not* whether jobs will be lost; it is bound to happen; but whether other jobs will be created elsewhere ? Since the group/class of workers (defined in true economic sense) displaced/unemployed may be different from those benefitting from the new technologies; how the society is going to rehabilitate such audience is crucial to the society in general and to that group/class in particular.

(viii) Some of the prospects and possibilities about the future work patterns, discussed earlier, may be on the distant horizon, beyond the time frame of Seventh Plan; but so is the realisation of technology induced productivity. Possibilities discussed are real; likely to surface initially inconspicuously subsequently widespread.

If history, experiences of others, has any relevance then sunrise technologies have far reaching implications, beyond the pale of productivity viz; in terms of economic structure—business concentration (structural and operational source both); international dependence hence linkage of the domestic economy; for employment, and ideology of work. Rada's observation (op. cit. p. 6) that "most trade unions in developing countries do not treat this as a central issue in industrial relations", does not reflect the situation correctly. Even Japanese unions are increasingly showing signs of unease and have pressed, and are pressing, for agreements on the introduction of new technologies.

In conclusion, induction of new technologies that can play a key role in overcoming stagnation and stimulating economic development seem to be a contemporary economic compulsion. What public policy should recognise is to contain, if not being able to fully avoid, the fall-out effects albeit how to offset job-income losses if nothing more.

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Strategy Formulation : A Case Study

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The authors in this case study describe a model for strategy formulation as applied to a firm in South India in a comprehensive manner.

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Introduction

The firm, Venkateswara Agro-chemicals and Minerals (VACM) at Madras formulates pesticides and produces trailers for use in the urban areas. It is a daughter of Peirce Leslie India Ltd. (PLI), but quite autonomous.

The pesticides are distributed by the parent company in the four southern states. See Figure 1. The trailers are distributed by an independent sales-representative. For the sake of simplicity we will deal in this article with the pesticides. It is a small firm: some 50 employees, 2 crores Rs (1 crore = 10^7 Rs = almost 10^6 U.S. $) turnover, some 10% added value. The potential market in India is over 400 crores, and slightly increasing every year. Formulating is done by 250-300 firms. Most formulating is being done by basic manufacturers (Bayer etc.), but the Indian government does not allow them to formulate more than 50% of their production.

The balance they have to give to a few other minor firms, mainly by government choice. Nevertheless, these basic manufacturers are very strong in the market. First of all because the initiate new products with brand names. The others follow. Secondly the larger firms have some 10 to 15% of the market. VACM under 1%. Thirdly: most small firms don't live long because they lack financial means to have a

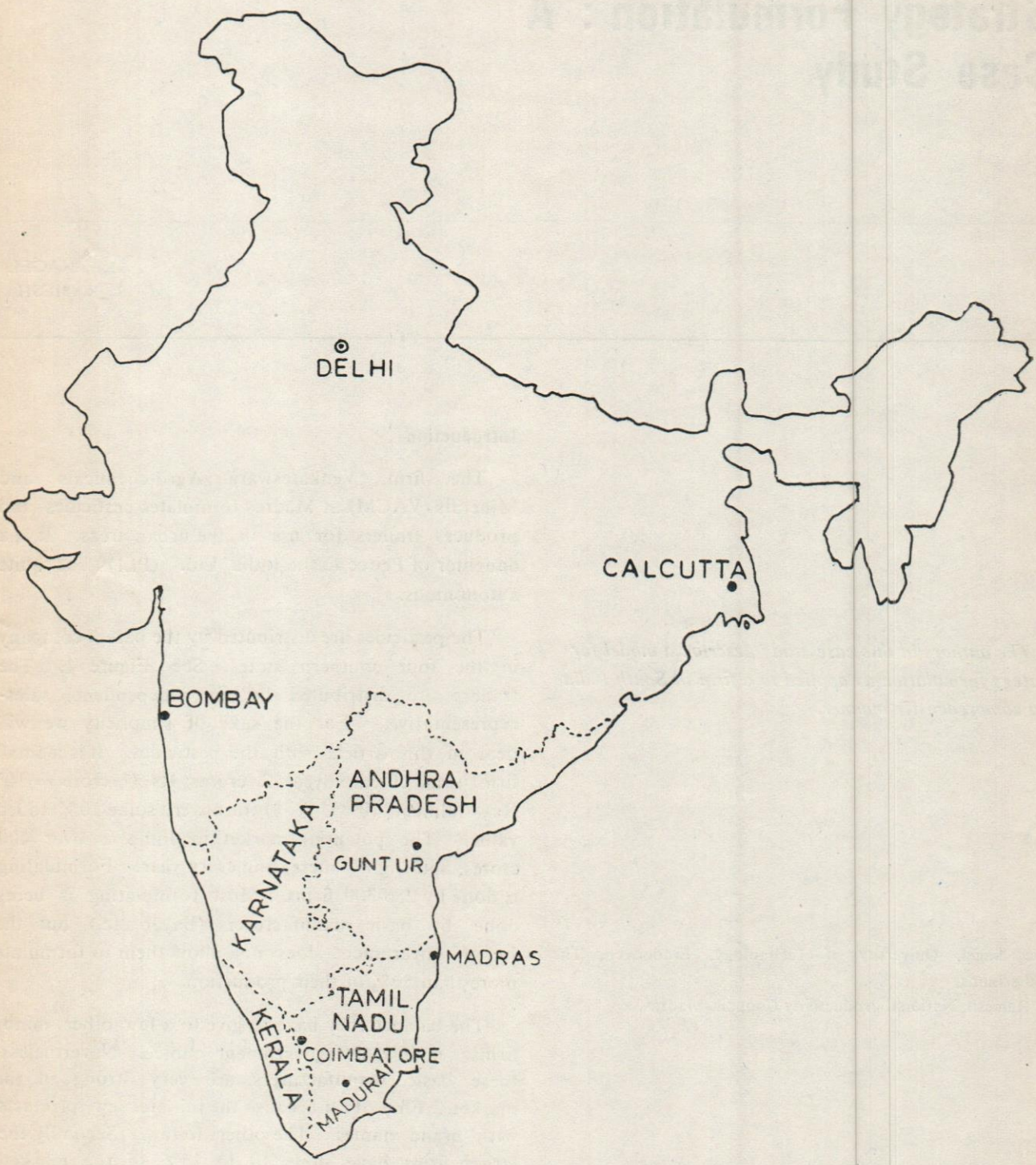

Fig. 1 : Madras and Environment

long breath and—last but not least—they have a weak distribution channel.

So there is little scope that the number of small firms will increase.

VACM has obtained registrations for over thirty products, among it the newly introduced synthetic pyrethroid. This range is quite good, although a larger range should be more attractive for the dealers.

In Tamilnadu, Andhra Pradesh and Kerala there are some 300-400 dealers. Most of them are supplied by VACM. The farmers can pay only after the harvest and as a consequence 1 to 2 months credit is given to the dealers by the formulaters. Likewise basic manufacturers give some credit to the formulaters.

We tried to make a product-market analysis (one of the key information you have to have in a firm) in terms of sales and contribution per product per crop per year per area, but this was, in spite of the extensive and detailed information VACM has at hand almost impossible.

We were given six lists of products and markets, but these were not compatible in terms of unit (litres, pieces, MT, Rs.) time period (one whole year, others April till December) and the like.

It is possible that better information than we got could be derived from the files but our impression is that things could be organised much better in this respect.

Anyway, we could produce some relevant product-market matrix out of the data given.

From this we could draw several conclusions, e.g. :

1. Andhra Pradesh and Karnataka have more than 90% of the volume. Why is Tamilnadu so lagging ?
2. Four products provide for 95% of the volume. We have to compare this with aggregated data for all companies per area per product (if available) to assess whether VACM is performing well or not for a given product and area.

Analysis like this can't give straight-away solutions, but they give questions; keys for solutions via discussion and/or in depth analysis.

We carried out a market survey. The questionnaire is shown in Figure 2. And the results are summarized in Figure 3. These results are quite obvious. Dealers

1. Is VACM your supplier ?
2. If not, why ?
3. Which are the products VACM supplies you ? For how many years ?
4. Do you know the whole product range of VACM ?
5. How many years are you in the pesticides business ?
6. Yearly sales turnover ? Wholesaler/retailer ?
7. Main crop in this area ?
8. Are there products which VACM could provide, but upon which you prefer other suppliers ? If so, why ?
9. Are you satisfied or not satisfied with VACM's quality, price, delivery time, service, credit facilities, sales incentives ?
10. Do you foresee any increase/decrease in the amount of crop ?
11. Same for crop diseases and pest population.
12. Do customers indicate the brand or is it due to your choice ?
13. Do you foresee increase/decrease of certain products (all companies) which and why ?
14. How many suppliers do you have ?
15. Do customers prefer small or large packages ?
16. What do you think about VACM packaging ? Symbol ?
17. What do you think of VACM (PLI) agents ?
18. What do you think of VACM's sales promotion ?
19. Any comments on PLI and VACM brochure ?
20. Your name please.

Fig. 2 : The questionnaire (abbreviated)

--46 dealers and 5 agents were interviewed.

Distribution of the dealers interviewed :

—Guntur (the place of the pesticiedes market) : 18

Main crop : Cotton, further on tobacco and Chilli.

—Madurai—Main Crop: Cotton : 6

—Madras—Main crop: Paddy : 11

—Coimbatore of which : 11

Nilgiris: Crops: tea, vegetables

Pollachi: Crops: paddy, cotton, groundnut and vegetables.

—awareness of VACM to dealers can be improved greatly; this can be effected because :

—not all farmers insist on established brand-names; Half of the farmers are indifferent and satisfaction about VACM is quite good.

—packages are quite different;

—commodity product;

—quality and price okay;

—delivery time okay;

—dissatisfaction about credit facilities and other incentives;

—the packages are being liked;

—agents/salesmen are appreciated very well although some agents are less interested in pesticides than in fertilizers;

—an overall lack was felt in fieldwork and sales promotion;

—farmers are in favour of small and liquid packages, although there are signals that granules might come up;

--the yearly turnover of a typical dealer is some 5-10 lakhs, whereas this is much higher in Guntur;

—also in Guntur one will find the whole range of products, whereas in other areas only half of the range is applicable;

—Other dealers' attributes :

number of VACM products carried : 2—4

number of suppliers : 10—15

number of total products : 30—40

—a slight increase in crop diseases and pest population can be expected;

—dealers foresee an increase of the use of :

* Synthetic Pyrethroid (except Madras)
* Monocrotophos (Guntur)

—and a decrease of :

* BHC (Madras)
* Carboryl (Madurai)
* Malathion (Guntur)

Fig. 3 : Summary of Market Survey

are satisfied with VACM except for the sales incentives and promotion by VACM.

VACM has ambitious plans to penetrate the markets in North-West India, making use of the distribution network of PLI. This because of two reasons: Increasing sales and spreading risk over the country. Having increased the sales VACM management thinks it would well be possible to go into basic manufacturing. We don't think that this is possible. The required know-how and skills is not easily available to the company. It requires also a different attitude (research). The investments will be high and it is a 'law of business' that the value added by backwards integration is less than in forward integration. So instead we think in the opposite direction. In our opinion there are two more reasons for spreading the the wings over the country. The market of pesticides is growing by several percentages per year. So one should enter now when it is still growing. It could well be that it will stabilize or even decline in 10 to 20 years (source: Agricultural Dept. in Madras) due partly to substitution by biological control. A second reason is the possibility to make a more precise total forecast because if the forecasts of several areas are independent, the deviations will level out.

Also VACM sees much opportunity in home insecticides. In fact it was introduced right after our survey.

SWOT Analysis:

To summarise previous diagnoses, forecasts and comparison, one can state some key-issues in strengths — weaknesses — opportunities—threats matrix. Some strengths may help to overcome some threats, or exploit opportunity. On the other hand some weaknesses may be reinforced by some threats or phased out by some opportunity. See Figure 4.

Alternatives

Having all the data gathered and analysed, we had lengthy discussions with VACM management and we eventually came up with the following feasible alternatives.

—Increase in sales in South India especially in Tamilnadu by adjusting the marketing mix— promoting by posters, brochures, (including safety-aspects) field work (VIDEO) demonstration, meeting with dealers and extending credit periods.

—Enter North India, relying on PLI distribution network, and start in the near future a second unit in this area.

—Exporting to e.g. Taiwan, Singapore, and Sri Lanka.

—Forwarding integration, i.e. selling or hiring out equipment to use pesticides; sprayers, helicopters, safety equipment etc.

But better than adhoc alternatives, one can consider the *common thread of the business.* Like many managers VACM's management is highly inclined to enter any attractive market. So the home-insecticides are entered, which has no single relationship with agro-pesticides. The only similarity is that some agro-pesticides are insecticides. But both manufacturing, marketing, distribution, use and purpose is totally different ! VACMS's common thread could be e.g. agro-cultivation rather than agro-chemicals ! And since management has decided to go into home-insecticides, one could argue that a second division is urban cultivation (for use in houses, kitchen gardens, hotels, restaurants to kill insects and protect plants and flowers). The second market is a consumer market, where the former has more characteristics of an industrial market.

In Figure 5 we show some basic features :

As argued already VACM should go into forward (vertical) integration rather than backwards. Think of the synergic impact of the farmer using VACM equipment together with VACM pesticides.

Being in urban-cultivation one can think of small packages pesticides for e.g. vegetables (kitchen-gardens) or plants and fiowers. But also think like deodorants, sprayers for use of pesticides etc.

Objectives should be rated in functional rather than in physical terms.

For all three divisions this could be worked out more in detail. The message here that if one has a more fundamental look on the business, one can see other possibilities. Important here is that these possibilities are related to the present business and not just unrelated product market technology combinations.

Recommendations

Finally we come up with the following ideas, agreeable for VACM's management (in which the financial recommendations are not fully explained here, being not relevant for the purpose of this article) :

General

1. Split down the company in two divisions :
   Rural-cultivation and Urban-cultivation.
   It will spread (financial) risk and profile the identities.
2. Improve management information, with or without the help of a computer.
3. Avoid high investments. First consolidate the businss. Avoid too rapid growth; monitor the liquidity carefully. First of all equity-debt ratio should be 'normal' before VACM can invest heavily. Another reason to consolidate

	STRENGTH						WEAKNESSES						
	BACKED BY PLI	INRRASTRUCTURE (DISTRIBUTION NET WORK OF PLI)	ACCOUNTING SYSTEM	RELATION WITH BANK	PROFESSIONAL MANAGEMENT	QUALITY/PRICE/ PACKING SERVICE	PL AGENTS HAVE DIVIDED INTEREST	FIELD WORK/ PROMOTION	NO AGGRESSIVE SELLING	INADEQUATE EXTERNAL MGT. INFORM. SYSTEM	PRODUCTION PLANNING	DELEGATION	NO PRODUCTION FACILITY FOR GRANULES
OPPORTUNITIES													
AVAILABILITY LAND													+
SPREAD RISK OVER COUNTRY	+	+		+	+	+	−			−	+		
INCREASE SALES	+	+		+	+	+	−	−	−	−			
TIE-UP WITH COMPANIES FOR TECHNICAL MATERIAL/ JOINT VENTURES					+	+							
EXPORT MARKET	+				+					−			
HOME INSECTICIDES	+				+								
THREATS													
SUBSTITUTION OF PESTICIDES BY BIOLOGICAL CONTROL										−			
GOVT. REGULATION ON POLLUTION (SAY BAN ON DDT)										−			
NEW REGISTRATIONS					+					−			
LIQUIDITY HAS TO BE MONITORED CAREFULLY			+	+									

THE + (POSITIVE) and − (NEGATIVE) ARE THE KEY-ISSUES TO BE CONSIDERED

Fig. 4 : SWOT Analysis

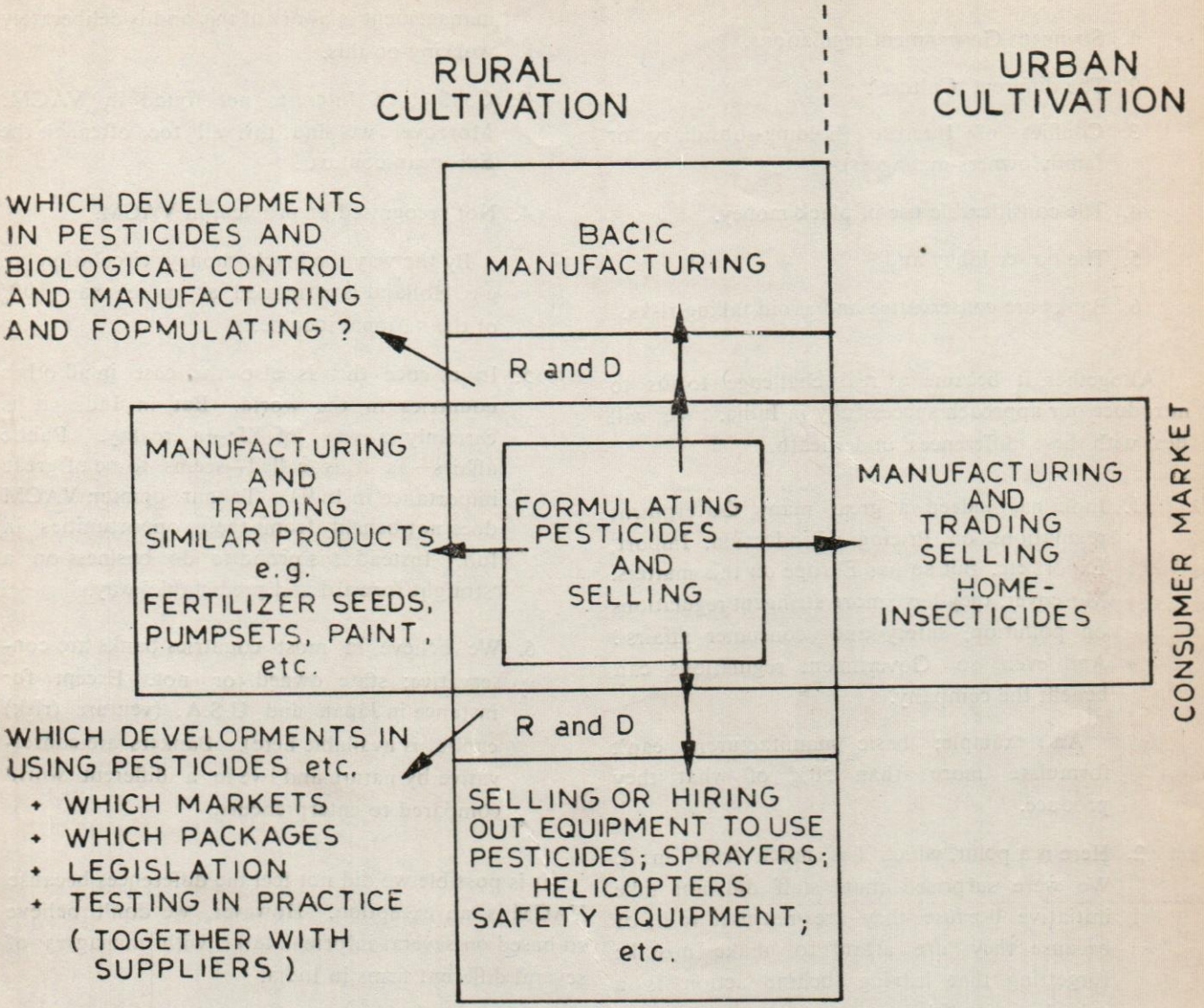

Fig. 5 : The common thread of the business versus various alternatives

is to work on the task structure in the company; delegation should be improved.

Rural-cultivation

1. Introduce pesticides in one or two states in North India on a full scale range rather than a few pesticides in many states. Other states can follow in the next year.
2. Forwards integration instead of backward.
3. Improve sales promotion. Especially in Tamilnadu this can lead to increased sales.

Urban-cultivation

Introduce home-insecticides at, at least the break-even level.

Use of the Approach in the Indian Context

First of all we can state that given this company, we see no reason at all why our approach would not be applicable for India. There are no essential differences. Many people (in India or well in Europe)

had doubts about the applicability because of :

1. Stringent Government regulations.
2. The different 'Culture'.
3. Conflict of Interest (holding-subsidiary or family owners-managers).
4. The considerable use of black money.
5. The power lobby and
6. Banks are conservative and avoid taking risks.

Altogether, it became a real challenge to us to introduce our approach successfully in India. We will deal with these 'differences' underneath.

1. India has indeed a great many Government regulations on Pricing, Production, Import, Export etc. But so has Europe on this matters. Moreover, they have more stringent regulations on pollution, safety and consumer affairs ! And even so Government regulations can benefit the company.

   An example; basic manufacturers can't formulate more than 50% of what they produce.

2. Here is a point, which has much truth in it. We were surprised that staff did not take initiative because they are not used to it, or because they are afraid to make mistake forgetting that leaving behind action is a mistake in itself !

   An agent of VACM, quite familiar with VACM, put it this way : "its odd, but whatever question you raise to anybody you find yourself taking the general manager ultimately".

   One manager in a conglomerate in Madras argues, that all this is mainly due to the colonial heritance : the British were the rulers; the Indians had to obey.

   Management "mistrusts" the staff and monitors them constantly. Staff just does what they are told (clerical behaviour) and is looking for excuses and alibis. VACM management is aware of this and is deliberately working on this.

3. Conflict of Interest, not found in VACM. Moreover we find this all too often in the European context !

4. Not recognised or problem in VACM.

   By the way the black money circulation in e.g. Holland is estimated as more than 10% of the national income.

5. In essence this is also the case in all other countries in the world. But in India it is certainly a way of life—a reality. Public affairs—as it is called—seems to be of great importance in India. To our opinion VACM does not benefit from these opportunities in full. Instead it is proud to do business on a 'straight forward and predictable' way.

6. We believe in most countries banks are conservative; state owned or not. Except for instance in Japan and U.S.A. (venture (risk) capital is available here). Bankers are conservative by nature and live in a different world compared to enterpreneurs.

It is possible we did not feel the differences because VACM is an exception. However, we don't believe so based on several informal talks with managers of several different firms in India.

What really differs from the European context is that it takes time, say twice of what in Europe due to several reasons :

1. Telephones and Telexes function badly.
2. Copying documents is very troublesome, rather it is retyped.
3. Indians have a different meaning of time. Appointments can be made but it seldom happens that one is on time. We refer here to the phenomenon Indian Standard Time; the appointment ± 1 hour !

4. Conditions are worse. No proper office—five to six people sitting in one room behind a tiny desk. Air conditioners and fans are buzzing. If not air-conditioned the heat can be enormous.

5. Also efficiency of many staff people is low, partly because of 2, 3 and 4.

Post Script :

We never come across a firm of comparable size with VACM in Europe, which had such an extended information on all kinds of areas mainly in the field of accounting, which seems perfect to us.

A different thing is het mode in which it is filed. This could be improved in several ways; most of the data are given very detailed. Asking information we were shown one detailed sheet after another. This might be okay for day-to-day operations, but when it comes to management information to direct the firm it is quite insufficient. It is too detailed to monitor the structure and the trend : data are mainly given per year per sheet. Also management information about the environment is stated in only quantitative terms and scattered over management, staff and agents/salesmen. That means for instance no systematic monitoring of strategic mover of competitors, developments in crop-cultivation, plans of government, new technologies to formulate, no systematic product-market analysis in terms of trends, no analyses of market growth and market share and so on.

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Hazards and Safety Management

K.P. NYATI

The author in this paper emphasizes the need to manage safety to prevent mishaps in and outside chemical Industry.

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Introduction

When, one thinks of mankind's basic requirements in terms of food, health and clothing, the important contributions made by chemical process industries towards meeting them, can hardly be refuted. But, it also cannot be denied that it is one segment of industry, which did pose and is still posing a serious threat to the very people whom they serve by way of their hazardous nature and pollution intensity. It is not surprising, therefore, to see people opposing setting up of such industries in the vicinity of their habitats, despite their positive benefits and the newer dimensions that they provide to the way of people's life.

The magnitude of hazards and safety problems is unquestionably gigantic. There are roughly 60,000 chemical substances that are currently produced and used in quantities above 100-500 tonnes annually and 200-1000 new chemicals are added on to this list every year[1] of these, nearly 30,000 are classified as high risk chemicals.[2] The problem of safety and hazards management consequently is not confined only within the boundary walls of industrial enterprises, they are confronted also while handling, transporting these

1. Maugh. T, "Chemicals : How many are there", Science 193, 162 (1978)
2. Sors, A.I, "Risk assessment and its use in management—A State of art-review", in "Evaluation and Risk Assessment of chemicals" Interim Document No. 6 W.H.O. PP. 244 (1982)

chemicals and is associated even within the usage of final products.

The problem is much more severe in our country, as the studies carried on by Central Labour Bureau, Shimla, National Institute of Occupational Health and some other institutes have revealed that over 7000 deaths occur per annum in industrial accidents. The fatality rate in India is nearly 5 to 7 times higher than that of industrially developed nations as could be seen from Table-I below :

TABLE I

(Fatality rates per 1000 Workers)

Sr. No.	Country	Fatality rate
1.	Japan	0.02
2.	U K	0.03
3.	U S A	0.03
4.	India	0.14

While, the share of chemical process industries admittedly has not been very high, but it could grow, if early warnings are ignored. The committee headed by Dr. R.K. Garg, Head, Chemical Engineering Division. BARC, observed that "only 7 per cent of the chemical factories are safe".

If, however, unorganised sector is also considered, on the basis of same fatality rate as in organised industrial sector, the total industrial accidents, account for nearly 10,000 death every year.[3]

It is not merely an issue of statistically proving a point. but an issue that mandates initiation of corrective programmes immediately. We can not afford another tragedy like Bhopal, nor do we need one, to bring us out of our apathy.

Yet, and unfortunately, the reports about accidents like ammonia tanker colliding another, leakage of Co., H_2SO_4 fumes, chlorine gas etc. keep pouring from all over the country.

Industrialization—The Growth With Pranks

In the recent past, there has been a tremendous spurt in industrial sector. More and more newer industries, with imported know-how are being set-up. From the economic development point of view it is a very welcome phenomenon, but, it is also time to pause and look into the kind and type of technologies we are inducting in our country, particularly in the context of international competition and its repurcussions in terms of hazards and environmental degradation that these technologies might inflict in the long run. It has to be realized, that cleaner & safe technologies cost more and are normally not available for technology-transfer. The net result, therefore, as the past history also indicates, is that in developing countries, most manufacturing plants come up with the kind of technology which is either unwanted or prohibited, on one or more grounds of safety/hazard, in the donor countries themselves.

The point therefore, is not to raise a debate about the ethics and morality of what goes on in the international arena but the argument is that the developing countries, with relatively more hazardous or unsafe technologies, ought to be better prepared and mandates them to have better safety and hazards management strategies than the countries who sell their technologies to the developing world.[4]

The argument does not apply to chemical process industries alone but, virtually to the entire industrial spectrum indeed. Be it an asbestos-cement plant in India, a battery plant in Indonesia or a caustic-chlorine plant in Nicaragua, one could find almost every where in the third world, workers being continuously exposed to the dangers of dreaded "death-traps" like cancer, kidney failures, minimata, itai-itai and so on. The irony is that all this goes on unnoticed and where-ever, even if observed, they are often ignored in the so called "business interests". The

3. A UNI report. "Industrial Safety still a hazard" Times of India, February 24 (1986)

4. Bob Wyrick "Exporting Contamination, U.S. Style", Express Magazine, Indian Express, February 28 (1982)

fact remains, that many lives without their consent and knowledge are put on the alter of corporate profitability, just to finally see the fat figures at the bottom lines on the right side of balance-sheets.

Areas of Concern

Almost all the industries, irrespective of what they manufacture as product, do produce wastes. A substantial portion of these wastes are hazardous in nature. Table-II gives an idea of hazrdous wastes generation in Indian Industries :

TABLE II[5]

Status of hazardous chemical wastes generation

Sr. No.	Sector	% Hazardous wastes of the total waste	Specific hazardous waste generation (in tonnes/tonne of product)
1.	Chlor-Alkali	93.20	0.03
2.	Drugs & Pharmaceuticals	80.56	4.00
3.	Dyes & Pigments	100.00	1.36
4.	Engineering	86.18	1.26
5.	Nitro-fertilizers	7.70	0.007
6.	Inorganic Chemicals	15.30	0.04
7.	Organic Chemicals	58.00	0.15
8.	Pesticides	100.00	0.07

It can be seen from this table that the industries producting and using chemicals, do produce greater quantity and proportion of hazardous wastes. These wastes, when dumped indiscriminately on land which unfortunately is the case in our country (nearly 80% of the hazardous wastes are disposed off into low lying areas in India) not only leads occasionally to accident-prone dangerous situations but also results in contamination of the ground water. In fact, presence of toxic inorganics like cyanides, chromium nickel, manganese, copper etc. in quantities much higher than the WHO-Drinking water standards in the ground water of a city in northern India is significantly linked to callous dumping of toxic and hazardous wastes by the industries around.[6]

The scenario as has been described does bring out very clearly that safety and hazards management in the chemical industry sector is a matter of life and death, literally or otherwise and throws up certain compelling issues which have to be urgently addressed to, both at macro and micro level i.e. at policy level and at enterprise level. Since the chemical industry by virtue of the variety and complexity of chemicals it uses and produces, the approach for this sector has to be radically different, compared to the conventional 'Accident Prevention' approach only.

In order to channelise the resources and efforts effecttvely, in a result oriented manner, it is necessary to identify the 'areas of concern' and within each area the problems have to be defined objectively. The solutions would automatically emerge.

These 'areas of concern' broadly could be visualised as given in Figure-I and to that extent the primary focus of the strategies have to be essentially these areas.

While, it is evident that each of these 'areas of concern' require specific expertise, but it is worthwhile to delineate them into two groups with a view to isolate the actions required at policy or national level and at unit level. For instance, induction of a type of technology is a matter that has to be dealt at policy level, because coupled with it are a variety of factors such as, energy intensity, cost, etc. In addition to safety & hazards aspects, but efficient operation & maintenance of that technology, which also has a tremendous bearing on safety, has to be under the purview of the unit's management itself. It also has to be recognised that there shall be certain unavoidable overlapping, for example, the pollution control

5. "Hazardous chemical waste Management"—A Project Report, Prepared by Pollution Control Cell, National Productivity Council, for Department of Environment, Government of India, January (1985)

6. "The Pollution Status of the city of Ludhiana"—A Study Report, Pollution Control Cell, National Productivity Council, New Delhi (1980)

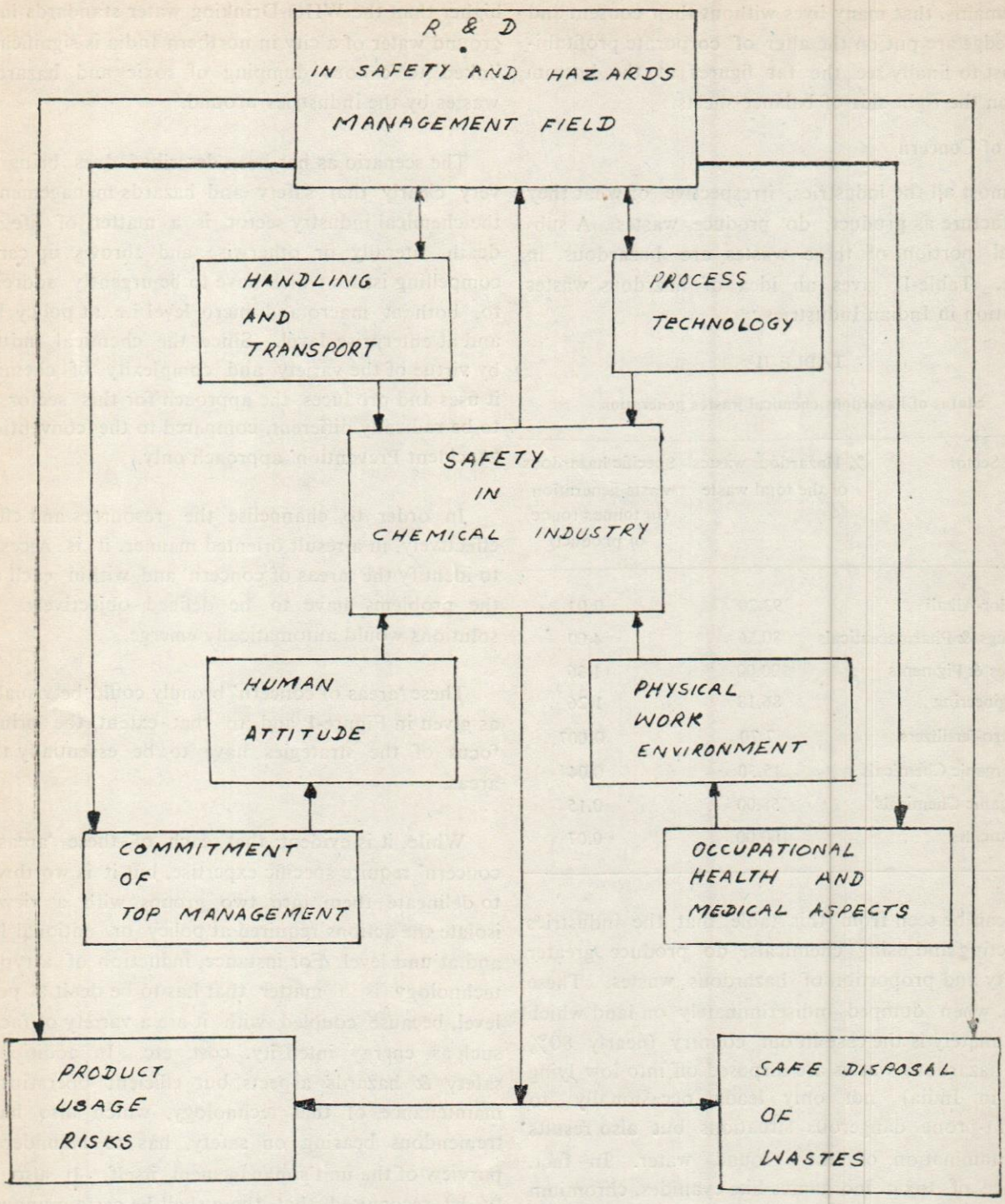

Fig. 1 : Areas of Concern

& safe disposal of wastes will have to be dealt with, both at policy level and enterprise level. This, obviously calls for close co-ordination and co-operation of concerned agencies and the industrial enterprises.

Enterprise Level Responsibilities

From the safety point of view by & large, the responsibilities that fall on the managements of indus-

trial establishments are very much compatiable with the corporate objectives. Hence, it can be presupposed that the managements generally shall be quite willing to undertake them, provided there extists an appreciation and the awareness about the linkage between safety and profits. Options, however, should be kept open to make such responsibilities mandatory or statutory, in case the industry does not respond. Such responsibilities could be :

(i) Efficient Operation & Maintenance of the Plant

Efficient operation & maintenance obviously being directly related to profitability, every management shall and hopefully does strive to achieve. But, in a business environment where competition is consicuously absent, the productivity is the first casualty, and consequently, inefficiency, both technological and managerial remains hidden under the carpet of buoyant market. It, then slowly leads to unsafe and hazardous plant conditions, until something shocking happens. It is probably seldom realized that, had safety & hazards management been one of the priority areas of management's attention, the profits with the improvement in house keeping, better working conditions, morale of workers etc. (along with favourable business climate), could have been higher. An Excellent Safety record could have been an additional bonus.

(ii) Pollution Prevention

'Wastes' whether hazardous or non hazardous finally appear as pollutants. They not only pollute the work-environment within the plant but the entire environment outside as well. Pollution prevention therefore, not only strengthens safety but also paves the way for resource conservation, leading ultimately to greater profits : Preventing pollution always pays & pays handsomely. In fact, NPC's pollution prevention services, in one industrial enterprise has been able to eliminate the need of a waste-water-treatment plant altogether just by recovering & recycling the chemicals which earlier were finding their way into the waste water making it highly polluted. The savings by way of reduces chemicals consumption consequently were of the order of Rs. 550/- per day. In another unit, NPC was able to reduce the total process water consumption by 20%. This not only enabled the unit to put up a smaller waste-water-treatment plant thereby saving significantly on the initial investment but also helped the unit to run at full capacity during water scarce summer months, which the company could not do earlier during such periods. The managements of industrial enterprises therefore should mount a systematic effort to eleminate the sources of wastes in their units.

(iii) Safety Audit

As the name itself suggests, the 'Safety Audits' enable the managements to have a closer look at the processes plant risks. Safety audit is an important tool for identifying areas of risk or vulnerability, falling standards, hazards and potential accidents and helps in determining the actions required to remove the hazards before personal injuries, damage to plant and machinery occur. By including every component of the total system in the audit, e.g. management policy, layout, operating procedures, emergency plans, personnel protection standards, accident records etc., it is possible to identify and isolate, both the strengths and weaknesses, and the main areas of risk. The periodic necessity of such as audit therefore, can hardly be over-emphasised.

(iv) Handling & Transport

When it comes to transport of chemical loads the Railways perhaps take more care (may be inadequate) though) compares to Road Transports. On the other hand, transport of chemicals by road is progressively increasing. Consequently it is important that clear, relevant and precise information concerning the nature and possible hazardous properties of the chemical load is made available with the vehicle. Since, the intensity of the hazard presented by a chemical is dependent on the frequency, duration of exposure and the concentration of the chemical, when dovetailed with the manner by which the chemical substance enters the body i.e. by inhalation, injection or absorption dictates the preventive measures necessary, in the exent of an accident. Knowledge of vapour density, specific gravity, mixability with water also

helps in combating the emergency situations. The transporters of chemical loads, therefore have to be equipped with the necessary information and should be trained adequately, so that they can meet any eventuality squarely without panic gripping their guts. Infact, clear instructions to transporters shall make them realise the seriousness of their job, leading ultimately to the reduction in number of accidents.

(*v*) *Disaster Management*

While, the safety audits help in preventing accident or disasters, but to manage a disaster, should it occur, requires a kind of "War preparedness"—a plan, well thought out in advance. To start planning when the disaster has struck, tantamounts to proverbial digging of well while the fire is on. What is required, therefore, is advance contingency plans, spelt out in every conceivable details. Obviously, preparing of such plans need inputs both in terms of expertize and unfortunately the experience as well. Perhaps, it would be worth while to take a leaf out of the marine pollution field. For example, almost all the international harbours all over the world do have such plans ready in the form of a document or a manual to deal with oil spillages anywhere in the harbour area. This document contains all the details of material, manpower, tools and other requirement, including their location, availability, quantum etc., how to get them, step-wise procedure to fight out the spillages, co-ordination and marshalling details and so on. Literally it has all the information one would prefer to have at hand in such emergency situations with whats, how's, why's, where's etc., of containing the impact as well as final clean-up of affected area. Such a thing can & should be done at least for such of those chemical industries where danger of potential disaster is apparent. Think of it, had such a plan existed at Bhopal, the impact surely would have been far less. The tragedy would not have been as devastating and certainly, it would not have got atleast the distinction of the greatest tragedy. It must, however, be clearly understood that each and every industrial plant need not have all the combat facilities on their own. Whereever feasible, industries within easy reach of each other should jointly and collectively participate in such an efforts, so that the cost could be minimised through common facilities. In any case, this does not obsolve the individual units of the responsibility of having their own 'contigency plans' specific to their plants.

(*vi*) *Waste Disposal*

Most chemical industries do produce wastes including hazardous wastes, which have to be disposed in a safe & secured manner. The method usually followed is dumping in low lying areas both inside and outside the plant. It is quite understandable if this method is employed for non-hazardous wastes only but the trouble is that even hazardous wastes are being indiscrimately dumped, with no concern whatsoever to the possibility of ground water contamination, compatability of wastes, hazards and risks such disposal might present.

A survey of Hazardous Wastes Management practices carried out by the National Productivity Council revealed that all the 8 industrial sectors covered in the survey do produce hazardous wastes though, the total quantum of wastes both of hazardous and non-hazardous category vary from sector to sector and from plant to plant within a sector. It was found that the 131 units surveyed produce 0.22 million tonnes of hazardous wastes annually. Of this total, nearly 80% is dumped in the low lying areas; only a very small proportion of 2.6% is incinerated and another 4.5% processed for reutilization or exchanged between the industries. The consequences are obvious and can be imagined by everyone. Industries therefore have to evolve a system of their treatment or detoxification prior to disposal.

Since, wastes represent a potential resource, industrial units should explore the possibility of inter-industry waste exchange before they decide to dispose it off. Infact, such an inter-industry utilisation of wastes is possible on much larger a scale, if industries through their associations could organise such an effort at regional levels. For instance the waste-exchange-bank (Abfallborse) managed by chamber of commerce, Hamburg, West Germany, which publishes the 'offers' and 'enquires' of different industrial wastes in its monthly—"Hamburges Wirtschaft," the April 1985 issue contained only 3 'offers' of such

wastes where as the enquiries were as many 64. It indicates, how effectively the practice of waste-exchange is being followed in West Germany.[7]

(vii) Human Attitude

Things flow from higher potential to lower potential this is a law of nature so also of science and thermodynamics. If safety in a plant is to be ensured, first of all the commitment of top management and that of 'Opinion Leaders' and trade unions have to be enlisted. No safety programme can ever be meaningful, if the emphasis on safety does not flow from the 'Board rooms' of industrial establishments to shop-floors & this emphasis both overtly or convertly should be out of conviction. Safety attitudes would automatic develop in every body and the work-environment would visibly become healthier. In order to involve employee at all levels, it is extremely important that the information regarding hazards is regularly communicated to them and they are priodically trained in safety & hazards management aspects, with specific reference to the employees working environment.

Policy Prescriptions

Related with safety, hazard & environment are certain issues which requires action programmes at National level. To treat, however, the questions concerning safety and environment in isolated water-tight compartments perhaps may not be strategically effective, because of the obvious linkages that exist amongst "the areas of concern". While, each area does requires a separate set of policy prescriptions but they ought to be tempered with the knowledge of their effects in other areas. After all every accident in chemical process industry is a potential pollution problem. To that extent, integrated policy (level) initiatives appear logical. How, this integration can be brought about is an issue which requires further in-depth analysis, but what probably can not be disputed is that there is an overdue necessity of having an Institutional mechanism, an arrangement which can address issues concerning environment, tecnnology, waste disposal, occupational/environmental health aspects in a manner which recognises the inter-relationship amongt them, comes out with overall most cost-effective policy formulations and generally oversees the progress in each one of the areas. What ever might be the set up, important issues as enumerated below have to be tackled now and without delay.

(i) Safety Audits

They must be carried out periodically, quarterly or annually or at a frequency that could be determined on the basis of necessity. This could be carried out by an independent agency possessing the requisite expertise. Their recommendations could be made binding through a suitable mechanism or a legislation if necessary.

(ii) Contingency Disaster Management Plans

The above stated agency could also be entrusted with task of not only helping the individual industrial units in scrutinising/preparation of such plans on consultancy basis but perhaps to oversee that all the industries have the necessary where-with-all, as well.

(iii) Pollution Prevention Studies

In all the industrial units, keeping in view the interests of all the units and the interest of national economy, it could be thought of, making the Pollution Prevention Audit by accredited agencies mandatory, at least once in five years.

(iv) Hazardous Waste Disposal

To overcome this problem, perhaps, a suitable legislation is necessary as one finds such laws practically in all the industrially advanced nations like Abfall-beseitigungsgesetz (Abfg) of West Germany; Resource Conservation and Recovery Act, (RCRA), USA, etc. In addition, a pragmatic & workable system of control & monitoring of hazardous wastes has to be evolved, may be something like trip-ticket system of West Germany, which follows these wastes right from 'cradle to grave'.

(v) Transport of Chemical Loads

A national register of known potentially hazardous

7. "Abfallborse" pp. 89-91, Hamburg Wirtschaft, 4 April, (1985)

chemicals may have to be developed, perhaps on the lines of IRPTC (International Register of Potentially Toxic Chemicals), with all the relevant informations. With the help of such a national register then, comprehensive control mechanism for safer storage, transport, handling, health effects etc., of such chemicals could be worked out.

(*vi*) *Industrial Health Service*

For the benefit of workers exposed to potentially risky environments, the scheme of regular health check-ups and preventive medication though exists may have to be intensified. Since, no monetary compensation can really be a true compensation for reduction in life expectancy, or serious physical disability, it is extremely important that this aspect is given due recognition, specially with respect to implementation of such a scheme on a broader scale.

(*vii*) *Technology Transfer*

In order to scrutinize the technologies being bought from the angle of energy, hazard, cost, pollution intensities etc., it shall probably be prudent to start a service what could be called as "Technology information & Evaluation Service (TIES) to help enterpreneurs select the right kind of technologies, equipments, product designs etc. Such a service would not only help in better safety and environment preservation but will greatly boost competitiveness and therefore export capabilities of industrial enterprises.

(*viii*) *Product Usage Risks*

With a view to protect the unsuspecting consumers from the health hazards and other risks faces as a result of products usage, it is necessary to have a mechanism to ensure safety in the use of product on a larger and on going basis.

To promote and evolve, on a continuous basis, safer ways of working, R&D efforts have to be intensified, may be under the umbrella of National Safety Council of NIOH (National Institute of Occupational Health).

Conclusion

Safety is not a subject that can be left to chance, if one does, he may get no chance at all and ever. It otherwise shall be exactly like one not getting a second chance to make first good impression.

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Productivity of Indian Women Scientists

RADHA CHAKRAVARTHY

"This paper addresses itself to an examination and analysis of the productivity of women scientists and the identification of the causal factors which have impact on their development wiih particular reference to productivity."

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Nearly half the available human capital is women. Their involvement in Science and Technology has not only to be significant, but also imperative for balanced national development. However, due to historical reasons, the bulk of Indian women have remained socially and economically backward with their involvement in Science and Technology minimal. It is only in recent times, after the Independence movement and the call of Late Mahatma Gandhi that women have come out of their homes to participate overtly, albeit in a small way in the national activities in several fields. Indian women today have entered diverse fields, hitherto considered as men's preserves.

Status of Women in Science and Technology

Recognition of women as a human resource for Science and Technology is given a concrete effect in the Constitution of India which enjoins equal rights and privileges for men and women and directs the State for making special provisions for women. In our planning strategy also, the Five-Year Plans have consistently laid special emphasis on providing minimum health facilities' integrated with family welfare, nutrition, acceleration of women's education and in general improved access to and control over material, economic and social resources. But regrettably, the low status of women in large segments of our society continues and the process of change to raise their status is not only gradual but even halting. This is very

conspicuous in the involvement of women in Science and Technology as may been seen from a survey, conducted in 1981 which ascertained that women among the total scientific personnel accounted for only 14.4 %.[1] This is despite the fact that there are to-day over a million women in India who have qualified in Science.[2]

Women have taken to Science and Technology significantly only after Independence. Evidence of this is available in the University Grants Commission Report according to which women students' enrolment for Science and Technology courses in the Universities from 1969-70 to 1982-83 has been increasing. The Table 1 below highlights this :

This enrolment however does not find consummation in women taking to or occupying positions of scientists and technologists as is evident from the data compiled by the Department of Science and Technology. A look at the Table 2 will show that the number of women, engaged in R & D work in the Central, State and Private sector during 1980-81 did not exceeded 3,000 out of the total R & D personnel of nearly 65,000. Another feature is that there are more women in such establishments, attending to administrative work than in attending to scientific and research work.

Indian women have thus failed to gain access to Science and Technology and to scientific establishments in proportion to their numbers—not even a miniscule proportion to their numbers. Even though more and more women are now enjoying same privileges as men to develop their intellectual capabilities, India is way behind number of countries in the percentage of women scientists in the total stock. For instance, Bulgaria, U.S.S.R., Hungary, Yugoslavia and Spain have women scientists percentage at levels upwards of 20%, some of them having levels upwards of 40%. What is further striking about these countries is that there is a steady annual rate of increase in the number of women participants in the R & D activities.[3]

In comparison, a study made by the Manpower Division of CSIR, shows that Indian women scientists are an insignificant number in the total scientific

TABLE 1

Women student enrolment for Science and Technology in Universities

Subject	1969-70	1975-76	1979-80	1980-81	1981-82	1982-83
						Estimated
Science	449,778	463,841	508,763	233,859	578,766	619,100
Engg./Technology	87,465	96,067	118,607	128,937	130,189	142,583
Medicine	78,577	105,140	112,194	110,020	113,794	116,893
Agriculture	22,851	30,160	39,962	39,231	39,318	40,139
Veterinary	5,325	6,377	7,435	7,648	8,173	8,732
Total	643,726	701,585	786,961	819,695	870,240	927,447

Source : University Grants Commission Report.

1. Women in India—Country Paper, Ministry of Social and Women's welfare, Government of India, New Delhi, April 1985, p 65.
2. This is according to the estimate of CSIR, cited in 'A Disqualified Sex' by Amita Das, Science Age, March 1985.
3. Division of Statistics on Science and Technology. Office of Statistics of UNESCO, 'Participation of Women in R & D—a statistical study', September 1980, pp 6-13.

TABLE 2

Women in R & D Establishments, 1980-81

Sector	R&D Work	Ancillary Work	Administrative Work	Total
Central	2,356	2,224	4,057	8,637
State	295	157	535	987
Private	341	148	261	750
Total	2,992	2,529	4,853	10,374

Source : Department of Science and Technology Report.

stock. In July 1980, for instance, the number of women scientists in CSIR institutions was only 162 in a total stock of scientists numbering 3828. More disappointing is the fact that among 543 scientists at the senior level, there are only 6 women. Women scientists, holding senior posts among themselves constituted only 4%.[4]

These data relating to CSIR are reflective of and extendable to the general position and participation of women in Science and Technology in India.

Scientific Creativity of Women

This brings us to the basic question whether women possess creative abilities in an adequate measure to prosecute the profession in Science and Technology. One of the frequently used arguments regarding women in scientific and other intellectual activities as misfits is that they have no creative ability and lack the spark of genius. In support of the arguments, it is pointed out that very few women have excelled in arts and sciences, more particularly in mathematics. Furthermore, one of the reasons alleged in support is the inescapable role of women in the reproduction of the human race. The so called superiority of the masculine genius is also attributed as a reason.[5]

Lately a sociological explanation that has been put forward controverts the argument that innate biological differences between the sexes could be behind the low percentage of women in science and suggests that the root cause lies in the differences in the socialisation experiences to which men and women are exposed. For instance, female socialisation systematically brainwashes women into developing a set of personality attributes which make them passive, emotional and dependent.[6] Creative ability can not be linked to biological causes, but to a broad range of psychological, social, cultural, economic and organisational factors.

The process of socialisation of individuals is hinged on all these factors and essentially consists in proposing to the individual the stereotypes to which she is impelled to conform. The agents in this process are the family, the school and the society as a whole. This socialisation process shapes and moulds certain characteristics in women, which discourages them to take to Science. Those characteristics which are important to enable women to take to Science can be ingrained and developed in them only if the agents of socialisation namely the family, school and the society reorient their approach towards women and development. As it is the school that provides conformist environment, it is the responsibility of the society and the educationists to refashion the education system to further the interests of women and in particular encourage policies designed for enabling women to take to Science.

An essential point to be noted is that it is not any innate deficiency in women towards intellectual activity

4. Radha Chakravarthy, Anju Chawla and Geeta Mehta, "The Status of Women Scientists in India" Paper presented in the Foundation Day Lecture Series on the 'Organisation and Efficiency of R & D Systems', National Institute of Science, Technology and Development Studies, (CSIR), 4-6 February, 1985, New Delhi.

5. Goldberg, S., 'The inevitability of patriarchy', New York, N.Y. Morrow 1973.

6. Kelly, A. 'A discouraging Process—How women are eased out of science'. Paper presented at the Conference on 'Girls and Science education' at Chelsea College, March 19-20, 1975, Bulletin of Science and Technology and Society, Vol. 3, 1983. Pergamon Press Ltd., U.S.A.

that is the reason for the low status of women in Science, but factors which are external to the scientific community as such. For example as Veronica has noted, "the cultural values transmitted through the process of sex-role socialisation and frequently reinforced by the sexual division of the labour in the family often result in self-selective avoidance of scientific occupations by women".[7]

The importance of social, cultural and environmental factors will have to be recognised and research undertaken to identify those causal factors which impact adversely on women to be in Science.

But however, the scientific creativity in women in terms of productivity is not in adverse light, compared to men. This finds support in the empirical data on the productivity of women scientists in research groups in India.

Empirical Survey

This study is based on data on research units in six countries viz. Argentina, Egypt, South Korea, Poland, USSR and India, collected in the 'International Comparative Study on Organisation and Performance of Research Units'. Only Limited data, pertaining to India have been used, the relevancy of the data being determined by the specific objective of this paper, namely the productivity of Indian women scientists. The study covered more than 600 research units, identified in a major scientific agency in India with a network of laboratories in the field of Science and Technology. A two stage random sampling was adopted. A sample of 1150 scientists was drawn from 250 research units, out of which 118 were women scientists. The data were collected by means of a set of standardised questionnaires and interviews.

Analysis and Results

Age Group

The frequency distribution of the age of women and men scientists in the sample is presented in Table 3.

TABLE 3

Frequency Distribution of the age of women and men Scientists (as % of total in each group)

Age Group	Women	Men
30 and below	35.0	16.1
31-40	36.4	42.0
41-50	25.4	31.0
51 and above	3.3	11.0

The Table indicates that the proportion of younger women scientists is much larger than that of younger men scientists which is an emerging welcome trend. About 35% of the women scientists are below the age group of 30 years as against 16% of the men scientists. About 3.3% of the women scientists as against 11.0% are found in the age group of 50 and above. This clearly indicates that entry of women in the area of scientific research is a recent phenomenon. What therefore are the special characteristics of Science and its disciplines that discourage women from pursuing Science ? Why are there not more women in Science as in other areas ? Much of the investigative work in this field has been done by Astin who found that boys tend to be more encouraged than girls. Parents provide more stimuli for boys to take to careers in Science.[8] The attitude of families towards girls' education and the pattern and philosophy of educational institutions, guiding students towards fields of specialisation and ultimately into careers in Science, could be held responsible for the low numbers of women in Science and Technology.

Terman (1947), in a psychological study observed that there were other factors, besides intelligence

7. Veronica Stolte-Heiskanen, "The role and status of women scientific research workers in research groups" in 'Research in the interweave of Social Roles' : Jobs and families,' Vol 3, 1983.

8. Astin. H., 'Sex differences in mathematics and scientific precocity' (Paper presented at the meeting of the American Association for the Advancement of Science in Washington) Dec. 1972.

which determined an individual's career and that among these, an important one was sex. According to his observations, "while girls equal or surpass boys in the school and university period, they cease to compete with them in the working world and this behaviour was not attributable to lack of ability but that its basis should be sought in the limitation of opportunity and in other motivational causes which derive from the process of socialisation".[9]

The data indicate that though the number of women entering the scientific profession has increased in recent years, women scientists still constitute only a tiny part of the country's total number of scientists. Conventional explanations of the variations in the rate of participation of women in different scientific fields usually stress women's own preference for certain disciplines of their innate lack of qualifications. But the question as to why a great many of the girls choose disciplines such as life sciences, chemistry and humanities and a great many of the boys choose technological sciences, physics and mathematics needs to be examined at the stage of school level.[10] There are several ways in which science and engineering raise difficulties for women, some of which appear at school level and continue to operate and others which do not appear until later. Of these which appear at school level, the most important are the difficulty of identifying with an activity which is clearly male dominated and the genuine dissonance between the intellectual demands of Science and the feminine personality. These difficulties manifest as well in scientific research.[11]

The scientific research community also presents some rather different manifestations of difficulty. The whole way it operates makes it difficult for women to get on partly because of the time commitment, based on the male pattern of work and career and partly because men seem to have difficulty in including women in the social networks and support relationships.[12] Seear observes that in industry, there is evidence of the same problem regarding working hours and career patterns and there is considerable prejudice against appointing women to positions of authority over men which obviously cuts out most of the senior jobs.[13] Women college graduates in America do perceive most of these factors as being reasons why few women take up science, medicine and engineering.[14] The proportion of women scientists in Table 4 shows a similar pattern where women scientists seem to have low preference for technological sciences, mathematics and physics.

The data indicate that about 50% of the men scientists as against 33% of women scientists belong to technological sciences. A significantly higher proportion of men scientists is found in fields like technological sciences, mathematics, physics, earth sciences, astronomy, astrophysics, and space sciences. Women show overwhelming preference to life sciences where about 30% women scientists and only 7% of men scientists belong. Similarly in chemistry, the proportion of women scientists is more than men. Apparently over and above the possible effect of discouragement at parental and school level and the career pattern problems, other factors such as the intensity of open competition and the extent of official policies also influence the receptivity of a field to a women.

The comparison of distribution of women and men in research groups and scientific fields thus indicates the differential levels of their participation in different fields.

Participation of Women and Men Scientists in Research Activities and Tasks

Research groups represent a very concrete form of

9. Tosi Licia, "Women's Scientific Creativity", Impact of Science, 25, 2 : 105-114, 1975
10. Shapley Debrah, "Obstacles to Women in Science", Impact of Science on Society, 25, 2 : 115-124. 1975.
11. Rossi, A. "Barriers to Career Choice in Engineering, Medicine or Science among American Women", in Mattfeld. J. and Van Aken. C. (edsi), Women and the Scientific Professions, (M.I.T. Press, U.S.A.).
12. White, M.S , "Psychological and Social barriers to women in Science" ' Science, Vol. 170, 1970.
13. Sear, N., "A Career for Women in Industry", (Oliver and Boyd), 1964.
14. Op. cit. Rossi, A., 1965.

TABLE 4

Distribution of Scientists by Sex and by Scientific Field

	Women	Men	Total
Mathematics, Physics, Astronomy and Astrophysics, Earth and Space Sciences	15	202	217
Row %	(6.7)	(93.3)	
Col %	(13.0)	(19.5)	
Chemistry	19	148	167
Row %	(11.4)	(88.6)	
Col %	(16.5)	(14.3)	
Life Sciences	35	76	111
Row %	(31.5)	(68.5)	
Col %	(30.4)	(7.4)	
Agricultural Sciences	0	30	30
Row %	(0.0)	(100)	
Col %	(0.0)	(2.9)	
Medical Sciences	8	23	31
Row %	(25.8)	(75.2)	
Col %	(6.0)	(2.2)	
Technological Sciences	38	503	541
Row %	(7.0)	(92.9)	
Col %	(33.0)	(48.7)	
Social & Human Sciences	0	51	51
Row %	(0.0)	(100)	
Col %	(0.0)	(4.0)	

organic cooperation in scientific activity. The division of labour among researchers—all other things being equal—also reflects the value of the broader scientific community and provides an excellent testing ground for the extent to which equality between the sexes is realised on the day to day level of the world of research.

Information was obtained from the scientists on various aspects of their research activities in and out of research group. The various tasks performed by scientists were jumped into the following categories :

(i) R&D work which includes research and experimental development work both inside as well as outside the unit.

(ii) Other scientific activities which include teaching consultancy, extension, scientific information and documentation, standardization, routine control analysis or measurements, scientific surveys, design and engineering studies and feasibility studies.

(ii) Administrative activities.

(iv) Other professional functions which include editorship of journals, membership of committees of other institutions and membership of societies, etc.

TABLE 5

Time Spent on Various Research Activities

Type of Activities	Percentage of work time				
	Women		Men		
	Mean	S.D.	Mean	S.D.	t-va
Research & Development	64.2	30.2	59.7	25.9	1.53
Other scientific activities	26.3	26.4	30.1	24.3	1.43
Adminiministration	3.7	7.1	5.0	9.4	4.76*
Other Professional functions	5.7	16.9	2.9	9.6	1 .72*

* $p<0.05$

While the women scientists spent an average of 64% of their work time on actual research and development (R & D), men scientists spent an average of 60%. Although the difference is not very great in India, there is a tendency for women scientists to spend more on R&D work than men scientists, which is also indicated in other countries.[15] The percentage of women scientists in other scientific activities such as teaching, cosultancy work, scientific information, routine and control analysis is about 26% as against men scientists, spending about 30% of their time. But the percentage of women scientists is especially low (less than 4%)

15. *Op. cit.* Veronica Stolte Heiskanen, 1983.

relative to men who spent 7% on administrative activities, which indicates hierarchical distinction in the division of labour in Science, not only in terms of formal positions they occupy, but also in their isolation from certain activities of the research process. They also have less opportunities to participate in professional functions like being member of scientific societies, editors of journals and member of committees of other institutions.

Table 6 shows differences in the percentage of women and men scientists having high involvement in different areas of activities of R and D. R and D activities have been categorised as analytical activities on the one hand and empirical activities on the other as one can distinguish qualitatively different apsects of the research process which in group work may be differently stressed in the activities of individual researchers. The various kinds of activities, performed by a researcher can be clustered into the said two basic categories which indicate the analytical and empirical dimensions of research. The analytical dimension comprises such activities as identification of area of interest, formulation and statement of hypotheses, problem conceptualization, formulation and analysis, orientation and perception of methods, whereas the empirical dimension comprises such activities as literature review, collection, production of data and report writing. The level of involvement in different areas of activities of women and men scientists was measured with the help of 5-point Likert scale (5 and 4 = high involvement and 1 and 2 = low involvement).

TABLE 6

Level of Involvement of Scientist in Different R & D Activities
Percentage having high Involvement

Type of Activity	Women	Men
Analytical Dimension		
Identification of area of interest	47	64
Formulation & statement of hypotheses	29	42
Problem precision, conceptualization, formulation and analysis	47	60
Orientation and perception of methods and techniques	56	60
Research design	51	62
Empirical Dimension		
Literature review	66	57
Collection and production of data including experimental work	76	65
Results : detailed analysis, interpretation and conclusions	65	74
Report writing	52	62

In the analytical dimension such as identification of area of interest, formulation and statement of hypothesis, problem precision, conceptualization, formulation and analysis, orientation and perception of methods, the data indicate that women scientists are less involved than men scientists in creative and analytical activities. In the empirical dimension, such as literature review, collection and production of data, compared to men, women scientists are more involved, which clearly indicates that activities of women scientists are limited and women are relegated to the secondary position as they seem to be performing more routine research functions than actual scientific activities in comparison with men.

Women scientists seem to be often left out of the actual activities of research. Commitment and creativity in science are not merely a function of an individuals' competence or excellence, but are a product of the social environment as well. Opportunities for involvement in challenging and stimulating activities are essential for occupational or professional identity and for creating an inner sense of role competence which can lead to greater productivity in professional work.[16] "Restriction of opportunity not only blights hope; it excludes the person from the chance to acquire the knowledge and skill that would in turn enable him to surmount the barriers to effectiveness. Deeper knowledge and more varied experience would provide greater status and greater esteem; not primarily extrinsic rewards, but intrinsic satisfactions.[17]

16. Perrucci, C. C., "The Female Engineer and Scientist—Factors Associated with the Pursuit of a Professional Career," 1968, unpublished report.
17. Smith, B.M. (1968) in "Socialisation and Society," J.A, Clausen. Ed. (Little, Drawn Boston).

Scientific Productivity

One of the arguments most frequently put foward is that men throw up more geniuses, creative writers and have higher productivity than women. When productivity is measured in terms of number of books, articles and patents, men are generally found to produce slightly more than women. Marriage and child bearing have been shown not to be an important cause of women's lower productivity. It was found that, married ones published as much as those who had not married. Similarly, married women scientists with children published more than those without children.[18]

The data as shown in Table 7 furnish interesting results on productivity of women scientists. There is very little difference between women and men scientists in the higher levels of productivity, for example item relating to 4 and more in items of books, articles (national journals and foreign journals), reviews and bibliographies. A vast majority of both women and men scientists produced no books at all during the past three years. In the production of patents and experimental devices, there are however, greater differences and men scientists have a higher proportion than women scientists which could be probably related to women scientists' low involvement in creative type of scientific activities, participation in limited research functions and lack of scientific communication compared to men. Consequently, they are in a relatively more disadvantageous position to produce, to get credit for and have their contribution accepted by relevant channels for publication. The relationship between lower status and lower productivity seem to hold good for women scientists.

Let us look at some of the constraints on women scientists' productivity.

As Epstein has succently noted, the barriers to women's advancement, achievement and productivity are not merely a function of prejudice or incapacity. The structures of professions, narrow and inflexible, as they often are, may create limits which are largely unintended. He suggests that groups and colleagues are powerful forces in shaping attitudes and behaviour; the institutional settings and social mechanisms which inhibit commitment and identity can also be used to promote change and to encourage different consequences.[19] As one of Ann Roe's studies of eminent scientists indicated "intelligence and imagination alone are not sufficient to make eminent scientists; acceptance, recognition and challenging interaction with other professionals are necessary for creative work".[20] Publishing possibilities are also known to be influenced by the scientists' status and

TABLE 7

Productivity of Scientists During the Past three Years of Work in Research Units (in Per cent)

	Books		Articles National		Articles Abroad		Patents		Experimental Services		Reviews & Bibliography	
	W	M	W	M	W	M	W	M	W	M	W	M
None	92.4	86.3	21.2	24.0	60.0	51.9	84.1	70.6	79.7	57.0	78.1	63
1-3	6.1	12.4	43.9	33.0	27.7	31.7	11.1	22.8	11.9	28.3	14.1	29
4-5	1.5	1.3	15.1	16.4	9.2	8.9	3.2	4.6	3.4	8.1	6.3	5
6-9	0.0	0.0	9.1	12.3	0.0	3.4	1.6	1.6	3.4	3.5	0.0	1
10& above	0.0	0.0	12.1	14.2	3.1	3.3	0.0	0.4	0.0	4.3	1.6	1

18. Cole J.R., "Fair Science : Women in Scientific Community :, Free Press, 1979.

19. Epstein. C. F., "Women's place" (University of California Press, Berkelay) 1970.

20. Roe Anne, "The Making of Scientist," New York.

informal communication networks.[21]

Causal Factors

Though the productivity of women in science is not adverse, compared to that of men except marginally, it can not be denied that women productivity would have been much more and even better than that of men if certain barriers were not to exist. These barriers could be categorised as follows :

(1) *Attitudes*

Men's entrenched prejudices still remain not only in India but in other countries as well. The image of man of Science has stuck in society. Despite advances in social legislation, the cultural patterns in the society and the attitude of the community have been responsible for the relatively small extent of women participation in productive life and in particular in Science. Furthermore, the belief that the women's place is in the home has affected their professional lives because this prejudice is manifested in covert and subtle attitudes of the society. Illustratively, while girls and boys in theory have equal access to vocational and scientific training, in practice, access to girls is restricted, because. the society does not encourage girls to study Science and Mathematics. Efforts are needed to encourage young women and girls to take to more of Science in the early age and to explore a wider range of Science based career for them. For this, how important it is to bring about a change in the attitudinal approach of the society can not be overemphasized.

(2) *Economic, Infrastructural and Institutional Constraints*

In order to train or educate women as scientists and technologists, there has to be a requisite infrastructural and institutional capability. While this capability exists in general to develop, train and educate individuals as scientists, there is no special measure in terms of which women could avail of the facilities. Such special measures would involve apart from the will, special financing and allocation of budgetary resources. Despite the political and cultural will to support equality of opportunity for men and women, what has so far been attempted in terms of policies and plans in India has been so minimal, that its impact has hardly been significant. As we have noted earlier, women constitute less than 15% of the total scientific personnel. This economic constraint apart, much needs to be done towards creating a proper scientific and technological infrastructure, covering a broad spectrum of disciplines with a view to making the fullest use of the human capital resource in the country, particularly women. Concerted endeavour needs to be made to involve women in all major socio-economic activity to ensure that Science and Technology is an integral part of the development programmes for women in the country.

While the Seventh Five-year Plan admonishes all the major scientific departments and agencies to fully involve women in Science and Technology it can be deemed only as a beginning as the leeway can not be compensated and overcome merely through such advice as it will have to be supported by substantial allocation of resources.

(3) *Dual Role Syndrome*

The family is the social context within which all Indian women live and work and have their identity. Family network is important as a support system for them. Though primarily her duties have centred around her life in the home, she is assuming new roles outside the home with the new educational and occupational opportunities.

Taking to a profession or a career has however not meant any reduction in her home responsibility. This kind of double daily work load or *dual role syndrome* to a great extent reduces her flexibility in her professional life. The demands of pregnancy, motherhood, joint family system and transfer (when the husband is transferred to another location as a part of his professional career) all contribute to certain instability in the professional lives of women. In terms of re-

21. Whitley, R.D. (1970), "The operation of Science Journals—two case studies in British Social Sciences" : Sociological Review, 18 : 241-258, 1970.

muneration, promotion, career advancement, job satisfaction and entrustment with responsibilities of a scientific creative nature, the syndrome acts as a kind of barrier to women in Science.

This double role syndrome itself is the result of the socialisation process which limits their ambitions and in particular their pursuits of careers in Science. Because of the obstacle of the dual role, women face difficulties even at the time of recruitment. The argument, advanced against the recruitment of women is that they are less committed than men because motherhood and children absorb part of their energy. But instances are plenty where when the competition has been on an equal footing women have never lagged behind. But more often than not, the attribution of merit for creation to men alone is observable even when the creation is due to women. To illustrate this, we may quote Leprince-Ringuet who said "In the case of Pierre and Marie Curie, Pierre Curie was the creator who with his genius established new Laws of physics. Marie was outstanding for other qualities such as character, exceptional tenacity precision and patience."[22]

Thus even when women put as much diligence into their work as men do and accomplish work of high quality, they receive less recognition. But despite this, women are continuing their scientific careers and devoting their best for creative activity.

Strategy and Suggestions

We have seen that despite the many barriers, and discriminative practices, the productivity of women scientists is only marginally lower than that of men scientists –in certain areas their productivity is more than that of men. This is contrary to the common belief that women scientists have lower productivity than men. The results of the study have suggested that despite the lower status of women, they are not less productive.

In formulating policies for women's development and in particular, active participation and association of women in Science and Technology, there is a need for a shift in the recognition of women *from being regarded as targets of welfare policies in the social sector to their being regarded as critical groups for development.* One could perhaps see, this shift being materialised for the first time in the country in the Sixth Five year Plan which contains a separate chapter on 'Women and Development.' This shift asserts the principle of women's equality of rights to participate effectively in the process of development. It also represents affirmation of the ideology that the country's development is not possible without the willing and conscious participation of one half of its population, namely women. Through such participation, women should be able to reduce if not overcome the resistance and barriers to equality and development.

Another wind of change that is blowing is the new thrust that is being imparted in the development thinking which recognises the importance of economic independence, status, educational freedom and social freedom for women in society. Evidence of this is visible in the three strategies, outlined in the Sixth Plan for women's development, namely economic independence, educational advancement, access to health care and family planning. The growth of organised articulation of women's problems by social organisations and the revival of the social debate on women's issues are so important that Government should come out with strong legislative and institutional support. Use of the audio-visual media, academia, bureaucracy and other professions and political parties will help promote the process of consultation and dialogue between Government, development agencies and non-Governmental organisations interested in women's development.

Mention has already been made as to how the Seventh Five year plan has given a call for the involvement of women in scientific and technological activities. It is not sufficient to conceive of development of women in terms of awarding a few more scholarships to encourage them to enter Science. What is needed is women's participation in a full

22. Quoted in 'Women's Scientific Creativity' by Lucia Tosi, Impact of Science on Society, 25, 2 : 105-114, 1975.

manner in Science and Technology with the society giving up its patriarchal, hierarchical and authoritarian attitude which oppresses and exploits the female segment.

For women, to be actively involved in Science and Technology, and major policy making activity should not be carried out only by one sex. It is in the national interest that the abilities of women need to be used as well as those of men in the important area of Science and Technology.

Productivity
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Storage of Agricultural Commodities

S.D. DESHPANDE

This paper highlights various handling methods, manual and or mechanical for minimum handling loss. Various dehumidification systems for maintaining the required temperature and relative humidity in a conditioned storage facility are also described.

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Introduction

Harvested grain is transported, threshed, cleaned, and moved to a grading point, either manually in bundles or in sacks, or mechanically by combines that simultaneously accomplish the intermediate processes of harvesting and threshing while in transit. Tractor-drawn endless conveyors may also be used.

In tropical countries, simple grain cleaners are needed during threshing, before and after drying, and prior to milling and processing. Conventional winnowers popular in Asia clean grain by exposing it for a short duration to a high velocity airstream. These winnowers do not satisfactorily remove large straw, chaff, and unfilled or immature gain from mature grain.

Cleaning of Grain—Manual

A popular winnower design consists of a paddle—type blower in a wooden housing, which directs the air against grain falling from a hopper. Baffles are used to separate the impurities from cleaned and semi-cleaned paddy. Semicleaned paddy is recycled through the winnower for further cleaning. The use of high air velocities to obtain a satisfactory degree of cleaning results in excessive loss of grain with the impurities.

Cleaning of Grain—Mechanical

Grain cleaners popular in a industrialized countries

clean the grain in two stages : (1) the grain passes through a set of oscillating screens to remove the larger impurities; and (2) the grain falls through a high velocity air blast to remove the lighter impurities. Oscillating screens are often a source of mechanical problems and do not perform well when excessive amounts of straw and other large impurities are present in the grain. The short-duration exposure of the grain to the air blast does not satisfactorily remove all the unfilled, immature kernels.

Grain (especially seed grain) is moved in sacks as well as in bulk. The sack moving equipment establishes a connection between stories of the granaries and is used in part for sack leading of vehicles. Automatics leaders and lift trucks are used on the farm of large seed-producing firms and at railway goods stations, but the use of these machines is uneconomical within small agricultural enterprises (United Nations 1960).

Handling Equipments

The capacity of the vehicles serving the granary determines the maximum number of vehicles that can be used, given proper organization. Immobilization due to waiting, turn-around, and movement of vehicles, together with stoppage, account for 30-40% of working times. The economic efficiency of vehicle operation is also influenced by the nature of the handling equipment in the granaries.

Large farms permit full use of vehicles and power loading devices. On small farms, physical labour is made easier by the use of a simple which-operated mechanical shovel, which has a maximum of 5—10 t/h for a motor rating of 4.5 KW.

Various Modes of Trnsport

However, in traditional rice countries of Asia the following methods still prevail (FAO 1967-1968). Transportation of stack paddy is by shoulder poles for short distances. Over long distances, the paddy is transported by means of boats, sledges, buffaloes, tractor-drawn carts, and in some cases by small hand-drawn carts mounted on bicycle wheels. Assuming an average production of 2.4 tonnes of stack paddy per hectare, the transportation to remove the crop from 1 ha requires approximately 60 shoulder-pole loads; 30 sledge loads; 6 ox-cart loads; or 12 hand-operated cart loads.

When electrical energy is available, many machines can be conveniently located on the farms. However, in developing countries, rural electrification is limited and small gasoline engines are generally used.

Grain Movement through Various Conveying Systems

The handling of bulk grain in rice mills involves the movement of large quantities of material in both the horizontal and verticle directions. The rate at which grain is handled depends upon the capacity of the storage facility and the type of operation being conducted. The conveying equipment must be selected and sized to meet the requirements of each particular operation.

A conveyor is a mechanism that moves material from one location to another in a continuous manner. Bulk grain handling systems utilize one or more of the following types of conveying equipment : (1) screw conveyor; (2) chain conveyor; (3) belt conveyor; (4) bucket elevator; (5) vibrating conveyor; (6) pneumatic conveyor; and (7) lift trucks.

Requirements of Good Seed Storage

The general requirement for good seed storage is a dry and cool environment. Seed operations located in climatic areas with high temperatures and relative humidities must have some system of controlling both the relative humidity and the temperature of the air inside seed storage rooms. Sealed storage (vapour-proof containers) has been used for many years in the vegetable seed industry; however, two factors have limited the use of this method for storage of field crop seeds; (1) the cost of vapour-proof containers, and (2) the moisture content of the seed, which must be 2-3% lower than that normally considered safe for seed packaged in non-moisture-proof containers.

Before considering several systems that can be

installed to maintain low relative humidities and temperatures, let us consider the basic requirements : (1) a structure must be provided that will keep infiltration of moisture and heat to a minimum; (2) there must be some means of dehumidification (removing moisture from the air); and (3) there usually must be some provision made for lowering the temperature of the air which is in contact with the grains.

Storage Room Construction

The question of how to build a good seed storage room becomes a question of what is the best way to construct a 'Large container' and make it as airtight as possible. This is necessary to keep the initial cost and the operating expense of the dehumidifying and cooling equipment at a minimum.

For low humidity conditions, it is essential that adequate vapour barriers be included in the construction and that they be installed with the greatest of care, making sure that all joints are properly sealed. Thermal insulation requirements will vary with geographic location. Obviously, the size of the storage area should not be larger than absolutely necessary. If seeds are to be stored in a large warehouse, it is more economical to condition only a small portion of the warehouse rather than to attempt to dehumidity and cool the entire structure.

Dehumidification

Generally speaking, there are two major categories of dehumidifiers : refrigeration-type and chemical-or absorption-type.

Refrigeration—Type Dehumidifier

The refrigeration-type dehumidifier operates by drawing warm moist air over a metal coil through which a refrigerant such as Freon-12 is circulated. A part of the atmospheric moisture condenses on this cooling coil and is collected in a pan or bucket or is drained off. The cooled air coming from over the coil, which now has a low temperature and a high relative humidity, is reheated by the condenser coil of the refrigeration system; thus raising the temperature and lowering the relative humidity. The water removal capacity of this type of system is dependent on the difference in temperature between the entering air and the cooling coil. Although these units are quite effective at high temperatures they lose efficiency below 21°C (70°F) or 50% relative humidity. Heat from the electric motors that drive the compressor and fans add sensible heat to the atmosphere.

Absorption-Type Dehumidifier

The absorption-type dehumidifier operates by drawing moist air over a solid drying agent (desiccant) that has the ability to extract and retain moisture on its surface by a phenomenon known as 'absorption'. The air is filtered and dried to a very low dewpoint in the process, and the desiccant is periodically regenerated by means of heated outside air that vaporizes the moisture and dispels it to the outside of the conditioned space. Continuous operation of these machines is achieved by either using two desiccant beds that switch back and forth automatically, or by using rotating beds of desiccant, a portion of which is always dehumidifying the air while the remainder is being regenerated.

Desiccant dehumidifiers provide maximum efficiency at low temperature and are able to maintain constant relative humidities even below 10%. A factor that should not be over-looked is that heat is added to the controlled atmosphere although the units is placed outside the storage room. The latent heat of vaporization of the moisture that is removed is converted to sensible heat. There is also a certain amount of residual heat left in the desiccant after reactivation, which increases the air temperature.

Heat Removal—Various Means

Because an excessive heat buildup will usually be experienced when either type of de-humidifiers is used alone to reduce the relative humidity in a seed storage room, let us consider several means of removing this heat. The most common and familiar method is by using a refrigeration-type air conditioner, which can also be used to 'dehumidify'. It operates in a manner similar to the refrigerant dehumidifiers except that it

has a larger cooling coil area and provides air or water cooling of the condenser coils.

Water after-coolers can be used with a desiccant-type dehumidifier if the sensible heat load of the storage room is not excessive and a supply of cool water is available. Pre-cooling and after-cooling coils that are cooled by a refrigeration system are a most efficient way of removing large amounts of moisture with a desiccant dehumidifier. At temperatures below 10°C (50°F), silica gel will remove nearly 90% of the moisture from the air-stream; at 38°C (100°F) this removal ratio is only about 50%.

Depending upon the temperature, relative humidity requirment, moisture and sensible heat load, one method or system is usually more efficient than another. Therefore, let us consider eight possible systems for maintaining the required temperature and relative humidity in a conditioned seed storage facility.

Various Systems for Maintaining Required Temperature and Relative Humidity

Dehumidification System—Type I

As shown in Fig. 1—Type I, refrigeration-type dehumidifier is placed inside the condition space. This self-contained unit consists of the following components : refrigeration compressor; motor and fans; and evaporator and condenser coils. The air inside the room is recirculated through the unit until the set relative humidity is reached and a humidity control switch in the electrical circuit shuts the unit off. The humidistat will automatically turn the unit on again when the moisture content of the air begins to increase due to infiltration or movement of moisture from the storage product or from other moisture inside the room. This system can be used satisfactorily only in locations where temperature control is not necessary, that is where the sensible heat increase does not raise the air temperature above safe limits.

Dehumidification System—Type II

Figure 1—Type II shows a desiccant dehumidifier located outside the conditioned space. This self-contained desiccant unit has the following components : desiccant (usually silica gel); heater coils, conditioned air blower; and reactivation blower. The air in the conditioned space, through a closed system, is recirculated through the unit until the set relative humidity is reached. A humidistat, located inside the conditioned space, controls the running of the conditioned air blower. Most desiccant dehumidifiers are wired so that the reactivation cycle continues even though the conditioned are blower stops. This is desirable only when the unit must run most of the time to maintain the relative humidity in the conditioned space; otherwise, the result is excessive heat and expense. By having the reactivation heaters and fan wired to shut off when the conditioned air blower shuts off and by

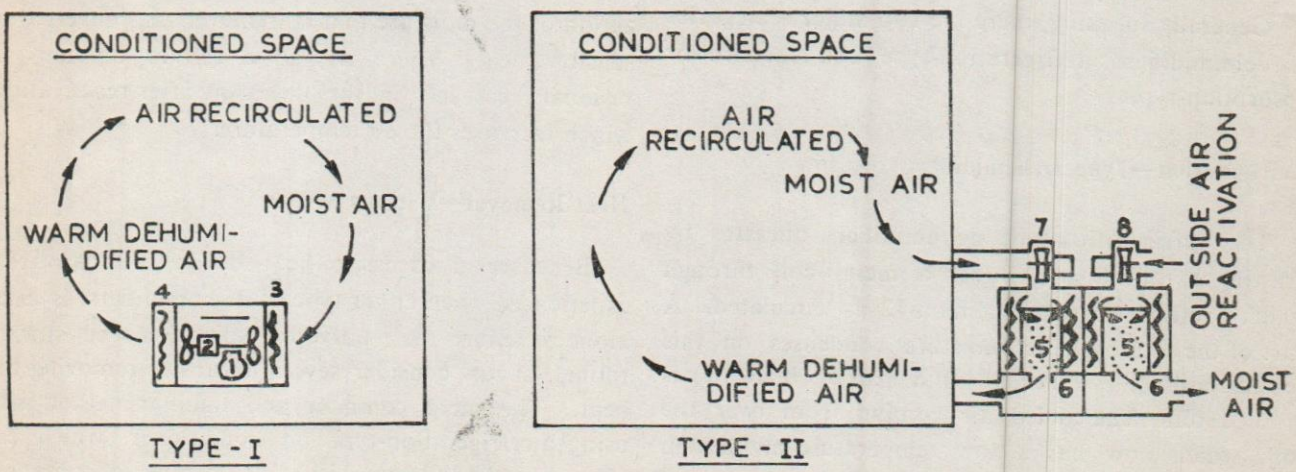


Fig. 1 : Dehumidification System

locating the machine outside the conditioned space, the heat build-up can be kept to a minimum.

Dehumidification and Cooling System—Type III

A conventional-type air conditioner can be used to maintain temperature and relative humidity when the reduction of temperature is necessary for control of the sensible heat load. As shown in Figure 2—Type III only the evaporator section of the refrigeration unit is placed inside the conditioned space. The air within the conditioned space is recirculated over the cold evaporator coil, where moisture is condensed out of the air. Outside air is drawn over the condenser coils releasing the transferred heat to the atmosphere. The unit is controlled by a thermostat that shuts the compressor off when the temperature of the inside air is reduced to the set level. Because moisture is removed only when the room temperature is too high, sizing of the air conditioner for the sensible heat load becomes critical. For dehumidification, the compressor must run to keep the evaporator coils cold. To maintain a more constant relative humidity condition, electric heater strips are sometimes used to add heat to the air, which keeps the unit running longer. If these heater strips are connected through a humidistat, they can be turned on and off automatically as the humidity inside the conditioned space changes.

Dehumidification and Cooling System—Type IV

The system shown in Figure 3—Type IV consists of a desiccant dehumidifier with a water after-cooler. The water cooler is used to reduce the air temperature as it leaves the desiccant dehumidifier. The size of the after-cooler coil and the quantity and temperature of the water that passes through the coil determine the amount of heat that can be removed. The system is very effective for maintaining low humidities, and temperatures in the range of 5-10 degrees above the water temperature. A magnetic valve can be used in the water supply system to automatically regulate the water flow, and thus keep the air temperature within the set limits.

Dehumidification and Cooling System—Type V

Figure 3—Type V shows a high capacity moisture removal system that utilizes a refrigeration unit in conjunction with a desiccant dehumidifier. Cooling for the pre-cooling coils is provided by a refrigeration system. Because silica gel can remove nearly 90% of the moisture from air at a temperature 10°C (50°F), the air in the conditioned space is cooled by the pre-cooling coil before it contacts the desiccant in the dehumidifier. In the process of absorption, latent heat of condensation is converted into sensible heat. Because this sensible heat increase may increase the air temperatures as much as 28°C (50°F), the after-cooling coil is necessary to reduce the temperature to safe limits. With automatic controls the temperature of both cooling coils can be regulated; thus it is possible to maintain, within close tolerances, low

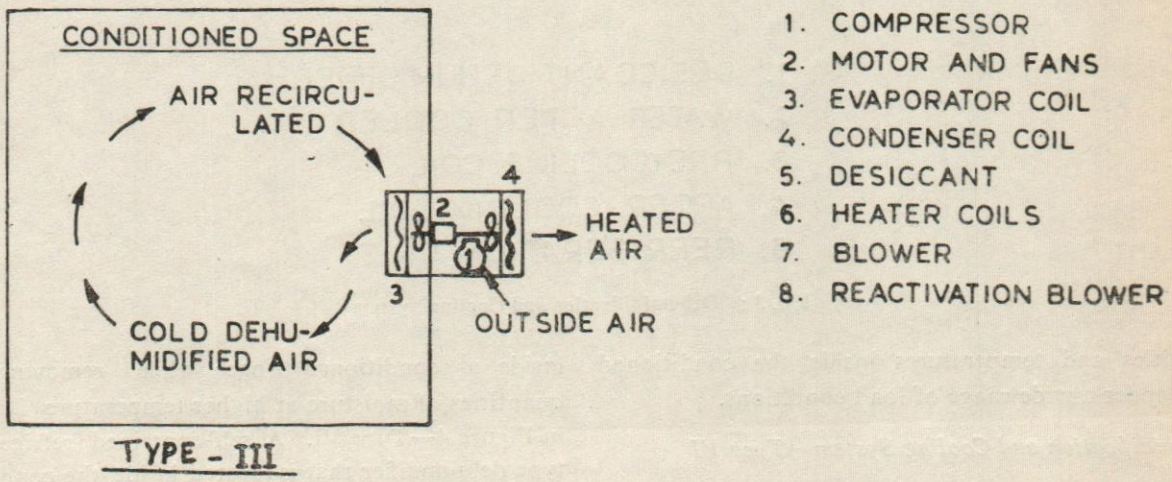


Fig. 2 : Dehumidification and Cooling System Type—III

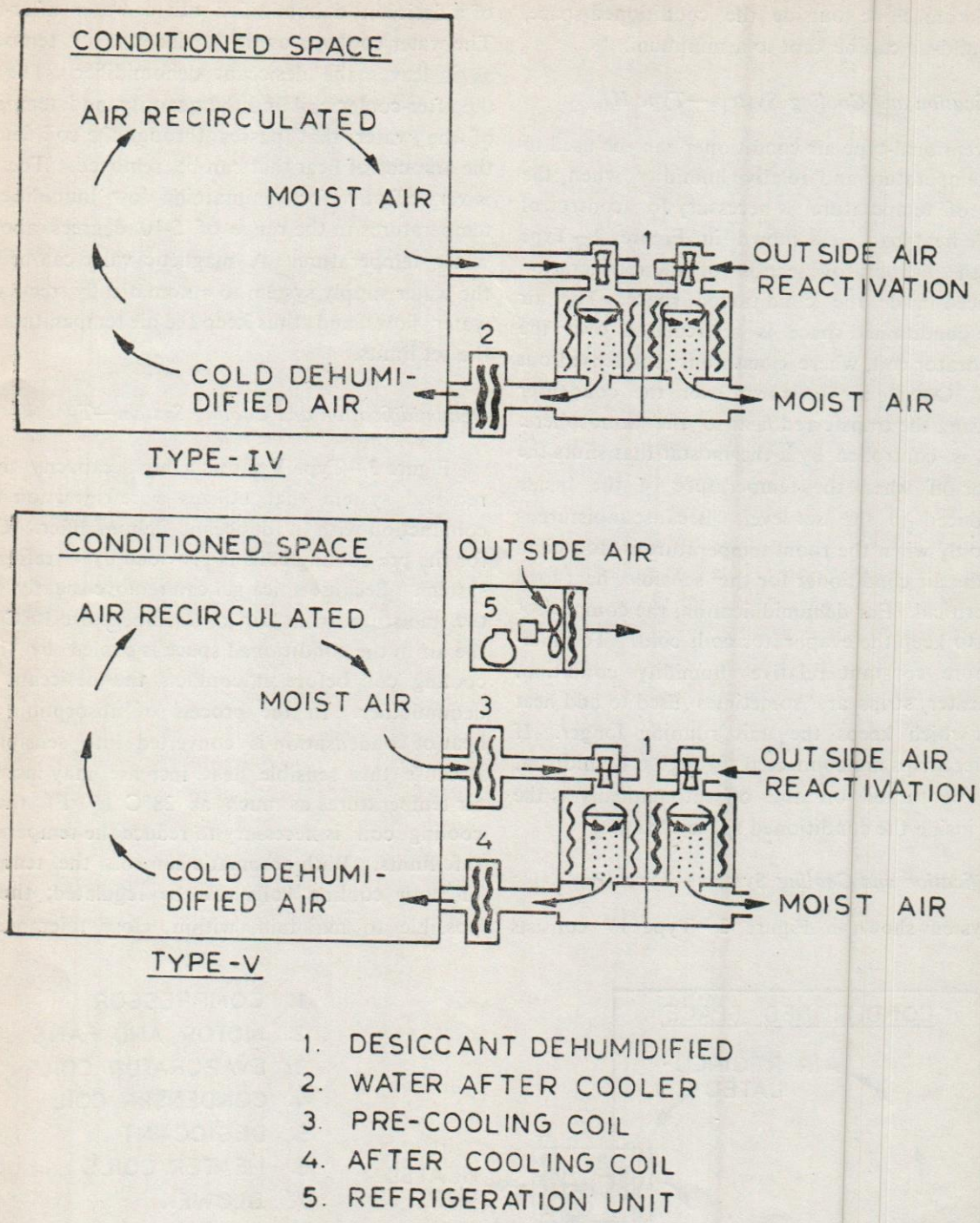


Fig. 3 : Dehumidification and Cooling System

humidities and temperatures inside the conditioned space under a wide range of load conditions.

Dehumidification and Cooling System—Type VI

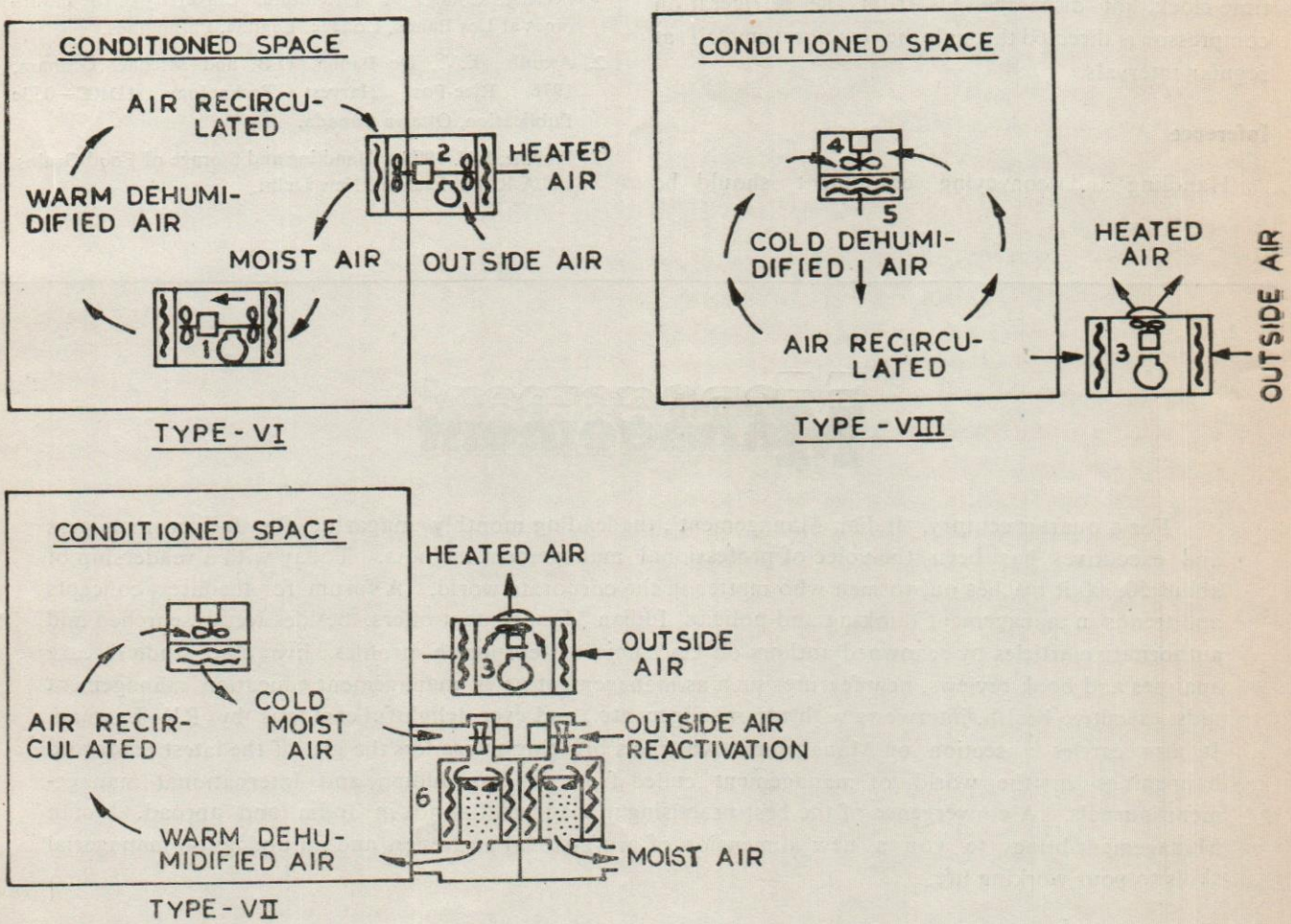
A simple system for controlling the temperature inside a conditioned space while removing large quantities of moisture at higher temperature is shown in Figure 4—Type VI. A self-contained refrigeration-type dehumidifier that is located inside the conditioned space removes the moisture from the air and is

controlled by a humidistat. The sensible heat load is handled by a refrigeration unit that transfers the heat to the outside atmosphere. The air temperature inside the conditioned space is kept within set limits by a thermostat that turns the refrigeration compressor on and off. This type of system loses efficiency at temperatures below 21°C (70°F) and relative humidities below 50%.

Dehumidification and Cooling System—Type VII

A dual system, as shown in Figure 4—Type VII can be designed to maintain low humidities and low temperatures in the conditioned space over a wide range of load conditions. The refrigeration system will dehumidify (within limits of design) as well as cool the air. It works independently from the desiccant unit; however in normal operation the two systems complement each other. The desiccant dehumidifier has a much higher moisture removal capacity because cold moist air enters the machine. Under extreme load conditions, the temperature of air leaving the unit can be high enough to pick up sufficient moisture before entering the evaporator so that a certain amount of water will condense on to the cold coils.

Because either part of the system can lower the



1. REFRIGERATION TYPE DEHUMIDIFIED
2. SELF-CONTAINED REFRIGERATION UNIT
3. REMOTE REFRIGERATION UNIT
4. EVAPORATOR
5. HOT-GAS DEFROST SYSTEM
6. DESICCANT DEHUMIDIFIED

Fig. 4: Dehumidification and Cooling System

humidity to a certain extent, this dual system offers a safety factor in case of mechanical failure.

Dehumidification and Cooling System—Type VIII

A mechanical refrigeration system, as shown in Figure 4—Type VIII can be designed to maintain low humidities as well as low temperatures inside a conditioned space. Because the evaporator coil temperature must be below the dewpoint of the conditioned air at low temperatures and relative humidities, the moisture that condenses out will freeze, forming ice on the coils. Some provision must be made to melt this ice and remove it as water from the conditioned space. In the illustration, a hot-gas defrost system is shown. Using a time clock, hot discharge gas from the refrigeration compressor is directed through the evaporator coil at regular intervals.

Inference

Handling and conveying equipment should be selected in such a way that it can perform various operations during storage and subsequent handling without excessive strain and minimum quality and quantity loss. It should be pointed out that a refrigeration system that will function well at temperatures below 21°C (70°F) and 50% relative humidity is not composed of standard 'Comfort' or 'Cold Storage' refrigeration components. Humidity control must, therefore, be built into the coil design and other components of the system.

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Performance Budgeting in a Nationalised Bank

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The Authors have tried to show in this paper as to how Performance Budgeting can help the management in over-coming management by crisis and adhocism, through the case study of a nationalised bank.

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The concept of Performance Budgeting (PB) has developed in the United States of America in the context of govermental budgeting. In India too PB caught the fancy of different commission and committees only in the context of governmental budgeting. Later on, finding utiliity of this new system the Estimates Committee and the Committee on Public undertakings recommended its application to public enterprises.

Business Planning in Banks

By tradition banking industry is conservative and orthodox in its philosophy as well as action. Because of this status quo approach most of the banks never thought of using any modern management technique. Business planning, what to talk of bottom up business planning, was never given a serious thought. Their business was on an increase because their clients' business was increasing. During the pre-social control business planning by banks was target-oriented and it used to denote deposits only. Lending was a privilege limited to Head Office of the Banks and branches were merely the collecting agents for deposits.

After nationalisation of 14 Commercial Banks in July, 1969 the demands on banking system increased. To meet the aspirations of the people, adhoc targets came to be fixed for lending to hitherto neglected

sectors of the economy. But this changed system of business planning was no way better than the earlier system since it had the following drawbacks :

(i) Targets were still set by the Head Offices of the Banks. This target setting was not based on field studies, but past experience.

(ii) There was no involvement of rank and file in target setting but targets were merely passed on from the Head Office to Regional Offices and there from to Branch Offices.

(iii) Since there was no involvement of rank and file in determining the targets, there was no commitment to achieve them. Thus targets were not given a serious trial by the branch staff.

(iv) Because of the imposition of targets from the top branches indulged in unhealthy window dressing, especially on the eve of yearly closing.

It was because of these problems that the public sector banks were advised in 1972 to have a performance budgeting system to translate objectives into meaningful and feasible action programmes and to ensure that such programmes are implemented and the objectives realised. "Performance Budgeting is a total management system. Basically a tool of planning and control it encompasses all the management functions as well as all the organisational functions. It is a fine blend of system approach, management by objectives (MBO), corporate planning, Taylor's scientific management and linear programming". PB is different from earlier practice in three ways : firstly the focus is shifted from money expenditures to activity planning; secondly, each and every member of the organisation is involved; and thirdly, productivity is visualised as a result of a combination of all the functions/ departments.

The Process of Performance Budgeting

Budgeting is a cycle involving formulation of corporate budget, its periodical review/appraisal and corrective actions including revision of budget, if necessary. The overall process of PB as it operates in Punjab National Bank (PNB) can be broadly divided into three phases :

1. Budget Preparation.
2. Budget settlement.
3. Monitoring and Review.

Budget Preparation

The Budget preparation phase is activated by the Central Office by mailing the policy guidelines and budget formats to the Regional Offices. The Regional Office in turn sends them to the branches under its jurisdiction. The Central Office formulates its policy guidelines on the basis of the following categories of information :

(a) Past performance of the Bank.

(b) Internal and external environment.

(c) Performance goals set in corporate plan.

These guidelines are formulated by a group consisting of several executives responsible for operations as well as staff function. The Regional Office forwards them to the branches alongwith supplementary guidelines relevant to their own area of operations. A calender is fixed for all the exercises relating to PB at different levels.

After receiving the guidelines and the budget format, branch manager will prepare and update its Area Profile, collect data of past performance and expenditure. Although past performance figures are collected with relative cases, the task of environmental data collection is related to the continuous process of being aware of the environmental conditions. Environmental analysis encompasses an understanding of the various components of the environment together with the co-relation of the important factors (political, social and cultural, technical and economic, agricultural, industrial, commercial, economic policies of the government and competition) with work situation. The categories of environmental data required by different branches and emphasis to be placed on each of these categories varies appreciably, depending upon the type of branch, its geographical location, population in the

command area, etc. While arithmatical co-relations do not exist between environmental factors and the work, as environmental analysis does not lend itself to that level of objectivity and precision, linkage can definitely be established between various elements of the environment and the Bank's business activities. After furnishing necessary information in the Area Profile From, branches has to send one copy each to the Regional Office and the Management Advisory Services Division (MASD) at the Head Office.

In order to make the exercise of PB down to earth and practical the MASD has designed Planning Sheets, both for deposits and advances. These are meant for translating the business potentialities as reflected by the Area Profile, into figures of deposits and credit to be budgeted. Deposits and credit have been grouped into as many categories as possible. For example, credit has been divided into priority credit, differential rate of interest scheme (DRIS) and non-priority sectors. Total credit needs are planned as to how much term loan and working capital will be required by the existing borrowal accounts and the new borrowal accounts. After translating business potentialities from Area Profile to Planning Sheets, the next step is to prepare budget on budget sheet.

Budget Sheets are definitely wider in scope, operations and utility. Every branch prepares three copies of the budget—one to be sent to the Regional Office other to MASD at Head Office and the third to be retained by the branch itself. The Proformance Budget Sheets are divided into four parts :—

Part A—Deposit Budget

Part B—Credit Budget

Part C—Income & Expenditure Budget

Part D—Manpower Budget

The Budget thus prepared at branch level, necessarily in consultation with the staff by the branch manager will be only a draft budget which will be submitted to the Regional Office for settlement/ discussion. At this stage it will not be out of context to mention that a Performance Budget is not an exercise in forecasting, but it is a business programme to be implemented as per schedule.

Budget Settlement

Once the preparatory exercise are completed both the Head Office (in marco terms) and at the branch (in marco terms), the next phase of settlement begins. After getting all the draft budget proposals from the branches, the Regional Office scruitinises them and subsequently holds a budget settlement meeting with each individual branch manager. For settlements, the Regional authorities have corporate goal parameters on the one hand and the regional requirements on the other. The discussion in these meettings are crucial part of budget exercises. It is here that macro expectation has to be matched through an aggregate on the individual branch budgets. Budget setting determines how a good performance is to be extracted from branches taking into consideration the varying environmental constraints under which the branches operate. The final budget shows, with periodic break-up, the expected level of branch activity in each of the important activity area, e.g., deposits, advances, branch expansion, manpower, expenditure, profits, etc.

In the second phase, similar exercises, take place between the regional authorities and the Central Authorities. This settlement brings out of the final figures of the budget for the Bank as a whole. The Bank budget is then put up to the Board of Director for their approval. The process of settlement helps in bridging the "planning gap" between the subordinate level and the supervisory level.

Monitoring and Reviewing

Despite best of efforts, it will be seen that settlement may either be an over-settlement—where the budget goals turn out to be unreasonable, or the budget may be below the local business potential. Further even where realistic branch budgets are settled it is possible that the branch manager/staff are not performing to the expectations and need some motivation to reach their business goals. Thus, periodic monitoring and reviewing are an integral part of the PB system.

For monitoring, the branches have to send periodical performance reports to their superior authorities. The Performance Appraisal Sheet is to be filled in

triplicate by every branch at the end of March, June, September and December evey year—one copy each to be sent to the Regional Office, and the MASD and the third one is retained in the branch. Branch has to measure its performance in key areas of operations against budgeted performance. Variance analysis is also expected. Apart from these reports branches send many returns at different intervals.

Review of performance is made daily, weekly, monthly, quarterly, half-yearly and annually. There are many committees meeting regularly to review performance. One such meeting is known as 'Prayer Meeting' to be held daily at 9.30 A.M. From the year 1979, the monthly review has been discontinued. Quarterly Review – in consonance with the periodicity of the performance budget—is a much fuller review. Mid-year Review is infact a revised budget for the later half of the current year based upon actual performance in the first half. Yearly Review is made at the time of presentation of the next year's performance budget Reviews are made not only on the basis of returns received but also through audit and inspection of individual branches and conferences with concerned managers. In reviews actual performance is compared with the planned performance. Certain workload factors, e.g. credit/deposit ratio, priority sector credit to total credit ratio are also calculated.

The corrective actions to be taken may include in extreme cases, a revision of the budget itself, or pushing slackening managers to put in greater efforts or recognising the competence of good managers as the case may be.

The performance reviews are finally sent to the Board of Directors for its perusal and action.

Structural Analytical and Informational Preparation

PB is different from 'management by crisis'. To put PB into operation, many structural (identification of programme, indication of projects, and a suitable organisation, etc.), analytical (installation of work measurement and application of performance standard, proper accounting system, etc.), and informational (data capture, verification, storage, processing, generation retrieval and presenting the same to the performers and to the supervisors, etc.) measures are to be simultaneously taken care of.

To begin with, Punjab National Bank, in 1973, recognised the functions by creating a number of groups, division and departments, each representing an area, a discipline or a groups of them. Secondly, five functional committees were set up either permanently or for a specific task. These committees were formed to secure wider-participation in decision-making, an inter-disciplinary examination of problems, and a deeper involvement of managers at younger and junior levels by giving them an opportunity to work as equal with their seniors. The committees are structured functionally and not hierarchically.

In the field, the number of regions were enlarged from 8 to 10 in 1973, in order to create compact regions making for concentrate field attentions and on-the-spot decision. At present there are 1890 branches, 29 Regional Offices, 10 Zonal Offices, thus representing four-tier organisation. Since, 1973 many new divisions and departments have been grouped, regrouped divided and sub-divided. To impart group-dynamics, the committees were given due importance. The basic objective of the entire process of restructuring is that while through dialogue between head office and regions, policy should be formulated, whose instrument of expression and control will be the budget, all operational administration should be delegated to the regions. For proper co-ordination between regional and the head office a Regional Co-ordination Division was created in 1973 itself.

Towards 'system,' communication has been improved both at mechanical and information levels. To fortify information system within the organisation Management Information System (MIS) was given top priority. The MASD has brought out manual of MIS for Head Office and Regions. Data Processing System was also commissioned in 1973. A Personnel Information System (PIS) was introduced in 1979. To evolve a new vigilance system, Inspection Report was redesignated. Pre-sanction and post-sanction appraisal system was renovated in 1980.

Apart from these, new operational philosophy was

put into gear. To this end, the problem of ageing management was overcome through new promotion policy. Decentralisation and delegation of authority have been opted for. Many of the erstwhile central functions have been delegated to regional offices. Particularly participation of employees in the Board is new a regular feature.

Continuous reorganisation of functions, system and policies is a clear indication of new culture in PNB—culture which shows the capacity to change old into new without any outside pressure.

An Evaluation

PB in PNB is now a decade old and an introspection would certainly be worthwhile. On a closer examination of the working of PB following shortcomings have come to light.

Budget Proposals

Budgets emnate from branches. Branch budgeting to become totally effective calls for a total faith in self: accountability, familiarity, with planning, a sense for figures and atttitude to involve all members of the Branch. During the interaction with some branch managers it was tested whether they, who practice PB understood its usefulness. Shockingly, it was noticed that many of them got their annual plan document prepared by senior clerical staff merely to submit the completed documents to Regional Office and the MASD. It was thought of merely as a form-filling exercise. like numerous other returns, which have to be submitted to higher ups by a particular date.

In most of the cases, it was found that environmental data was given the least importance by the branch managers in their budget formulation and primary importance was given to their past experience, followed by Head Office corporate goals and Regional Office guidelines. There was a general lack of appreciation of the usefulness of environmental data. Some of the managers were found lacking in skill and sources to make such an environmental survey. Although 'Planning Sheets' were introduced to serve as a link between Area Profile and the draft budget, there was a lack of guidelines for translating the environmental data into the budgets.

One of the features of PB is its democratic character in the sense that it places the Atlantian load of responsibility for the process on the latest number of shoulders. However, this involvement of staff members was totally a missing link. In most of the cases, either the staff was reluctant or in a few cases the managers felt no need to consult them.

Managers seldom realise and recognise planning as one of their relevant functions and therefore do not devoted adequate time to it. Their obsession with operational details and branch transactions provide them little freedom for such matters. Today's branch managers are transaction—oriented instead of management-orientated. *They act merely as chief clerks of the organisation and not as managers.*

While the plan document prepared by a manager speaks of segmental deposits, growth rate, manpower plans, etc. the obsession still remains with the total year and deposit figures. Thus the branch manager, keyman, is no, way impressed by the multi-dimensional character of the system and is concerned with one aspect, i.e. deposit mobilisation.

A few of the managers said that while they were loaded with the responsibility of growth etc., the present definition of command area was found to be insufficient to them. Since business depends upon personality of a manager, his command area should be as wide as he wants. But some others strongly opposed the idea because it was bound to create many complexities. Transfer of a manager would mean transfer of business from the present branch to the new branch.

In regard to type of budgets prepared, it appears that till 1975 due care was taken of all the aspects. However, budgets like loosing office budget, Manpower Budget (as it was designed in 1974), Income and Expenditure Budget, Publicity Budget, Renovation and Equipping of Offices Budget were conspicuously non-existent in the Bank's Performance Budgets for 1979, 1980, 1981, 1982 and 1983.

Recovery Budget was introduced in 1982—to be proposed by the Head Office to Zonal Office and Zonal Office to transfer it to branch budget. But there is nothing of it in Performance Budget 1983. All the more this budget does not emnate from grass root level. In previous budgets too there is no classification of overdues on the basis of time.

Settlement

An ideal PB system gives vital inportance to the budget settlement process. An ideal settlement process recognises the planning gap (gap that exist between the branch draft budget a result of the branch manager' perceptions and interpretation—and the budget as perceived by the Regional Manager) that usually exists between the branch manager and the Regional Manager. It calls for free and frank dialogue between the Regional Manager and the individual branch manager with a clear awareness on the part of both, of the constraints under which they have to work and of the goals to be reached.

In PNB—"our budget relates to last days of June and December and the settlement of the same starts in February and extends upto the month of April in some regions. Thus a large number of branches operate without budget in the first quarter of the year and they have only three months at their disposal to attain the budget for the first half year, i.e. June". *Thus, the purpose of the PB is defeated.

The budget settlement meetings at times turn into bargaining sessions. The branch managers were very critical that deposits goal given by them were invariably revised upwards on the premise that they deliberately underestimated the potential of the area, and the Bank's objectives were not, sufficiently taken into account. On the other hand the regional officials said that branch managers do underestimate so as to avoid any challenge. Thus, there is a distrust between the two sides, which is contrary to the spirit of PB.

In most meetings, discussions tend to centre on finalising deposits and advances only and the required attention is not always paid to the activities like manpower, establishment facilities, customer services, etc. Such a focus on output budget and bypassing the input budgets is undesirable. In this regard it is of interest to note that there is a tendency on the part of branch managers to demand staff more than what is needed.

Monitoring and Reviewing

A performance monitoring and review system should possess the following figures :

(i) Timely submission of performance reports.

(ii) Joint review.

(iii) Quantitative and qualitative review of performance.

(iv) Targets should be thought of just standards and not a contract by the performing unit.

(v) Only controllable variables to be evaluated.

(vi) Variance analysis : analysis to be an integral part.

(vii) Emphasis to be on performance areas than individuals.

(viii) The data flowing out of the monitoring and review should become a meaningful exercises rather than a ritual.

(ix) Rewards and discouragement linking/linked with performance.

In regard to monitoring and reviewing in PNB following are our observations :

(i) Although the Bank claims to have a very effective MIS, but at all the levels the information never reaches in time. "Receiving information from the branches is most important—something in which PNB was regarded a 'Chronic defaulter" and still it is so. As such it is not at all surprising that various performance reports get ready only two to four months after the expiry of the relevant budget period. In general the MIS suffers on

* D.O. letter of PNB Chairman to Zonal Managers, dt. 10.11.1982.

the following counts :

(a) Time lag is collecting, processing and feedingback.

(b) Duplication.

(c) Inconsistencies.

(ii) The reviews too are not made in time. To illustrate, the Monthly Review of January, 1978 was issued in May, 1978. Such late review means finding flaw at a late stage and allowing them to continue for a longer period.

(iii) One of the objectives of introducing PB is to help the branch manager to assess the performance of a branch. But the branch managers in most of the cases treat the periodic monitoring under PB as a form filling exercise. Submission of data in the form of statements in a routine and is given secondary treatment. Some officials at the branch level fill up the form and the manager merely signs it. It will be worthwhile to quote the experience of managers. There was a near unanimity in their opinion that they did not gain much out of the documents which involved considerable figure work, regardless of the size of the branches. Planning has been reduced to paper exercise and a paralysis has been created through analysis.

(iv) A few of the branch managers were very critical of the evaluation. In their opinion it was evaluation of a branch manager, instead of the branch as a whole. It is this phenomenon that leads branch managers to not to involve staff in the whole exercises of PB.

(v) At present it seems that if a branch manager achieves his deposit goals, irrespective of the number of accounts or sectors, he is supposed to have performed well. At this stage the Regional Managers forget to care for even the deposit mix. A few managers pointed finger to the fact whether deposits were the only indicator of efficient performance ? What about shortfalls in credit and profits ?

(vi) A few branch managers felt that PB is a way of reward punishment. In some cases targets were lowered for those who were either in the good books of the Regional Manager or happened to be influential otherwise, and thus given certificate of appreciation. On the other hand the case was found to be otherwise for non-favourites. These managers naturally view PB as a stick used by high ups to beat them with. The procedure for selecting branches and staff for rewards and prizes is neither clearly spelt out nor made known to the branches.

(vii) In case of favourites where targets were not lowered, the regional office came out with temporary relief by managing some short-term deposits, thus directly engaging in window dressing. This aspect has worried even the Chairman of the Bank, who has very rightly remarked—"you are also aware of the phenomenon of post-closing decline in aggregate deposits during the past 2/3 years." There is statistical proof to this effect. Aggregate deposits growth rate on the last Friday of 1980 was 25.1% and on the last day (after 4 days) of 1980 was 27.2%. This increase of 2.1% took place just within 4 days.

(viii) While quantitative dimensions of the performance is cared for, the qualitative dimensions of performance, e.g., customer service, prompt submission of return and reports, absence of major frauds and regular attendance at District Credit Committee are hardly bothered. In regard to customer service-infact the customer has neither 'voice nor choice'. Savings week is an indication of management by drive. How customers complaints are treated will be visible in the number of outstanding customer complaints every year :

Year	Outstanding in beginning	Recd. during the year	Disposed of during the year	Outstanding at the end
1979	635	3202	3258	579
1980	579	3070	3027	622
1982	925	3736	3612	1049

(ix) As regards to variance analysis, it is a mockery in the hands of all the levels. Neither it is regular nor scientific to find out causes so that various constraints hindering business achievement could be eliminated to the extent of their controllability is not done at all. In many cases variance analysis is made of deposits only. Even where such an analysis is made it is found entirely prefunctory. It was also noticed that variance analysis is made only for negative variances, even if positive variance is glaringly large.

(x) Review of performance is made at Regional Office in a routine manner without the involvement of the performing branch manager and the necessary feedback is sent to them through correspondence, which is far from the true spirit of PB.

(xi) The Regional Managers often regard the settled budget targets as commitment or contract made by the branch managers to accomplish them irrespective of whatever changes occur in the operating condition or delay in provision of agreed and other resource.

(xii) In evaluating branch performance inter-branch comparison or inter-bank branch comparison is not made. However, at the macro level the Bank evaluates its performance vis-a-vis banking system.

General Observations

While the problems relating to draft proposals settlement, and monitoring and review have been mentioned, a few other observations are also relevant here. It was observed that the managers were found to be wasting most of their time in clerical duties instead of developing business. Stationery was found to be another constraint. The managers were reluctant to take any action against erring employees because organisational support from the higher level was not forthcoming. On the part of branch managers it was noticed that they could not shed the past habit of referring even petty matters to regional office for clarification so as to avoid any decision-making. Frequent changes in banking policy by the Reserve Bank of India or in the corporate plans by the Head Office were also causing anxieties and strain on them to bring down the percentages of loans and advances for a particular segment, which was not possible overnight. Recovery was also a big problem. Head Offices of none of the banks (including PNB) have so far been able to integrate the three types of planning viz., Performance budgeting, district credit plans and the annual credit budget. The problem of co-ordination between different divisions at the Head Office was also sensed. Non-adherence to time-schedule is a problem with the Head Office also. The Head Office was also a party to window-dressing. Interest on doubtful debts is often included in net profit (even of an account where recovery is almost impossible).

Suggestions

Despite numerous problems encountered at various stages in PB, it can not be recommended to wind it up. The banks can present their account to all concerned in a better way only through qualified task in terms of functional classification, with the banks it must be clear to all that the element of objectivity should be brought in at all the levels at the earliest with total sincerety. Change in attitudes at all levels is a must. PB has been in practice for the last 10 years or so. Hence it must go beyond the 'formative stage'. In this regard following suggestions can be made :

(i) Since PB is based on MBO, there is need for total involvement. At the preparation stage it will bring a sense of responsibility and commitment and at evaluation stage an alertness and desire to overcome hurdles. Especially at the branch level, it is recommended to branch managers to get each and every member involved in the whole exercise. They should shed their traditional distrust in the capabilities of their subordinates. Unless group dynamism brought in its very basic purpose remain defeated.

(ii) PB being a new concept for commercial banks got less attention especially in the light of huge expansion work. Not only adequate publicity

required but it should form part of carricula while training clerks as well as officers.

(iii) No organisation works in vacuum. In this era of rapid changes, environmental understanding is a must for business planning. At the first instance, environmental analysis, however, rough-shed, provides some clues for assessing the potential for business growth. Secondly, it must may also provided an opportunity to the field staff to know the problems of the community and provide innovative suggestions to the top management for action and improvementation. And finally, it may allow the field staff to demarcate market segments in the area of operation and attune activities with the business plans.

As the environment consists of complex variables which are subject to frequent changes, any such analysis would be effective only if it is subject to an on-going review. To all concerned, it is suggested that in this area of planning awareness, environment should form the basis of all planning as well as an on-going review to take into account any change having a bearing on their business. As such it must be given due consideration.

A good way to start is to dispense with all redundant forms and schedules to be compiled; to concentrate on key branches for the valuable statistics on environment; and to bring in qualitative improvements in the process by training and educating all operational men, including clerical staff.

(iv) To make branch managers management oriented rather than transaction oriented there is a need to lighten their workload.

(v) While drafting branch budget, a branch has to keep into consideration the corporate goals, as well as policy guidelines and strategies, No doubt, the Bank has made them available from this year, there are not sufficient. It would be better if the Bank issues a detailed booklet on policy guidelines and strategies covering different aspects and sectors. If possible, it should be issued by Zonal Offices, because things differ from Zone to Zone, as being issued by the State Bank of India.

(vi) As said earlier, the regions as well as branch managers think deposits to be the only concern of PB. It is prudent to impress upon them that PB is multi-dimensional by character and hence not only deposit budget but credit budget should also be given due importance. Of special importance is that input budgets are most neglected, which have a great bearing on output. It is suggested that the Bank should include loosing office budget, manpower budget, publicity budget, renovation and equipping of offices budget, etc. within the framework of present budgeting exercise. The qualitative aspects—consumer satisfaction and recoveries also need good amount of budgeting.

(vii) The Bank should try to integrate PB, DCP and Credit Budget into one budget exercise.

(viii) In the evaluation section, attention was drawn towards inordinate delay in sending appropriate returns, forms (duly filled in) and statements at every point. A delay on the part of head offices led to delay in budgeting at branch, delay on the part of branch led to delay in budget settlement and proper corrective action and so on and so forth.

Business operations are often becoming difficult due to ever-expanding size of the organisation in terms of geographical coverage, member of people exployed, the diverse nature of operations, fierce competition and several regulatory measures. All these have added to the already existing uncertainties. There is need for joint efforts to develop a well-knit Management Information System (MIS). As MIS, an organised collection processing, storing and retrieval wherever necessary, ensures that managers get the right information in the right time to facilitate decision making. An MIS designed by full involvement of the users and implemented with the management's approval has a utility and is aimed at quenching the information thirst at various

levels of which they (operating unit personnel) may be just one of them. Speedy transmission of accurately compiled data by the operation's sub-system therefore, is an essential pre-requisite in the successful implementation of an information system.

Many a times information from lower levels does not come because they do not understand its utility. The Head Office should make the senders to know the use of data sent by them.

No doubt a sick MIS results in a sick organisation leading towards a comatose stage. However, it should not be regarded as a magician's magic wand.

(ix) To save budget settlements from being bargaining sessions, it is suggested that a moderate approach be adopted by both the sides. Unless the two sides take an objective view of the whole situation, nothing can be done.

(x) At the monitoring stage, as said earlier in it is proposed that performance reports should reach to the regional office and the MASD in time.

(xi) While sending such performance reports, branches do not bother to analyse variances. The branches should comment upon all the activities of the branch. The comment should not be perfunctory. To really understand the trend it is very important to analyse growth quantitatively. It has often been noted that branches especially do not offer any comments in regard to positive variances. There is need for both quantitative and qualitative analysis alongwith analysis of future trend.

(xii) At the review stage, again there is need for timelines. Apartfrom the above, the review itself needs overhauling. Firstly, the branch should be the unit rather than the branch manager. Secondly, deposit should not be the only item of review, because credit and profit are equally important. Within deposit goals, apart from the quantum, number of accounts and sectors be also reviewed. Thirdly, the performance should be compared between the branches of the same bank and between the branches of the same locality of different banks.

(xiii) To the controlling authorities, it may be pointed out that targets set are not contracts and PB is neither a way of reward nor punishment. If PB is made to be a success than the Head Office and the Regional Offices should actively participate in overcoming the problems in the way of achievement of targets. Of special attention the matter are industrial relations and delegation of authority.

(xiv) Window-dressing by Head Office, Regional Office and branches be made an offence. Window dressing not only gives a false picture but also perpetuates the short-comings.

(xv) Finally there is a need of review budget formats at regular intervals.

Conclusion

Change is life and life is change. The banks should understand it very well. Performance Budgeting is to help them in overcoming management by crisis and adhocism. Everyone in banking industry should honestly work for a successful PB, which is to help them in serving those for whom they are meant.

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Self Reliance from Reverse Engineering

M.L.V. RAMU

"The author in this paper attempts to highlight 'Modus-Operandi' of "Reverse Engineering." Reverse Engineering enumerates the methodology for manufacture of spare parts, laying out a process, material testing and carrying out fitment and endurance trials to substantiate the right use of the spare parts so made.

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Introduction

The standard practice of producing any item in industry is preceded by voluminous efforts of research and development. A prototype is made and offered for dimensional check, fitment/functional trials. Also the effectiveness of the product is ascertained in the specific environment it is meant to be used. All these activities are comprised in "Design Engineering." The present topic of the paper is just inverse of "Design Engineering." It is evident that to commence the task of 'Design Engineering' it has to have a "Data Bank" as an aid related to specifications of a product.

'Reverse Engineering' is a process which makes its debut in the absence of the related Design specifications. One would wonder as to its necessity and implications in the industrial field. Especially in our country, it is commonly noticed that whenever an agreement for purchase of foreign equipment is made, it is invariably experienced that either the technology is so much advanced in the relevant country that either product is sold in a semi-belated or belated condition. Added to this the related specifications of the newly purchased equipment are not simultaneously provided with the equipment. Besides this, the equivalent raw materials of the components are a dire need to produce the needy items as the specified raw materials are not locally available in the exact composition. Further certain design characteristics also may be at variance with our adopted Indian

standards. Now one can visualise the user's plight with the above drawbacks in an imported equipment. Instances are found where such an equipment has not been but into use after more than ten years of introduction in service. Especially the back bone of 'spare cover' warranted out of repair maintenance is broken in the first five years period of its use, due to the existing lacunae of hasty purchase agreements entered into with other countries.

Under these circumstances, 'Reverse Engineering' is the only answer to the user.

Definition

'Reverse Engineering' is the inverse of 'Design Engineering.' In the absence of the relevant manufacturing specification/sealed drawings, all the connected information has to be extracted by disassembly of parts. In turn each component has to be dimensionally checked and if need be the chemical composition and physical properties have to be ascertained by subjecting the part to a destructive test. The specification data are also derived backwards, and such compiled data is fed back to 'Design Department' and its correctness/suitability may be explored by fitment of indigenously manufactured items and carrying out simulated trials.

Scope

The science of "Reverse Engineering" is made use of only for products where 'Design data' is not available. Also it is very helpful in cases where specified raw materials are not available and components are to be manufactured to the existing Indian standards. Due to paucity of spares, Reverse Engineering helps to carry out vital modifications essential to render equipment fit for use.

Method of Application

In the absence of the 'design data' all specifications pertaining to raw material, dimensions, mettallurgy, processing details, assembly tolerances and finish are explored from the very part fitted in any equipment.

The drill laid out is as follows :—

(a) Spark test : Assuming the component to be a ferrous part, first subject the component to a 'Spark test' by holding its edge on to a bench grinder. In case light red long sparks are noticed then infer metal is mild steel. On the other hand if a number of dull red short sparks are observed, the metal proves to be an alloy steel. This test is quick and fairly informative.

(b) Chemical Composition test : Further the ingredients and its percentage are segregated by 'Titration process' in a laboratory. Even nonferrous items are covered by this test.

(c) Mechanical properties :

(i) In order to check the physical properties of the item, Rockwell Harness tester is used wherein by indentation under a specified load, the surface hardness of the object is examined. This figure is a direct function of its tensile strength. (Refer to Tables).

(ii) Compression test of items like helical coil springs etc. are carried out in standard compression testers (Avery make) to ascertain its suitability.

(d) (i) Surface hardness (Shore 'A') of various rubber items (Synthetic and natural) are checked by pressing pointer of shore hardness tester on the surface of the object.

(ii) Similarly the rubber mixing in Synthetic rubber (nitrile etc) and its curing may be assessed by flame test and chemical composition methods.

(e) Finish : Finish of metal parts may be by nickle plating, cadmium plating, chromium plating (Dull and bright), Phosphating, Galvanising, Anodising Spray painting with or without lacquer finish depending on its end use. By visual comparison details may be assessed.

(f) Dimensional check : Subject the item to a critical examination by using instruments like vernier, micrometer, depth gauge, thread

gauge etc., to record the characteristics and then decide on the working tolerances warranted from its end use. This is purely an experience exercise.

(g) Fitment trials : Having produced an item with the equivalent raw material to nearly accurate original part, carry out a fitment trial and simulate its function to check its suitability.

(h) Functional trials : Operate the equipment with this newly fitted item and watch for satisfactory performance or otherwise.

(j) Environment/Endurance trials : Subject, the equipment to continuous running in a specified environment and for a stipulated period to check its effectiveness and reliability.

(k) Feed back : The entire information compiled by this 'Reverse Engineering procsss' is fed back to 'Design Department, to update their 'Data bank' for records and eventual use.

Advantage

(a) Imported equipments (belated or semibelated) whose manufacturing specifications are not provided to user may be put into operation by resorting to "Reverse Engineering".

(b) Due to nonavailability of the exact specified raw materials of the components fitted in imported equipments, its equivalent raw materials can be arrived at by using 'Reverse Engineering'.

(c) Similarly nonmetallic items like Rubber, Plastic, Bakelite etc., can be substituted indigenously with the help of flame tests, chemical test and other laboratory facilities sufficing its properties to render correct functioning.

(d) Due to non availability of essential spares for imported equipments, some vital modifications are imperative to keep the equipment in working condition. 'Reverse Engineering' helps to manufacture the modified components and enhance its versatility.

(e) Equipment and machine utilisation is considerably improved and idling reduced.

(f) Many of the automobiles may be kept on road by reclamation techniques as an offshoot of Reverse Engineering.

(g) Considerable foreign exchange saved by resorting to indigenous manufacture.

Conclusion

Quite a number of industries are confronted with the type of problems enumerated above. 'Reverse Engineering' is the 'Modus-operandi' for personnel who are handling equipment associated with varied problems cited in this article. The efficacy of this system described in para four above may well be tried in the affected areas and the results watched.

Care may be taken to ensure that,

(a) Reliability of the equipment is not affected.

(b) Modified equipment is not accident prone.

(c) Preventive and repair maintenance do not pose any serious problems.

Hence the philosophy of 'Reverse Engineering' has to be given wide publicity to prove its merits.

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EXECUTIVE READINGS

Electric Machines
I.J. Nagrath and
D.P. Kothari

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Several years back the reviewer was much fascinated by a wall poster when he, as a student visited an electrical machines laboratory for the first time. The poster read 'Rotating Machines are the Bread and Butter of the Modern Society'. In those days, perhaps under the influence of this saying the topic of electrical machines used to begin with basic principles on which the working and operation of various kinds of electrical machines are based, and used to end with fairly detailed design procedures.

However with the advent of solid-state device-electronics and subsequent miniturisation of the devices, and with the availability of powerful digital computers and associated hardware and software the situation changed considerably regarding the electrical engineering education. The tremendous impact these all have had led to relegation of electrial machines to second place though they continued to fulfil, to a large extent, the impression carried by the above mentioned saying. Gradually the control and operation of electrical machines has gone a sea of change largely due to application of electronics, feedback control principles, and computer and microprocessors. This change has resulted in increased and efficient use of electrical machines and power in variety of situations, which were unthinkable, say, about 25 years back, so that the industry is today witnessing a completely new and changing engineering and technological environment.

Around the time when electronics and related topics on control theory and instrumentation were being provided with slowly increased quota of course content, a generalised theory of electrical machines as presented mainly by Fitzgerald and Kingsley appeared in the form of a book [1] on electro-mechanical energy conversion. Before appearance of this book standard work by Langsdorf [2], Say [3] Clayton [4] and Punchestein et. al [5] were in use for detailed study of electrical machines.

The book by Fitzgerald and Kingsley [1] made people to look at the electrical machines from a point of view where it is possible to consider common aspects of their operation so that a fairly general understanding of energy conversion dynamics may be developed. In some institutions the approach gained currency, and people used to feel elevated that they were dealing with higher level of conceptualisation. But soon it was realised that the approach was beset with a problem of inability of an average undergraduate student to grasp the

difficult concepts which involved considerable mental visualisation. Hence the euphoria of exposing the students first to the generalised theory did not last long. Presently it has been the practice that the generalised energy conversion principles are introduced rather briefly with some positive impact on the conceptualization process. The individual machines are then discussed in as much detail as desired.

The book, by Nagrath and Kothari under review represents exactly this very fact.

The book, which is primarily written for undergraduate students provides a useful and compact introduction to the electromechanical energy conversion processes and devices. The concise introduction is followed by two chapters on magnetic circuits and transformers. Though the treatment of magnetic circuits is brief but quite useful as one can easily grasp the idea of applying required amperetures to produce a specific amount of flux in iron core and the airgap. The treatment of transformers is given in quite detail. Since transformer is an important component in energy conversion system and its theory is closely related to that of electromechanical energy conversion, its detailed analysis is an absolute necessity.

The following chapter deals with phenomenon of electromechanical energy conversion which depends on the interrelationships between magnetic and electric fields on one hand and mechanical forces and motion on the other. The authors have used a desired level of mathematical formulation and examples in it for explaining the above mentioned general relationships. Even then it is felt that the students will perhaps feel difficulty in digesting, in the first attempt, the interplay of the above mentioned relationship.

The next chapter is about rotating machines wherein idea of generated e.m.f. and m.m.f. in distributed windings have been given in some detail. The chapter also includes the concept of rotating magnetic field produced through polyphase winding, and development of torque equation. Some physical concepts such as leakage flux, losses and dissipation have also been discussed for rotating machines in general.

The chapter 6 deals with armature windings only for both a.c. and d.c. machines.

Next the chapters 7, 8 and 9, which form the main body of the book, discuss in detail the d.c. machines, synchronous machines and induction machines respectively. The quality of discussion and analysis is mathematically rigorous covering all the essential features of operating principles, model building using valid assumptions as well as heuristics, testing for parameter determination, operating characteristics and constructional details. These chapters also include consideration of machine dynamics for development of transfer function. These transfer functions are directly useful when one desires to apply control theoretic principles for enchancement of under-standing of machines being used as control system components as well as when they are being controlled.

Chapter 10 is about fractional kilowatt motors which are of immense practical use. These are essentially single-phase machines and their operation is dependent on creating of rotating magnetic field using split phase or a similar technique. Theoretically the explanation of development of such a field is through cross-field theory. But the chapter includes a brief and simple treatment without venturing into cross-field theory as such. The chapter also includes brief discussions about servomotor, reluctance stepper motor of both variable reluctance and permanent magnet type, series motor etc, which should help in developing basic understanding about working of these machines.

The last chapter is on motor control by static power converters. As mentioned earlier it is here that direct application of solid-state electronics is seen in controlling the machine operation in various ways. The chapter gives fairly comprehensive treatment of motor control through semiconductor diodes, power transistors, and thyristors. The book also includes appendices on certain important topics.

The major merit of the book is that it successfully combines the general principles of electromechanical energy conversion with the explanation of the individual machines operational behaviour. The book is well written and amply

illustrated with clear diagrams and numerically examples. The main disappointment of the book is that it does not provide enough practical/industrial usefulness of specific machines. However the book is a valuable contribution to literature. It has potential of being considered as a test book on electrical machines.

The Aluminium Industry in India

V.B. Col, D.K. Abrol, P.R. Bose and Kishore Kumar

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"The book under review is an extremely good treatise over the problem, promises and prospects of Aluminium Industry in India. It vividly portrays the position of Indian Aluminium Industry in the world scenario and brings about its strengths and weaknesses", if it has to compete with the world market.

As the book has rightly pointed out, the major problem faced by today's Aluminium Industry is acute shortage of steady and continuous power at affordable power tariff. Apart from BALCO AND HINDALCO, all the three units of INDAL and MALCO are totally dependent on the State Electricity Boards for their power supply which is predominantly hydel. With the monsoon becoming leaner, year after year, the quantity of hydel power generated in the states has appreciably reduced over the years. One wonders whether it is due to the ecological imbalance of the nature and whether it will continue to be worse in the years to come. To add to this, steady growth of industrialisation has drastically cut down the share of power to Aluminium Smelters. Consequently not only have the production capacities shrunk to around 15 to 25%, the cost of production has also shot-up manifolds, thanks to the expensive raw materials used in the process. To compound the problems further, State Electricity Boards have whimsically and phenomenally increased the power tariff from a bare 2.0 paise per unit way back in 1974-75 to around 60 paise per unit during the current year an increase of around 300% in about a decade. No amount of R & D effort will be able to contain the cost under such conditions and make the metal cost competitive in international market.

To overcome the problem of power, the book has suggested at one place the installation of captive power plants by INDAL and MALCO. This problem is being extensively studied by INDAL. Major bottle-necks envisaged are—

(1) Hydel power projects are capital intensive and have long gestation periods. At the present moment the industry cannot bear the burden for such a long time.

(2) Except for Hirakud, INDAL Smelter at Belgaum and MALCO are unfavourably placed for coal based thermal power plants. Besides, the cost of power also would be prohibitively high.

(3) Co-generation systems, based on liquid fuels such as LSHS, diesel etc., though look attractive superficially, suffer from inconsistent supplies on fuel and unpredictable escalation of fuel cost. Nevertheless, these projects appear more viable for immediate reward. However we feel that governments should encourage setting up of such plants by ensuring regular supplies through their refineries and limiting the escalation.

As a long term measure the Central and State Governments must tap whatever hydel potential they have in the country as this would be the cheapest form of electricity any day. Besides they should set up more thermal/nuclear units and thus ensure steady power at concessional rates. Nevertheless, INDAL is actively thinking of installing a captive power plant either at Hirakud (coal based) and or Belgaum (hydel power through consortium of consumers).

Secondly, as you have rightly pointed out INDAL is trying to remain in the forefront as far as the technological advancement is con-

cerned. We have been encouraging R & D efforts starting from bauxite mining to fabrication of semis. Our constant endeavour has been to become self reliant and less dependent on TNC (Trans-National Corporations). However, we feel that while in the field of metal extraction we are fairly in advanced stage, in the area of down stream products we may have to continue to seek help from our collaborators. But we are of the opinion that if research in aluminium industry is to be encouraged the government should extend more help than what is offered, in the forms of increased development rebate, less import duty on raw materials and machinery purchased and exemption from taxes etc.

One aspect which has not received any attention in your book is the dual pricing policy of the government for metal sales. The present policy penalises the efficient company like INDAL and HINDALCO and rewards less efficient company's like BALCO and MALCO. This adversely effects the performance of efficient companies.

Secondly, the pricing policy should have an inbuilt provision to adjust the metal price as and when the prices of main raw materials like power, petroleum coke, furnace oil etc., increase. Past experience shows that years pass-by, between the increase in raw material prices and increase in the cost of levy metal, awarded by pricing authorities. This gap should be bridged for the increased viability of the business.

Talking of opportunities for promotion, we agree that as on today, electric sector continues to have the major share (around 52%) of aluminium consumption. However, in the field of transport, building and construction and packing it needs a further thrust. Particularly in transport industry it has to be taken with a sense of urgency in view of its tremendous bearing on conservation of fuel and potential for effecting a substantial reduction in the country's import bill.

As regards environmental aspect, INDAL has taken up monitoring and abatement plans both relating to surface and air pollution well before the enactment of pollution control laws. They have been taken up more from the humanitarian point of view rather than legislation threats. However, financial contraints restrict INDAL to do its best in this field. One subject of pride for INDAL is its Occupational and Hygiene Centre at Alupuram which aims at keeping track and improving the health of industrial worker not only in INDAL but also in surrounding industries. This centre is slowly spreading its wings in other units.

The book can act as an eye opener and create a positive impact on the government and other industrial circles.

Grass without Roots : Rural Development under Government Auspices

I.C. Jain, B.V. Krishnamurthy and P.M. Tripathi

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There have been a number of schemes, enunciated in India, to develop the rural poor but the results have been appalling. No doubt, removing the entrenched poverty is no easy task but it is also true that the methods adopted for removal of poverty have enabled the poor to remain poor. It seems that for this unfortunate state of affiars, the possible reason can be that people themselves do not find any place in the rural development; on the contrary, every inch of space is occupied by bureaucracy, and the community is on the peripherals. It would not be wrong to say that in the name of Community Development, the bureaucracy has been developed and perfected during the last three decades or so.

The present book by Lakshmi Jain and Dr. Krishnamurthy is a painstaking exercise based on empirical data to prove the above hypothesis. However, in their own words, "..... identifies the extent to which and the reasons why the rural extension organisation (its structure, functions powers, personnel, procedures, styles of functioning, contact and relationship with the

community) is an impediment in the satisfactory and speedy delivery of the intended development benefits."

To reiterate, the variety of CD programmes have been baptised as IADP, HYP, NDP, DPAP, HAD, CAD, IRD, PIREP, TRYSEM, NREP, SFDA & MFAL, etc. Each one had a set of objectives to strive for and were launched on an experimental basis in a group of villages/districts as the case may be. Each programme aimed at a section of people to mitigate their poverty and bring them in the mainstream of the development process. Lakshmi Jain's book traces, briefly, the history of CDP and shows how each one of them was conceived, implemented and what was the net outcome. The least common denominator of each programme's failure has been the faulty machinery and corrupt methods adopted by the bureaucracy. The District Administration, has, in fact, become the actual stumbling block for the success of any CD Programme. If one were to quote the instances where the lopsidedness of administration were evident, it would run into another book. However, it is suffice to say that one person got the land, second got a pair of bullock cart, the third got seeds, the fourth got an irrigation pump and the fifth got Rs. 35 or Rs. 100 as a working capital. The irony of the situation is that none of them can work together: Crores of rupees is spent to benefit a few hundreds or a thousand and that too in the above manner. Most of the funds do not percolate to the quarters to which they should go. When the game of corruption is visible to the poor they too tend to indulge in corruption : same bullocks being bought, sold, re-bought from the loans. It is, therefore, evident that the agencies have only sought to play the numbers game.

Where does all this lead to? Lakshmi Jain has very boldly pointed out that unless and until the administration is decentralised and that people are not involved, any amount of slogans or launched of New programmes would yield only marginal or no results.

The authors point out that vitalising of the Panchayats as a unit of self-government—is probably the answer to the perennial poverty. The ideas could be borrowed from various programmes and combine them judiciously to obtain the future direction. "This combination should include arrangements for establishing integration between the community and development planning and implementation, on the one hand, and the community and the administration and budgeting on the other."

The authors have given a few long-term measures which need to be given a serious consideration.

Having said all what has gone by, it would not be wrong to say 'where there is a will there is a way." It's time we search whether we, as a nation, have a 'will.'

The book is an excellant one and must be read by policy makers more than any one else.

Recent Experience in Human Resources Development
Edited By
T.V. Rao
D.F. Pereira

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Reviewed by
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An organisation is what the people in it make it to be. Human Resource Development is therefore the foundation for organisational growth. The Human resource development movement had gained momentum in India in the Seventies and several organisation both in the public and private sectors had pioneered in undertaking the introduction of innovative and constructive HRD processes and mechanisms in their organisations.

T.V. Rao and D.F. Pereira the editors of the present book have done a timely and commendable job in bringing together the varied experiences of processes and mechanisms like performance and potential appraisal; counselling, planning, role clarity exercise etc.

Of considerable interest to the reader would be "Human Resource

Developments Practices in Indian Indusiries : A Trend Report" According to the trend Report open appraisal and OD activity in organisations are increasing and at the same time it is sad to note that the potential appraisal does not seem to be in vogue as a result of which reward administration tends to be traditional. "HRD Climate in Indian Organisations" (5th chapter) tells us that HRD climate in Indian Organisations is far from satisfactory. The presentation should have included details about the sample included in the survey.

Udai Pareek and T.V. Rao in the chapter on "Line Managers and Human Resource Development" dwell on the interface between Line Manager and HRD departments without the involvement of line manager it is unlikely that HRD in any organisation can be a success.

Put against the facts of ever changing technology and increasing stress at work, it is surprising to know that only few organisation are having counselling, process. ("Can they have a word" ?) we can ignore counselling, only at our peril.

Durlabji's insightful article "Cultural and organisational content of Japan's HRD orientation" looks at the cultural and religious roots of the present day Japanese practices, which are informal, implicit and subtle instead of being explicit, data based and logical. Durlabji argues quite convincingly the need to adopt some Japanese processes in India.

Part II of the book, consists of first hand accounts of HRD practices in various Indian organisation like Larsen & Toubro, Madras Refineries, State Bank of Patiala, BHEL, Bhopal, Maruti, Shri Ram Fibres, Jyoti, T.V. Sundram Iyengar & Sons, Ltd., Bank of Baroda, Housing Development Finance Corporation, Madura Coats, State Bank of India and Crompton Greaves.

Each presentation gives a brief background of organisation in which new HRD processes and mechanism were started and a discussion of process mechanism and tools used. The presentations are quite lucid, readable and crisp. Commendable among them are : L & T's focus on performance and potential appraisal of personnel; OD effort in BHEL Bhopal—a good picture of as to what was attempted, with what results; HRD at Jyoti Ltd.,—a brief note of how people felt about the working of appraisal system and HRD experiences at Crompton Greaves using RAT to obtain Role clarity to improve managerial effectiveness.

For some one who wants to know as to what is going on in various organisation, this serves as a good window. To get a full picture, however, it is necessary to come up with the study of not only what has been introduced but also what have been the consequences there of. One hopes that the editors would bring out volumes subsequently with a focus on growing HRD movement. Printing and get up are quite good. Price is fair.

A low priced paper back of the same can be very handy for students.

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Select Bibliography
on
Environmental Risk Analysis

P.R.K. MURTHY

The interest of the people in the management of environment has been increasing, with the epoch making environmental hazards with their devastating effect on human life. The present bibliography is an attempt at putting together the literature in the area of environmental management.

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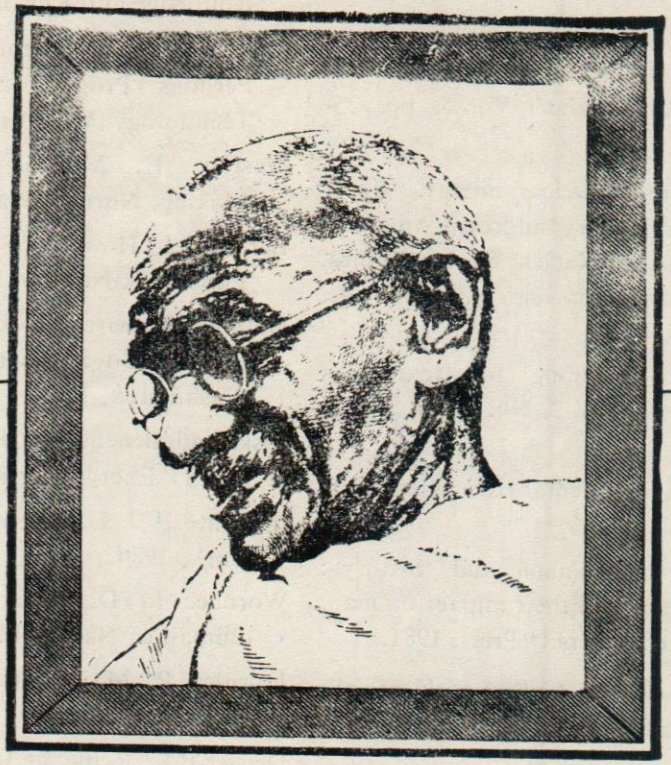

BAPU'S RELIGION

"My religion has no geographical limits.
My religion is based on truth and non-violence.
My religion forbids me to hate anybody.
Religion is not for separating people —
It is to bind them."

That was the Mahatma's religion

True Religion of Love and Tolerance

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