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# Management of Turnaround and Recovery

DR. BERNARD TAYLOR

*This paper discusses the challenges the management is facing in today's world and presents the strategies to come to grips with them. The author emphasises the need for the new style of management. It discusses the strategies for recovery of organisations and points out the need for the top management to spend a greater proportion of the time in explaining its policies to the public and to the media. It focuses on the need for rationalisation and the obstacles to rationalisation.*

Dr. Bernard Taylor is a Prof. of Business Policy, Henly Management College, London.

## The Present Crisis

During the 1980s management faces the unwelcome and unfamiliar task of 'Managing in Hard Times'—an era of low growth, intense competition for markets, scarce resources, cutbacks in government expenditure and fewer jobs. To quote Tony O'Reilly, President of H. J. Heinz: "The Chief Executive who pleads the case for holding on until things get back to normal has missed the point...The strategic problem of the next decade for many is going to be survival...*Today's conditions are not going to go away*".

## The Challenges For Management

The challenges for management are :

—to achieve radical changes with the necessary speed and without the compensations which are available in periods of affluence and growth ;

—to reorganise the business and help rationalise the industry in order to cut out over-capacity, concentrate production and reduce unit costs ;

—to pull out of traditional businesses where the firm can no longer compete, and to build up business which make more specialised, high-quality products ;

—to reduce the firm's dependence on home markets and construct an international organisation which will enable the business to compete in the major international markets :

—to re-design products and modernise processes, in order to get into the new technologies quickly before the current generation of products is rendered obsolete (like mechanical watches, office calculators and cash registers before them);

—to reduce manning among blue collar, white collar and managerial staff in order to raise productivity and to cut overheads to the levels necessary to compete in world markets.

**A New Style of Management**

To manage radical changes during a recession appears to demand a style of management which is more characteristic of the individual entrepreneur than the large company administrator.

*Decisiveness.* The situation calls for a speed of decision and ruthlessness in decision-making: a willingness to take unpleasant decisions and to face public criticism in order to ensure the continuation and recovery of the overall business.

*Direct communication.* Management must rely more on personal face-to-face meetings and telephone conversations, rather than on formal committees and paperwork systems.

*Personal responsibility and accountability.* There must be a greater emphasis at all levels on personal responsibility and accountability for meeting the targets and deadlines which are necessary if the business is to survive.

*Central control of funds.* This accountability is accompanied by a tighter central control of cash and an assumption by top management of the right to reallocate cash among divisions.

*Investment and Disinvestment.* Thers is a need to rethink the future prospects for each product and market segment—in terms of the growth and profit potential and how to stay competitive in price, quality and service often on a lower level of business, and take radical decisions to invest or disinvest.

*Expansion internationally.* As growth slows down in traditional markets, it is necessary to expand internationally, sometimes into politically risky areas.

*Personal negotiation.* The re-structuring and rationalisation which is taking place demands political skills of a high order and the ability to negotiate with employee representatives, with pressure groups, and government bodies at home and abroad.

*Innovation and risk-taking.* There is a recognition that firms must adopt and develop the new technologies, or go under—introducing new products and processes and pioneering new business.

**Strategies for Turnaround and Recovery**

In the successful management of turnaround and recovery, a central problem is to manage the contraction of traditional activities and the expansions of new activities within the same organisation. These two processes co-exist in most businesses but in a turnaround situation the shift of emphasis must take place quickly, often in conditions of crisis. Management has to work with limited resources and in the face of continual pressures from the work-force, the media and public authorities.

Typically, the strategies for turnaround and recovery involve :—

☐ *Mergers and Co-operative Supply Agreements*

These are necessary to reduce the number of firms, concentrate production capacity and to build a business or businesses of an appropriate scale to compete for world markets.

☐ *Scale of Assets and Reduction of Overheads*

In the business which needs rationalising and restructuring, there is often a cash crisis, and a need to reduce the level of debt. Paradoxically, management is forced to sell off valuable land and buildings and profitable businesses to re-establish profitability and to raise the cash needed for re-investment in new products and modern equipment.

☐ *Cutback in Central Administration*

Central staff departments are cut back and the personnel re-deployed in line management. Head offices

are closed or moved to less expensive sites. The number of management levels is reduced to produce a "flatter", "leaner" organisation. Operationally, the company is divided into separate businesses, for each of which a Chief Executive is appointed and held accountable.

☐ *A Business Strategy and Tight Budgetary Control*

Five-year planning is frequently eliminated. Funds for investment and working capital are allocated centrally, according to the cash needs of the total company and the prospects for each particular product/market. Operating management usually work on a tight monthly budget.

☐ *Pruning the Product Line and Introducing New Cost-Effective Products*

Traditional product lines are heavily pruned: marginal businesses are closed, and distribution is rationalised to focus on a few, big outlets. This enables marketing expenditure to be concentrated on a smaller number of established "pillar brands", and on the introduction of new products and services which have high profit potential in a period of recession, e.g., because they offer new features, value for money, energy-efficiency etc.

☐ *Achieving Dramatic Improvements in Productivity*

To achieve marked improvements in productivity usually involves major structural changes :

—closing obsolete factories and concentrating activities in fewer specialised plants,

—automating processes at home and moving labour-intensive operations overseas,

—involving the work force in improving quality and productivity.

☐ *Developing a Highly Productive and Well-Paid Work Force*

This normally involves :

—a reduction in staff numbers,

—the introduction of new technology,

—a dramatic increase in levels of productivity and quality—to match standards achieved by international competitors,

—retraining, up-grading and increased pay for the smaller number of employees who remain.

☐ *New Structures for Employee Participation and Communication*

Dramatic changes such as these require the involvement and willing co-operation of employees and trade union officials. This implies that management consult and communicate widely but they reserve the right to make the final decision.

☐ *A Strong Public Affairs Operation*

In a turnaround situation the top management team has to spend a larger proportion of its time explaining its policies to the public via the media and to local and national politicians and officials. This is necessary to minimise the social and political problems resulting from closures and de-manning, and to obtain government funding and collaboration in setting up new businesses at home and abroad.

**The Control of Public Spending**

Managemement in central and local government, in the public services, in nationalised industries and public corporations are faced with particularly difficult problems in attempting to contain the growth in public expenditure.

☐Total government expenditure appears to grow inexorably as the public demands more services and as Parliament continues to enact new laws.

☐The present crisis has brought extra commitments: support for an increasing number of unemployed, subsidies for ailing industries, higher interest charges, rising costs for energy etc.

☐As we have seen recently with the miners, public sector unions often wield monopoly power over essential public services and union leaders know that, whatever their demands, they are unlikely to force their employers into bankruptcy.

☐Politicians and pressure groups, too, acting through the media and through democratic institutions are frequently able to stop the cut-back of public services in a particular industry or region.

In a word, the process of "cut-back" in the public sector responds less to movements of supply and demand and more to political pressures. As a consequence, the public sector administrator is less in control of his costs than the manager of an independent business. In particular, there is likely to be more inertia and a longer reaction time before staff numbers and expenditure levels are reduced.

**Management Strategies**

Among the strategies which public administrators are adopting to control and reduce public spending are the following :—

☐ *Privatisation*

This involves 'hiving off' whole businesses or parts of businesses, such as British Petroleum, British Airways, or the National Freight Corporation, into the private sector.

☐ *Sub-contracting Services*

This involves public organisations in buying services from private businesses. These services might include, e.g., office cleaning, catering, building, refuse disposal, security services and fire brigade services.

☐ *Selling Services Abroad*

Many nationalised industries and public corporations, such as the National Coal board, the Electricity Industry and the B.B.C., add to their income by selling services, particularly to Third world countries.

☐ *Selling Services to Industry*

Many public bodies have assets—land and buildings, computers and other equipment, laboratories etc.—which are under-utilised. In many cases the use of these assets could be sold at a fee. National Research Laboratories, for example, cover a third of their budget through contract research for industry.

☐ *Selling Services to the Public*

Another means of raising income is to open up facilities to the public. Schools, universities and college, for example, can make their buildings and playing fields available for use by the public, or by sports clubs and other voluntary organisations, for a fee.

☐ *Office Automation*

The introduction of electronic office equipment opens up the possibility of reducing managerial and clerical staff, provided union agreement can be secured.

☐ *Transfer of Resources*

In many situations what is required is a transfer of resources from a declining area (e.g., maternity services) to an area of increasing demand (e.g., geriatric services).

☐ *Rationalisation*

Economics are also possible by cooperation between public organisations (e.g., in purchasing) and by amalgamating several smaller organisations into fewer larger units.

☐ *Simplification of Paperwork Systems*

A common way of saving costs is to eliminate or radically simplify bureaucratic systems.

☐ *Reduction in the Number of Levels*

Further reductions may be achieved by eliminating one or more levels in an organisation (e.g., the Area level of the N. H. S.). This could have the additional advantage of reducing delays and speeding up communication.

**Obstacles to Rationalisation**

In addition to the political opposition he may meet, the public official has also to work within a system of accountability which puts numerous barriers in the way of rationalisation :—

☐The scope of his activity is frequently limited by statute.

☐It is often impossible to transfer funds from one activity to another because they have different budgets.

☐A public authority is not organised like a business. To sell its services to industry or to the public usually involves a radical change in staff attitudes,

considerable reorganisation and a programme of training and development.

- ☐Strong vested interests abound and any attempt at cut-back in staff and budgets involves a bitter political struggle inside and outside the organisation.
- ☐These vested interests are protected by powerful professional associations and strong trade unions, and buttressed (e.g., in the case of the armed forces) by long-established traditions.
- ☐In many cases civil servants and professional groups, such as doctors, teachers and university lecturers, are protected from dismissal and may only be investigated by their peers.
- ☐The system of public accountability frequently encourages caution and discourages initiative.

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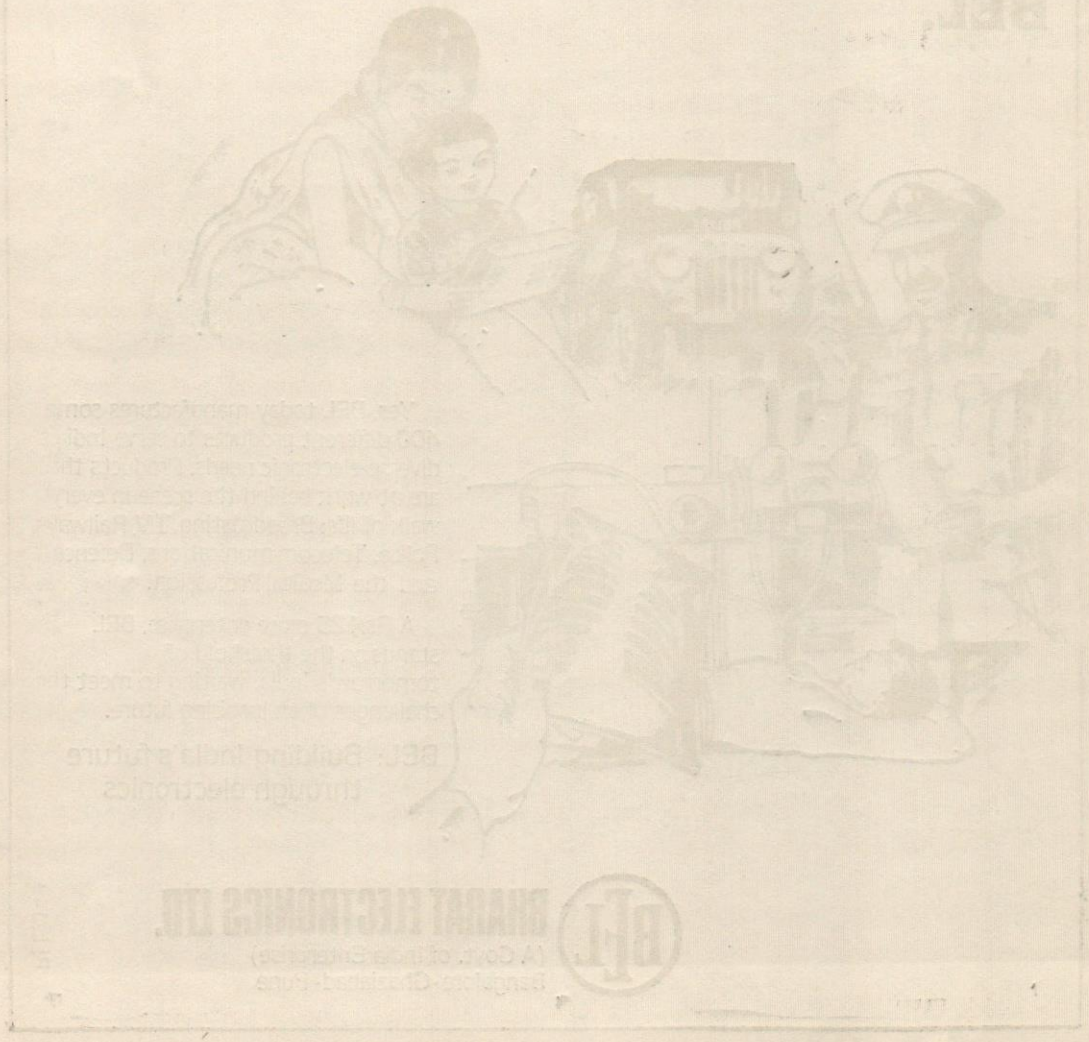

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# Is Strategic Planning Necessary ?

DR. RAVI K. ZUTSHI

*The ever dynamic socio-political and technological environment make it imperative that people exercise the Corporate Managerial foresight and have Strategic Planning. The paper briefly peruses the state-of-art of Corporate Planning and focuses on the issues central to Corporate Planning.*

Dr. Ravi K. Zutshi is a Senior Consultant, Planning Commission, Government of India.

## Introduction

The increased perturbations in the socio-political and and technological environment and the accompanying distortions in the product-market relationships have had its effects on the managerial thinking. It is becoming increasingly clear that in the shrunken time-space, the indirect and tertiary impacts of decisions are no longer insignificant or too far off in future that they can be reacted to at the appropriate time. The environment of heightened awareness, where the stakeholders and competitors alike are tuned to the changing trends and are ready to react to them, calls for greater managerial foresight and hence the need for strategic thinking.

These concerns have led the management scientists to pay greater attention to developing innovative methods and techniques for reduction of uncertainty. Consequently, the decision-makers and the decision processes have started relying more on rationalisation, formalization and sophisticated predictive models. Operationally, this has translated into what we observe and claim to be the growing "planning culture". Even the empirical research, overwhelmingly supports the contention that more and more companies are going in for long-range planning. Brown et al.[1] reports that the study of 165 manufacturing companies cooperating in the National Industrial Conference Board Survey of Business opinion and Experience revealed that 90 percent of the companies carried out long-range planning (as distinguished from annual budgeting). Rue[2] surveyed U.S. industry by questionnaire to deter-

mine which industries actually practiced long-range planning. Out of the approximately 250 responses, about 50% of the firms in each industry (52% in total) reported pro-forma IRP (moderate level of LRP), while a small percentage reported Primary IRP (little LRP). Approximately 25% of the respondents claimed to perform Progressive-Predictive IRP (high-level of IRP), which supports his hypothesis that Long-Range Planning has grown dramatically in the recent years. Seventy-five per cent of the responding companies averaged over $ 75 million in annual sales.

A number of surveys conducted among the British corporations also show similar patterns. Denning and Lehr[3] attest that a small percentage of British companies had introduced long-range planning by summer of 1967. Hewkins and Kempner[4], who also conducted a survey of British industries, report increases in the number of British companies performing long-range planning. Similarly, Taylor and Irving[5] report an increase in the long-range planning activities among the British firms. Strigel[6] (45) made a survey of the industrial firms in West Germany and concluded that, while the majority of the industrial forms in West Germany do not use overall coordinated planning, 69% of the 1600 firms that participated in the survey believed that industrial planning can partially replace intuition and 10% even believed that industrial planning was necessary. Recently, Ang and Chua[7] who surveyed 113 U.S. corporations, report that "from the result of the survey, it is obvious that long-range planning activity has become an integral part of the firm's decision process". Their research also reveals that planning is getting increasing support from top management.

Not only is corporate planning becoming a prominent part of the corporate life, corporations are also making increased use of corporate modelling to assist in the planning function. Gershefski[8] conducted a survey of 1900 corporations in 1969, to determine the extent to which corporate planning models were being used by the companies. Of the 323 respondents, he identified 63 corporations (20%) who claimed to be using or developing a corporate planning model. In September 1974, Naylor and Schanland[9] followed this with a similar survey of corporations in the U.S., Europe and Canada. This survey revealed that 73% of the respondents (numbering 346) were either using or developing a corporate planning model. Another 15% were planning to develop such models. This increase in the corporate modelling activity during the seven year period, between the two surveys, also points to the increased adoption of long-range planning. Recently, Mclean[10] conducted a short mail survey among chief executive officers of 1240 industrial, financial and other organisations to find out the extent of their use of computer based planning models. Responses were received from 410 firms, and he found the most CEO's were in favour of computer-based planning models.

Of course, there are others who claim that planning has not attained such acceptance. According to Ringbakk,[11] based on his sample of 350 companies that he surveyed, planning is practiced only to a limited extent. It might be said that things have changed in the past decade but Martin,[12] based on his consulting experience, argues that the "gap between corporate theory and practice is alarming and growing."

However, from the interest that strategic planning has generated in the academic and among the corporate practitioners, as exemplified in the literature and research results, it is evident that strategic planning has matured.

Whatever status "strategic planning" might have attained in the corporate world, it has to be realized that relying on the concept of rationality in policy formulation can lead to misleading results. Allison[13] claims that there are three alternative conceptual models. He contrasts the rational policy model with other models, and concludes that it is difficult to doubt the descriptive validity of the latter two models in the policy formulation process. All three of his models, are partial paradigms and to make good decisions, it is necessary to take all three models into consideration. Mintzberg, Raisinghan and Theoret[14] also challenge the reality of the view that decision makers at the strategic level approach the decision process in a calm, considered manner and go through the steps that are implied in a rational approach.

Assessing the impacts of planning on the resolution of public policy issues, Lindblom[15] rejects planning on

the contention that it does not validate the two assumptions implicit in most literature on policy making. The first is that public policy problems can best be solved by attempting to understand them; the second is that there exists sufficient agreement to provide adequate criteria for choosing among possible alternative policies. It would suggest that at the policy level the decision makers ability to negotiate and arrive at compromised solutions is more important than planning.

Another limitation of planning that merits thought is Hirshman's[16] argument that the utility of planning is extremely limited by the fact that mobilizing the potentially available resources and decision making activity itself is extremely difficult and, in fact, irrational. Further more, the inadequacy of incentives for problem solving belies the contention that, given the information and means of deciding, people will make choices which are effectively directed toward the specific problem situation.

The reason for raising these issues is to demonstrate that strategic planning has to be viewed from a broader perspective. To respond to the needs of the decisions makers, setting up of corporate planning departments and incorporating planning as a formalized organization function, is not necessarily enough. The need for this awareness is more pressing, in the Indian context, where inspite of the fact or may be due to the fact that we operate in a planned economy, the so called irrationalities are multiplied at the policy level, and this holds true for both the private and the public sector.

*The Issues*: The reason for raising these issues is to demonstrate that strategic planning has to be viewed from a broader perspective. To respond to the needs of the decisions makers, setting up of a corporate planning departments and incorporating planning as a formalized organisation function is not necessarily enough. The need for understanding this is more pressing, in the Indian context, where inspite of the fact or may be due to the fact that we operate in a planned economy, the so called irrationalities are multiplied at the policy level. This holds true both for the private as well as the public sector of Indian economy.

**Implementation of Strategic Planning: The Issues**

For those who view planning not as an end but as a means of improving the managerial decision making, and are interested in strategic planning for the purpose of enhancing the quality of the policy decisions, it is imperative to understand the implications of strategic planning in an organisational context. The question that any organization has to respond to is not whether to plan or not to plan but how to plan. It involves making hard decisions regarding—

(a) The level of financial resources to be invested.

(b) The level of sophistication of planning technology and the consequent investments in information gathering, modelling, etc.

(c) The formalization of the planning process which may necessitate structural rearrangements.

(d) The nature of the planning process to be adopted i.e., centralized-decentralized, bottom-up, top-down, etc. which calls for the involvement of various individuals.

It is at this practical, operational level that the evaluation of the benefits that the organisation may obtain from strategic planning attains importance. For strategic planning to be accepted the planners and the practitioners have to come up with systems that are technically as well as financially sound. The crucial test in operationalizing strategic corporate planning is designing a strategic planning system (SPS) that fits the needs of the organization. This paper, therefore, attempts to highlight the variables that need to be considered in the design of an effective SPS.

*Evaluation of Strategic Planning*: Evaluation and design are inextricably linked. A good design should meet the specifications, and this has naturally led to identification of specifications or the elements of evaluation. Most research on evaluation of strategic planning (long-range planning in many cases), has focused on two aspects:

*Classification of the Planning Systems*: The efforts, in this case, have invariably been directed toward establishing what a good strategic planning system should be. The preponderant consideration, in this scheme of things, was to establish criteria for distinguishing between the formal and informal strategic planners.

*Determining the utility of planning*: This, of course, carried the first exercise to its logical conclusion, i.e., attempts have been made to find out if investing in formalized planning paid. A number of research studies using different research designs have been carried out to determine whether the firms that invested in planning performed better as compared to those that did not plan. But as expected the results have been inconclusive.[17]

One of the implied assumptions that pervaded the planning literature in the past, was that planning, irrespective of the contingencies, was either utilitarian or not-utilitarian. This view, of course, has not survived and the planning literature has been enriched by the experiential and empirical findings. What emerges is that a strategic planning system has to evolve from within and has to be tailored to the needs of the organization.

From a detailed study of the strategic planning processes and the survey of the planning literature it has been possible to identify some of the critical dimensions which need to be taken into consideration in the design of a strategic planning system appropriate for the organisation.[18] These are :

(a) Strategic Fit

(b) Organizational Commitment

(c) Structural Dissonance

*Strategic Fit* : This refers to how the SPS is matched with the characteristics of the firm. The literature identifies four organizational and environmental variables which greatly influence strategy formulation, strategy implementation and strategy evaluation. These are :

(1) behavioral factors;

(2) structural factors;

(3) task/technology variables;

(4) external environmental variables;

A detailed review of the literature reveals that :

1. *The Structural and behavioral* factors do not seem to guide us in determining the optimum level of formalization of SP that is necessary to develop an effective system. In fact, one can provide reasoning in either direction. For example, it is suggested that—

(a) As the complexity of the organization increases formalizing strategic planning will become more difficult and expensive. Hence, managerial (process oriented) rather than positional (structurally oriented) view of the decision making may be preferable for such fiirms.

(b) With increased complexity, the need for integration as well as adaptation will increase. Hence, the need for formalized, strategic planning will increase, particularly, in a decentralized firm.

2. *The Technology/Task* factors are important determinants for the selection of the SPS. It has been found that in industries characterised by high rate of technological innovations and new product innovations, the formal planners performed better than non-planners.

3. *The environmental* factors, it is seen, are most important in the design of the SPS. It is inferred that :

(a) It is not clear how the static characteristics, i.e., (i) the size of the enterprise, (ii) type of industry and (iii) organizational diversity, alter the need for formalization of planning. The indications, however, are that larger the size, greater the need for formalization. But the relationship is not well established.

(b) The dynamic characteristics, i.e., (i) changes in competitive environment, (ii) changes in technology, (iii) industry growth rate and (iv) changes in overall product, market and resource environments; have more direct bearing on the formalization of the SPS.

From the analysis of the organizational and the environmental characteristics, it appears that the need for formalized strategic planning is more acute in the case of firms operating under conditions of environmental variability and complexity. Lindsey and Rue,[19] have developed, a detailed questionnaire to measure complexity and variability of the firm's environment.

*Organisational Commitment* : An important element of the planning process is the extent to which the SPS

has been accepted by the organization. It is possible to develop a comprehensive and sophisticated SPS but if those who make strategic decisions don't use it, it serves no purposes.[20] The major determinants of the organizational Commitment are :[21]

(a) Chief Executive Officer's involvement and actual participation.

(b) planner's; openness to suggestion, technical skills, demonstrated leadership, involvement with line personnel, influence on decision makers.

(c) SPS's compatibility with other organizational systems.

(d) Organization's Structure.

(e) Top management's commitment to SP.

(f) Organization's faith in SP.

(g) Objectives, goals and directions for growth.

(h) Resource allocation decision's rationality.

(i) The firm's preparedness for contingent events.

(j) Among line and staff : transfer and promotion, communication.

*Structural Dissonance.* The Strategic planning system consists of a number of interrelated activities.[22] It is possible that some of the activities may receive greater attention than the others. It would appear that for SPS to be effective, it is not only imperative that the firm invest in SPS but also, that the distribution of resources among the various activities, such as, environmental analysis, issue analysis, etc. be balanced.

**Inferences**

Based on the literature review, this conceptualized characterization and the research study that was conducted, it emerged that :

1. Firms that have initiated balanced strategic planning process have more effective SPS than those that have not.
2. CEO's support of SPS will result in increasing the effectiveness of SPS.
3. Higher investment in strategic planning (greater sophistication) does not necessarily lead to increased effectiveness of SPS in all firms.
4. Formalization of the strategic planning process does not, necessarily, lead to increased effectiveness of SPS in all firms.

These findings lend support to the thesis that a SPS has to be developed in the organizational setting and should fit in with the needs of the organization.

**Conclusion**

The characteristics of our corporate entities are preculiarly Indian, we are constrained not only by law but also by our management as well as socio-political culture which limits our strategic choices. In the case of our Public Enterprises, since the tenure of the Chief Executives is limited the *involvement* and *participation* in strategic planning is hard to expect. Of those who may be *committed*, many are so insecure and the external pressures too strong, with the result that hard decisions are often not made. One Chief executive, for example, mentioned that in his short tenure he received more than three hundred calls from the speaker of the Lok Sabha alone, trying to influence decisions. Some of the strategic options are out of bound for most chief executives in public enterprises; mergers; acquisitions, and, particularly, liquidations are difficult to conceive of. For many even the strategy of contraction and consolidation is difficult to accept, primarily because of its personal and political fall outs.

The private sector in India has its own limitations. In most parts the impetus is on growth and those who dominate it at the policy level are those with an entrepreneurial spirit. Superimposing strategic planning on top management that relies heavily on entrepreneurial mode of decision-making and has not developed a planning culture is disfunctional even if attempted in good faith.

These limits on the arena of options, real or imaginary have debilitating effects on strategic planners, the process of planning, and thereby limit the utility of strategic planning. Also, it appears that adopting formalized strategic planning systems, particularly, the techniques, without understanding either the texture of the planning process or the fabric of the corporate environment, may not yield results. I am reminded of

a corporation in India which years back started their corporate planning by buying the whole set of manuals for strategic planning from SR I. It is, therefore, felt that for strategic planning to become meaningful in India a managerial philosophy which is supportive of the planning culture has to take roots.

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22. A process model of SPS which identifies six process elements of the SPP has developed. See Ztushi, R.K. ibid. Chapter IV.

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# The Underlying Rationale for the Test of Validity of System Dynamics Models

DR. KHALID SAEED

*This paper attempts to explain the rationale for the tests of validity of analysis used in the system dynamics method. The mechanics of these tests are radically different for those of the contemporary methods of problem solving, although they seem to conform closely to the scientific method. The tests of validity of system dynamics models also appear to relate well with the objectives of this method which are to study organisational change so as to be able to design policies which can intervene in the social system (organizations) under study.*

Dr. Khalid Saeed is the Assistant Professor at Asian Institute of Technology, Bangkok, Thailand.

## Introduction

The system dynamics method for the study of a change in social systems has now been in use for almost three decades since it was introduced by Professor Forrester in the 1950s. While the range of the problems addressed by the method has considerably increased, the validity of many of the analyses produced continues to be questioned on many grounds. Interestingly, the analyses that observe certain ritualistic, but often irrelevant, validation procedures pass without being questioned, even though their validity may be seriously in doubt. On the other hand, many insightful analyses, that have conformed to the scientific method but have dispensed with the irrelevant validity procedures, have aroused much criticism.[1]

The criticisms directed at the analyses of systems dynamics do not appear surprising if they are viewed in the light of the substantial differences in methodological thinking between system dynamics and the traditional methods of problem solving. Although the methodological position of system dynamics is poorly documented[2] and many people associate it either with DYNAMO[3] or with doomsday modelling[4] this method incorporates practices and attitudes that differ radically from the traditional methods. Thus, when the correctness of the practices of the traditional methods are accepted a priori, the practices of the system dynamics method will indeed appear incorrect.[5]

This paper attempts to present the rationale for the validation procedures adopted in system dynamics.

These procedures appear to be logical and to conform to the scientific method when examined without an a priori notion of legitimacy. However, it should be added that the purpose of this paper is not to criticize the validation procedures of the contemporary problem solving methods, nor to refuse system dynamics. Its purpose is to state clearly for the practitioners of the method its requirements and to help them identify appropriate testing procedures that satisfy these requirements. The validation procedures for system dynamics are discussed in detail by Forrester and Senge[6], and by Richardson and Pugh.[7]

**Validity and Validation Procedures**

All scientific methods of problem solving involve the use of some kind of a model. The model is an abstraction from the real world that can take the form of a physical or a mathematical analogue of the system it represents or can remain a concept in the mind of a problem solver.[8] Although the mechanics of testing the validity of a model vary depending on the method used, in theory, two requirements of validity are recognized by all: the model should represent the real world as closely as possible, and the behavior of the model should be fully explained in terms of its logic.[9] In practice, however, validity may often be interpreted as nothing more than the observance of a set of ritualized procedures, irrespective of whether these procedures meet the theoretical requirements of validity or not.[10]

Thus, the criterion that there should be correspondence between the model and the real world may result either in the comparison of a mathematical model with metaphorical theories held sacred in a discipline[11] or in the testing of the significance of correlations between time series of data.[12] Likewise, the criteria for solving a a model may demand that the solution be expressed in a symbolic framework irrespective of whether it conveys to the parties concerned the understanding of the model or not.[13] Such ritualized, and, irrrelevant procedures of validity have become very much a part of most widely-practiced methodologies currently used for analysing social systems. Although a detailed examination of these procedures is outside the scope of this paper, a few example of the anomalous applications of these methodologies are given here to elucidate the point being made.

Mathematical models of social behavior proliferate, particularly in the field of economics, but most of these models are based on the normative theories of social behavior, rather than on the actual behavior of the social system being analysed. For example, a mathematical model in neo-classical economics may accurately translate the postulates of the descriptive theories of neo-classical economics, although, these theories may correspond very little to reality. A model using mathematical programming may be used to obtain an optimal solution of a resources allocation or a scheduling problem, but this solution really depends on how the objective function is formulated and how the utilities and costs of meeting the objective are measured. Yet, such models are freely applied in areas of public policy in which the complex objectives of the parties involved can rarely be translated into a function which is amenable to the computational capabilities of the method. Even if it is possible to formulate an appropriate objective function, the measurements of the pertinent utilities and costs are often practically impossible and, therefore, the measurements used may be highly questionable. A statistical model may be applied to a problem of change in a social organization, although, statistical methods disregard the organizational arrangements underlying the changing phenomenon being studied, and postulate relationships between variables purely on the basis of the correlations between the components of the phenomenon. Since organizational arrangements are capable of generating a variety of phenomena, a statistical postulate, although emanating a high level of confidence about its validity, is based on a phenomenon appearing over a specific time period and in special circumstances. Such a postulate may bear no resemblance to the relatively durable organizational relationships underlying the phenomenon on which it is based.[14] However, statistical correlates are freely substituted for organizational arrangements in the context of change.[15]

Apparently, the validity of an analysis is judged not on the basis of its expository value or its conformance to the requirements of the scientific method, but on the basis of the validity procedures legitimized in a methodology, irrespective of whether these procedures are

relevant to the analysis or not. Consequently, many views of a problem can be legitimized, thus creating controversies which may not have a common basis.[16]

Forrester, while discussing the issue of validity of models of social behavior, divides the various views of validity into two categories: the observer's view and the operator's view. The observer's view, as presented by Forrester, appears to subsume the analyses that create theoretical debate rather than provide useful information for policy intervention. Such analyses apparently derive validity from observing legitimized procedures. The operator's view is presented as a pragmatic one for providing pertinent information for a decision. Forrester advocates the operator's view for evaluating the validity of analyses that may have policy implications and proposes that this view be adopted by the users of the system dynamics method for building confidence in their models.[17]

To some, Forrester's categorization of the views on validity might seem a bit jaundiced, but it clearly brings out the difference between the system dynamics method and the traditional methods of analysis used in social sciences. The theoretically-based study of social systems has become encumbered with ritualized procedures which have served to legitimize controversial, and, metaphorical models. Although these metaphorical models have generated much debate, they have contributed little to the design of effective policies.[18]

The pragmatic view of validity advocated in system dynamics seems to have evolved as a reaction against the prevailing methodological practices. Thus, an undiscerning comparison of the procedures of system dynamics with those of the traditional methods only confuses the issue. Such confusion often appears in many critiques of the method, some of which criticize the pragmatic outlook adopted by it, which, ironically, is the very basis for its existence. In a not very complimentary critique of the method, Schwartz and Foin point out.[19]

> "Forrester's major contention is that we had better get on with the job of training model-builders in the art of "social dynamics," the forthcoming intellectual revolution of the final third of the twentieth century. Such a program will insure that there are enough individuals to make use of the best computer techniques for eliminating the ills of mankind. Otherwise we shall be faced with the spectre of bumbling decision-makers (and their academic advisors) muddling through with their totally inadequate models of reality."

This view of system dynamics is unfortunate, although one might get such an impression from the somewhat euphoric epilogue of Forrester's World Dynamics.[20] In fact, in the preceding chapter of the same book, Forrester takes a far more modest view of his analysis :

> "As a next step we can hope the dynamics of growth and equilibrium will be investigated by more people and the propositions presented here will be confirmed or altered until a consensus begins to form..."

A theory of social behavior emerges after repeated rethinking and reformulation, but this theory, again, should never be accepted as an absolute truth. An accepted theory might be rendered invalid if new aspects of behavior are discovered which the theory fails to explain.[21] However, a new theory advanced to replace the old one must go through repeated rethinking and reformulation. Indeed, the Schwartz and Foin critique makes this point well:

> "...For social systems models to be of value, much more hard work at describing their complexity will be needed. What is needed at least as much is an attitude of humility on the part of the model builders, which enable them to appreciate and admit their shortcomings and the uncertainty of their task. Perhaps then models could be used to inform people of possibilities, probabilities, and choices, not to promote technocratic solutions based on a sense of certainty that is entirely unjustified."

The Schwartz and Foin critique suffers from one grave inadequacy: It is almost entirely based on a limited number of early works of system dynamics, which may not be free from the euphoria of a new discovery. The System Dynamics method introduced the idea of experimentation into the designing of social policy. The introduction of similar ideas into the physical sciences forced the supporters of the previously held belief about the physical behaviour to produce experimental proof. This shattered many old theories,

and brought about a revolution in these sciences. That such experimentation became possible in the social sciences was indeed a methodological breakthrough, which may have been expected to be accompanied by the euphoria reflected in the early writings of system dynamics.

The early euphoria that related to the use of the system dynamics method was, nevertheless, a temporary phenomenon. The later applications of the method have strongly emphasised that the bounds of the analysis be clearly stated and that the analysis conform to the scientific method. The scientific method requires that the deviation between the conceptual abstractions and the real world be minimized through repeated comparisons of the empirical data with the deductions drawn from the abstracted models based on those data.[22] This is quite in line with what the contemporary methods of social science also advocate. In practice, however, these methods largely require that the formal procedures designated for validation be followed, irrespective of whether these procedures lead to scientifically valid and practically useful results or not. On the contrary, system dynamics dispenses with many formal procedures, although it places a great emphasis on the scientific validity and practical utility of its results.

Thus, validity in system dynamics is far from being a dichotomous matter depending on the performance of a set of rituals. Instead, it is interpreted as the level of confidence which can be placed in an analysis by a decision maker whose concern is to carry out policy intervention in social system. This confidence is acquired through painstaking, though non-formalized, tests which are integrated with the purpose of the analysis. This purpose is usually to identify pertinent pressure points for policy intervention.[23] However, the model is used not for merely obtaining procedures of policy directly from it but for clarifying the mental model, which leads to a deeper understanding of the problem. In a lecture on public policy implications of system dynamics Forrester points out[24]:

> "Computer models should be judged by the way they relate to, support, and clarify mental models. By the criteria of compatibility with traditional political processes, most computer models of today fall short of that goal. Too many computer models are presented without an adequate tie to the relevant mental models. Too often, the computer models are manipulated to get results that will support the prior opinions of those who employ the models to justify their own opinions."

The non-formalized testing in system dynamics, however, is not random. It strives to meet very specific requirements of validity which combine attempts to discern the organization of the system being analysed and to understand its behavior as well as possible. The considerations underlying the testing conducted in the following section.

**Considerations Underlying Tests of Validity**

The system dynamics method aims at studying change in the social organizations. At the outset, the method requires that the phenomenon of change be distinguished from the organizational arrangements from which that phenomenon arises. The method also involves the formulation of often complex formal models of social organizations. The behavior of these models is studied by using computer simulation. In fact the low cost of computer simulation has been a key factor in making the method feasible and a relatively simple computer code, DYNAMO, has made the programming for simulation accessible to a wide range of users. Because of its close involvement with computer simulation, the method is often confused with a mere use of DYNAMO,[25] although such applications of it are closer to conventional methods than to system dynamics.[26] In order to use this method to deal effectively with the problem of organizational change, the following requirements must be met:—

**Distinction between structure and behavior:**

The first and the foremost requirement in formulating a system dynamics model is description of the phenomenon of change under study. This is followed by the organizational arrangements underlying that phenomenon. These organizational arrangements represent the structure of the system under study. The structural relations, however, cannot be based on correlational factors as these factors, by definition, correspond to phenomenon itself, not to the organizational arrange-

ments which cause it. This is a very important distinction which is widely neglected in the study of social systems. Some examples from economics are the postulated relationships between labor productivity and wage rate, between saving and investment rates, between income and consumption.

There is no formal procedure for describing the phenomenon under study. Information which can be quantitatively or qualitatively observed over time constitutes system behaviour. A succint description of the whole fabric of behavior is necessary for establishing a basis for further analyses. This description also serves as a reference for comparing the behaviour of its model which is subsequently developed.[27]

The formulation of a model of the organizational arrangements is, at the outset, guided by the cybernetic principles of section and structuring of information.[28] These arrangements must be based on a deep understanding of the microstructure of the organization under study. The suggested sources for obtaining this understanding include participant observation, expert opinion, and literature. Numerical data are often not useful for delineating the organizational arrangements.[29] For example, the organizational mechanism for wage determination is bargaining;[30] investment depends on the backlog of demand, on money balances held by the investors, and on the availability of capital goods; consumption is determined by the money balances of the households and by the inventory of consumption goods[31] none of which may be reflected in the time series of data on investment, consumption and income.

A greater confidence can be placed in a model if its organizational structure is verifiable while its behaviour is consistent with what is empirically observed. However, there is no simple way to achieve this. Efforts to achieve consistency between behavior, structure, and empirical observation usually form a substantial part of a modelling effort using the system dynamics method. Figure-1 illustrates the sequence of the tasks performed in a typical system dynamics analysis. A model is formulated on the basis of observations about how various elements in the system interest. The structure of the formulated model, however must be reconciled with the alternative theories on the subject. Identification of the points of agreement and disagreement with the alternative theories help to reveal ambiguities in the model and to allow initial formulations to be revised and refined.

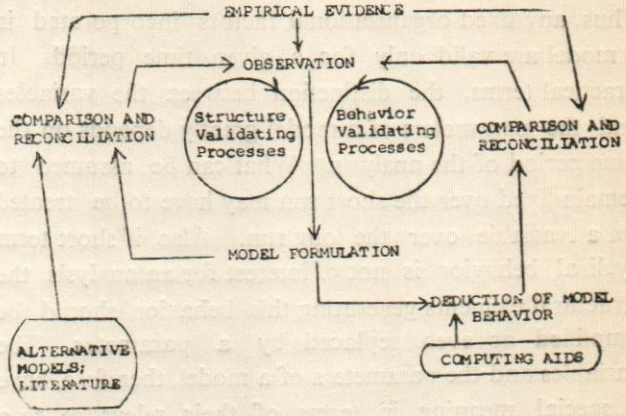


**Fig.-1 : Sequence of Tasks in the System Dynamics Method**

Once a satisfactory correspondence between the empirical evidence, the alternative theories and the model has been achieved, the model is subjected to behavior tests. Computer simulations are used for deducing the behavior of the model from its structural components. The behavior of the model is compared, and reconciled, with the empirical evidence of the system behavior. If a discrepancy is observed between the model's behavior and the observed behavior of the system, the model structure is re-examined and modified if found lacking in suitable detail.

Only when a close correspondence is simultaneously achieved between structure of the model and the theoretical and experiential knowledge of the system, and also between the behavior of the model and the empirical evidence about the behavior of the system, can a model be accepted as a valid representation of the system.[32] This requirement of validity considerably limits a modeller's freedom to modify the model structure at will. The modifications made in the structure, in order to obtain behavior similar to that of the system, must not violate known facts about the organizational arrangements. For example, if the behavior of falling objects is being modelled, the organizational arrangements of the model must not violate the laws of motion. This procedure discourages application of unnatural "fixes" to a misbehaving model.

*Time Period of Interest* : The organizational arrangements forming the structure of a system cannot be

considered as lasting for an infinite period of time. The experience of a certain behavior may create incentive to modify the structure that underlies this behavior.[33] Thus, any fixed organizational factors incorporated in a model are valid only for a given time period. In practical terms, the distinction between the variables and the parameters of a model greatly depends on the time period of the analysis. What can be assumed to remain fixed over the short run may have to be treated as a variable over the long run. Also, if short-term cyclical behavior is not of interest for an analysis, the structural elements generating this behavior should be simplified or even replaced by a parameter. The variables and the parameters of a model, therefore, have a special meaning in terms of their relevance to a specific time period. According to Forrester[34] :

> "No sharp distinction is possible between the structure and parameters. In many ways they are one and the same thing. Generally speaking, parameters stand for variables whose variation is thought to be unimportant (over the time period of interest)..."

Both parameters and variables have an explicit meaning corresponding to the organizational arrangements in the real system to which they apply. Thus, parameters pertinent for an analysis can be constructed from direct measurement of the characteristics of the real system which remain unchanged over the time horizon of the analysis.[35] The tests for selecting the variables for a model require the model to be constructed in steps. Each step entails incorporating into the model an additional variable and studying its behavior. This process continues until a behavioral correspondence between the system under study and its model over the period of interest is obtained and including additional variables does not change the basic reference mode generated. This may, however, identify additional aspects of the system behavior which are outside the scope of the analysis.[36]

The concern of the system dynamics method for developing a model pertinent to the time period of analysis is a refreshing departure from the prevailing practices in social systems, particularly in the area of economics where long run equilibrium models are often used to tackle short term problems, and vice versa[37].

**Solution or Understanding of Model Behavior :**

Even though it might be possible to obtain the time paths showing the behavior of a model, the model is of little value unless this behavior is adequately understood. One way of acquiring understanding of the behavior of an organizational model is to obtain its general solution using formal mathematics. But this method also requires that the solution be obtained through a set of logical deductions carried out in a formal symbolic framework. Unfortunately, formal mathematical procedures can be applied only to relatively simple organizatinal models. Because real world organizations are complex, the models that are formulated and solved using formal mathematics are often normative and quite removed from the systems they represent.[38]

The solution technique adopted by system dynamics represents a bold departure from the formal procedures of mathematics. Due to the emphasis on relating the model to the real world, a certain level of complexity has to be incorporated into the model. At the outset, this rules out the use of a formal mathematical framework for attempting its solution. However, a solution implies an understanding of the behavior of the model which can also be acquired intuitively if the solution does not have to be expressed in terms of formal symbols. This can be illustrated with the help of a simple model.

Consider a first order goal-seeking inventory system as shown in Figure 2. Inventory I is adjusted towards desired inventory DI and the production rate P is a function of the discrepancy between DI and I, and the inventory adjustment time IAT. Shipment rate S is a function of I and the inventory coverage T.

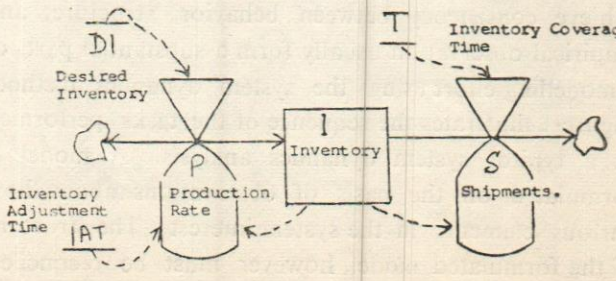


**Fig.-2 : Example of a Simple first Order System with 2 Negative Feedbacks.**

The solution of this model must incorporate the following information.

1. The equilibrium level of I
2. The transient behavior of I
3. How changes in the parameters DI, IAT, and T, and initial value of I affect the equilibrium value and the transient behavior,

This is a relatively simple system. Hence its solution can be obtained by inspection. First of all, since the equilibrium will occur when P-S, for this equilibrium,

$$(DI-I)/IAT = I/T$$
$$\text{or, } I\,(1/T+1/IAT) = DI/IAT$$
$$\text{or, } I = (DI*T)/(IAT+T)$$

which is independent of the initial value of I. The next issue is how this goal will be reached. Will there be an overshoot or an oscillation during the transient period? It can be easily established intuitively for this system that when P approaches S and becomes equal to it, further changes in the level of inventory cease. Thus, one may not expect an overshoot or oscillatory behavior. Since the net change in I, which is given by (DI/IAT−I*(IAT+T)/(IAT*T), progressively its equilibrium value, the transient behavior will be as shown in Figure-3 for the various initial values of I. Finally, the greater the value of DI, the higher the equilibrium value of I, the higher the value of T, the smaller the inventory depletion, which means that there will be a greater accumulation in the level when equilibrium is reached. Similarly, the longer the inventory adjustment time IAT, the smaller the rate of production P, which for a given value of T, will decrease the rate of net accumulation in the level over the transient period and thus limit the equilibrium value of I. Furthermore, the equilibrium value of I will always be less than DI as there must be a positive inventory discrepancy when the production and shipment rates become equal. Only when shipments are reduced to zero, i.e., T is made infinitely high, will the equilibrium value of I approach DI.

This model may be analytically solved as follows:

$$d(I)/dt = (DI-I)/IAT-I/T$$
$$+DI/IAT-1\,(1/IAT+1/T)$$
$$\text{or, } d(I)/(DI/IAT,-I\,(1/IAT+1/T)=dt$$
$$\text{or,}-(1/IAT+1/T)/(DI/IAT-I\,(1/IAT+1/T))\,d(I) = -(1/IAT+1/T)\,dt$$

Integrating this expression,

$$\text{Ln}\,(DI/IAT-(I\,(1/IAT+1/T)= -(1/IAT+1/T)\,t+A$$
$$-(1/IAT=1/T)\,t$$
$$\text{or, } DI/IAT—I\,(1/IAT=1/T) = B*e$$

Let I=I. at t=0

Therefore, $B+DI/IAT—(1/IAT+1/T)\,I.$

and,

$$It=(DI+T)/(IAT+T)-(DI+T)/$$
$$(IAT)\text{-}I,.T_e^{-(1/IAT+i/T)t.}$$

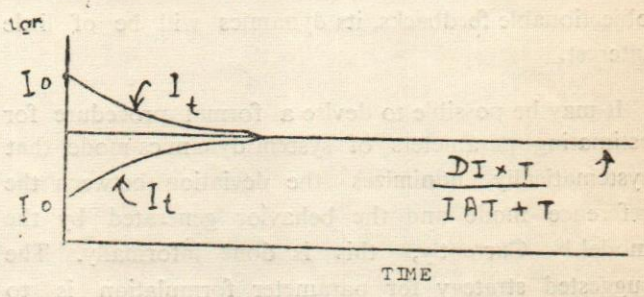


**Fig. : 3 : Time Paths and Equilibrium Value of Inventory I**

Both intuitive and formal solutions of the model described above contain the same amount of information, although the two solutions are obtained differently and are expressed in different forms.

When dealing with complex models, the system dynamist designs a set of simulation experiments for understanding the model's behavior. The objective of these experiments is to obtain as much information about the behavior of the model as might be contained in a formal solution. Without such experiments, simulations giving time paths of the model behavior are of not much value, even if the parameters of the model have been estimated with great rigor.

**Parameter Estimation :**

There appears to be a conspicuous difference between the contemporary methods of problem solving and system dynamics in their attitudes towards the selection of the numerical values of the parameters of their models. While most other methods favor rigorous statistical procedures for determining the parameters, system dynamics is often criticized for using subjective parameters.

A system dynamist spends a great deal of time and effort in assuring that the parameters he uses are either directly measurable or insensitive. Statistical procedures are not recommended for estimating parameters of the models of system dynamics.[39] These models have a feedback structure which incorporates strong interdependencies among variables, and violates the major assumption of independence between variables, which is necessary for applying the statistical methods. When these methods are used for estimating parameters of feedback models, little confidence can be placed in the estimates even when they appear to be significant. On the other hand, if the model does not contain the objectionable feedbacks, its dynamics will be of little interest.

It may be possible to devise a formal procedure for estimating parameters of system dynamics model that systematically minimizes the deviation between the reference mode and the behavior generated by the model.[40] Currently, this is done informally. The suggested strategy for parameter formulation is to estimate as many parameters as possible from real world measurements, then to obtain final values for those parameters which are difficult to measure by comparing model behavior with the reference mode and fine tuning these parameters to minimize the deviation between the two.[41]

Feedback models also have the fortunate property of being parameter insensitive because of the tendency of the negative feedbacks present in them to act against change. Parameter insensitivity is also a property of the real world systems in which the arrangement of the organizational elements rather than the parameteric differences between the behavioral relationships distinguish one system from another.[42] Thus, the parameter insensitivity of a model in itself is a source of confidence in it. In a good model, there will be very few sensitive parameters. The sensitive parameters will also often have policy implications. If not, much empirical research will be required to determine the values of these parameters.[43]

**Communication :**

The system dynamics method does not seek debate among the theoreticians from its analyses but aims at affecting the design of policy. This requires that a clear and logical picture of the implications of the analysis be communicated to the policy makers.[44] Thus, according to this method, it is desirable that the logic of the model and the understanding of its behavior be clearly and simply described in order to clarify and refine the mental models of the policy makers. The confidence of the policy makers in the analysis will depend greatly on how effectively that analysis is communicated. To facilitate communication, the method discourages the use of specialized symbols and jargon which are not universally understood.

**Conclusion**

The tests of validity advocated by the system dynamics method seem radically different from those used in the contemporary methods of problem solving. However, these tests strive to satisfy the requirements of the scientific method rather than to engage in mere rituals. The system dynamics method is meant for studying change. The procedures adopted by the method for developing a formal model of a system and building confidence in it seem to be very relevant to the subject of change in organizations. Furthermore, because this method has the practical aim of affecting the design of policy, communication is considered an important aspect of it.

The system dynamics method cannot adopt the mechanics of validation of the contemporary methods as these are not relevant to its framework of analysis and its purpose. The contemporary methods of social sciences seem to have adopted a view of validity which precludes questioning the legitimized but metaphorical theories of social behavior, as well as the ritualistic and sometimes irrelevant validation procedures. The system dynamics method provides a framework for experimentation with the models of social systems in order to develop theories of their behavior and, therefore, its analyses may question many theories which are generally accepted. But, such experimentation is in line with the requirements of the scientific method. Thus, the rationale for the validation procedures of the system dynamics method, which differ from those of the contemporary methods, lies in the radically new methodological outlook adopted in system dynamics.

The validation procedures of system dynamics appear quite appropriate if seen in the light of this methodological outlook.

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# Evaluating Strategic Planning System

WILLIAM R. KING

*A direct methodology for the evaluation of strategic planning systems is illustrated and contrasted with the indirect evaluation methodologies that have previously been used. The direct methodology involves twelve distinct varieties of assessment of the goals, inputs, feedback mechanisms and impacts of the planning system that are made in terms of the system's goals as well as various bodies of external standards.*

Mr. William R. King is a professor of Business Administration, Graduate School of Business, University of pittsburgh.

## Introduction

The strategic planning function in any business firm is one of its least evaluated and probably least accountable, activities. Planners are generally held responsible for their plans and their consequences only to a modest degree, if at all, and the planning function is not evaluated as routinely as are most other organizational functions.

Some of the reasons for this are clear and understandable. The staff planner is most often not the implementer of the plan, so one can argue that he should not be held accountable for its consequences. On the other hand, the planning function should be responsible for designing an implementation plan for the strategic plan and for business plans (King & Cleland, 1978). Therefore, the function's acccuntability must extend beyond the mere promulgation of a planning document.

This paper describes a direct operational approach to the evaluation of planning that provides the basis for the achievement of planning accountability and for the improved management of planning. The various elements of the approach have been developed and applied in real world contexts, although the entire framework has not been applied in any single firm. Although it was not primarily designed to do so, the approach has also proved to be a valuable tool for the diagnosis of problems in the organisation and in the way in which it conducts its planning, as well as a tool for motivating better strategic thinking.

### Planning Accountability and Management

General James M. Gavin (1978) provides an interesting insight into planning accountability in his book recounting his World War II experiences by saying that "Nothing chastens a planner more than the knowledge that he will have to carry out the plan."

In business firms that operate sophisticated planning systems, it is common to hear line managers refer to the "lack of realism" in plans, recommendations, and analyses coming from the planning department. According to Gavin, realism would be promoted if planners were made to carry out the plan. Barring that, planners—both line managers and staff planners—should be held accountable for it.

While such formal assessment of planning accountability may not be widely practiced, the need for it is implicit in modern planning thought. The notion that line managers, and not staff planners, must ultimately "do" the planning is widely accepted—partly because they can bring realism to it and, in part because they can more readily be held indirectly accountable for the plan through the performance exhibited by their unit. So too does the notion of "Planning implementation," (King, 1980; King & Cleland, 1978; Lorange, 1977) recognize the need for planners to be more involved in the implementation phase of the planning cycle—thus placing them closer to the consequences and to potential accountability. However, just as some firms have failed to apply "hard-nosed management" to their computer information systems function and perhaps to some other staff functions (King, 1982), so too have many failed to stringently apply such "gut-level" management to the planning function.

The consequences of this lack of strict management and accountability of planning is probably detrimental to the firm, to the planning function and to the profession of planning. Lack of accountability may be perceived as leading to greater costs, lesser effort and poorer planning performance than could otherwise be obtained. If this view is held, the planning department may come to be viewed as "organizational slack" whose resources can readily be cut back during times of austerity (Cyert & March, 1963). The overall view of the planning profession that may arise from this is also quite negative. The natural view of non-planners is that those who are not accountable and who are the first to be cut back must not be of real importance. If this is true of the staff people that are responsible for planning, its extension to the planning function itself is not too great a step.

Thus, despite the many valid reasons for failing to hold planners totally responsible for plans and their consequences, greater planning function accountability is undoubtedly desirable. Perhaps the most significant reason for the absence of greater accountability in planning is that there is no comprehensive and agreed-on basis for evaluating planning. Some other organization functions and entities have clear measures of performance—e.g., the cost of profit generated by the unit. Others have less clear, but nonetheless formal and accepted, performance standards which facilitate accountability—e.g., sales quotas, efficiency and productivity measures, etc. However, there are not such measures that may readily be applied to the plan, the planning function or the planning system. Thus, there is no standard that can provide a ready basis for planning evaluation and for the greater accountability and better management of planning that such evaluation permits.

### "Indirect" Versus "Direct" Evaluation of Planning

This paper develops a framework for the direct evaluation of planning. Most previous work in the evaluation of planning has been of an "indirect" variety that is not well suited to providing information that might enhance a firm's ability to better manage its planning activities. Nonetheless, the indirect approach to the evaluation of planning offers both an interesting perspective and the basis for the development of a more useful approach.

### The Indirect Approach to Planning Evaluation

The indirect approach to evaluating planning emanates from the claims of planning enthusiasts that planning will lead to improved business performance. As shown in Figure 1, planning "evaluators" using this approach have taken this assertion and set out to

assess its validity by attempting to measure the relationship between a firm's strategic planning system (SPS) and its business performance. (The format of Figure 1 does not make it clear why this approach is termed the "indirect" one. This will subsequently be clarified.)

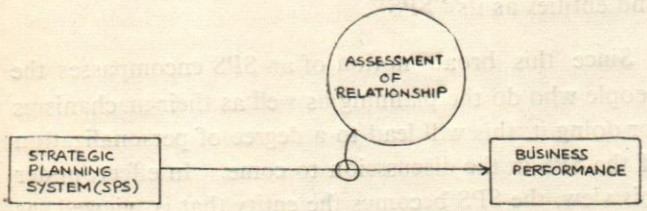


**Fig. 1 : Process Description of the Indirect Evalution of Planning**

Studies that have used this indirect approach evaluate the influence of planning by comparing various firms—each operating different levels or varieties of SPS—on the basis of their performance as measured by profitability, growth, etc. Proponents of this approach argue that these are the ultimate objectives to which planning is addressed (e.g., increased business profitability or growth), that these are the claims that are implicitly made for planning by planning enthusiasts and therefore that these are the standards by which planning should be gauged.

For instance, Thune & House (1970) used the indirect approach when they compared formal and informal planning firms in six industries and found that "formal planners" outperformed, informal planning firms in terms of ROI, ROE, and EPS while equalling them in sales growth. Herold (1972) used pre-tax profit as a performance standard and assessed some of the same firms over four additional years with similar results.

Ansoff et. al., (1970) studied firms using twenty-one measures of business performance. They distinguished between "planners" and "non - planners" using questionnaire responses as to the existence of eight characteristics of formal planning. Again, planners significantly outperformed non-planners. Malik and Karger (1975) used the same measures of business performance, but classified firms as "planners" on the basis of the existence of a written plan.

Rue (1973), Grinyer and Norburn (1974), Sheehan (1975) and Kudla (1980) have used a similar indirect approach and their results bring into question whether planning does indeed lead to better business performance.

Wood and LaForge (1979) studied 41 large banks and found no consistent relationship between business (financial) performance and the degree of comprehensiveness of the planning system that they used. They concluded that " . . . it is time . . . to abandon the smorgasbord use of financial measures . . . and try to match up the appropriate performance criteria with the primary objective of the organization being studied."

The indirect approach does not provide results that are operationally useful to management, even if the results were consistent. In effect, the indirect approach treats the products of planning—the plan, the strategy which it entails, etc.—as a "black box" that should be assessed solely in terms of the ultimate performance of the business. *Without* making direct assessment of the nature or quality of the plans and other elements of strategic choice, (except insofar as is necessary to ascertain the existence or level of planning in a firm), the indirect approach seeks to assess whether the existence of planning (or its level of sophistication) can be associated with business performance.

The logical basis on which the indirect approach is based has merit. However, the indirect approach has clear limitations and deficiencies:

(1) Because of the simple bases used to describe and measure the existence of level of planning, it provides little useful guidance concerning the improved management of planning.

(2) It does not consider either the quality or quantity of the direct outputs of planning. Rather, it views these merely as intervening elements in the process of producing business performance.

(3) It does not take cognizance of the many other intervening elements which also contribute to business performance.

(4) It is not possible to use the indirect approach to demonstrate a causal relationship between planning and business performance; rather it can merely

indicate the existence of, or degree of, association between the two elements.

(5) It does not consider "process values," such as the development of an improved understanding of the business, which frequently are claimed as important benefits of planning (King & Cleland, 1978).

(6) It does not consider the business performance levels that might have been achieved if other planning situations existed in the firm.

(7) It does not permit the use of any external standards; rather, only relative comparisons of various levels of planning and business performance are possible.

**The Direct Approach to Planning Evaluation**

In contrast to the indirect approach, the direct approach to planning evaluation that is presented here seeks to assess the SPS on a detailed and comprehensive basis. In effect, it seeks to redress, insofar as is possible, the limitations and deficiencies of the indirect approach.

The basic premise of the direct approach is that planning cannot adequately be evaluated if it is done on a "black box" basis. A wide variety of benefits are claimed for planning by virtually all of its proponents (e.g., Steiner, 1969). To fairly assess planning, the evaluator must assess the degree to which these diverse benefits are, in fact, achieved.

Moreover, each firm's SPS has specific goals that it is designed to seek. Illustrative of such goals are "ensuring that all relevant alternative strategies are given due consideration" and "improving the level of rigor with which strategies are assessed." Such goals may not be directly reflected either in business performance or in any generic evaluation scheme that is applied uniformly across many firms.

Figure 2 shows an expanded version of the process model of Figure 1 in which additional elements have been incorporated. The most important of these elements are represented by the block labeled "External Standards" "Resource Inputs," "Goals of the SPS," and "Outputs of the SPS"*.

*The Strategic Planning System (SPS)*—The "SPS" is the complete set of processes and entities through which a firm does planning. King and Cleland (1978) have defined an SPS in terms of subsystems such as a planning process, an information subsystem, a decision subsystem, and an organiational subsystem. At whatever level of sophistication and complexity a firm's planning operates, we shall here refer to these process and entities as its "SPS".

Since this broad notion of an SPS encompasses the people who do the planning as well as their machanisms for doing it, this will lead to a degree of personalization of the SPS in the discusssion to come. In effect, under this view, the SPS becomes the entity that is viewed as performing the planning.

*Inputs to the SPS*—The leftmost block in Figure-2 characterizes two varieties of inputs to the SPS—resource inputs and goals. The "Resource Inputs" are the people, funds, computer time, etc. that are consumed in the planning function. As well, it includes the time and emotional energy of the people that perform planning. The "Goals of the SPS" represent the specific purposes for which it was developed (and against which its efficacy should therefore, in part, be assessed).

*Outputs of the SPS*—An SPS produces documents—"plans"—as its primary visible output. However, the *content* of those plans represent the substantive outputs. King (1980) describes the firm's *strategic choice elements* to be its mission, objectives, strategies, goals, resource allocations and strategic programs. Each of these represent strategic choices that are outputs of the SPS. Similarly, many of those strategic choice elements that have been considered in the planning process, but which may not be a part of the plan—such as strategies that were proposed and considered, but not accepted—may also be considered to be an element of the SPS's output.

*Business Performance*—The rightmost element in Figure-2 represents the collection of indices that are used to assess business performance: profit, ROI, ROA, market share, etc. While most indirect evaluation studies have used a prescribed set of such measures that are applied to all firms such an approach is probably inadequate in that it does not reflect industry norms or the unique goals of the firm.

*The circled letter in Figure 2 will be explained subsequently.

*External Standards*—The "External Standards" block at the top of Figure 2 reflects the body of standards that may be appropriately applied to each of the other process elements. Any approach to measurement requires standards, and one of the difficulties that is inherent in the indirect approach to planning evaluation is the lack of such stanards.

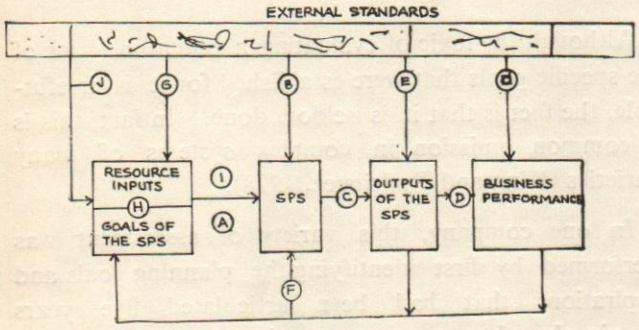


**Fig. 2 : Expanded Model of SPS Evaluation Process: Direct Evaluation**

## A Methodology for the Direct Evaluation of Planning

A comprehensive methodogy for the direct assessment of planning may be described in terms of the system elements in Figure 2. The methodology involves the execution of a number of assessments at various points in the process that is described there. These assessments are made in a fashion that is derived from a number of fundamental precepts.

## Underlying Precepts of the Direct Assessment Methodology

Among the fundamental precepts on which the direct methodology is based are those that ameliorate some of the deficiencies in the indirect approach. In addition, several other fundamental premises have been used to guide the development of the methodology.

*Multi-Dimensional Assessment*—The notion of assessing something in terms of a number of criteria and then reducing the multiple assessments to a single overall "utility" measure has great appeal, unfortunately, there are significant problems involved in doing so (Zutshi, 1981). Thus, the approach taken here is one in which multiple assessments are made, but there is no attempt made to synthesize the various measures into a single one. The overall evaluation must be made in terms of an array, or profile, of dimensions. This means that judgement is still required to make the overall assessments of the SPS. However, that judgement is not merely impressionistic. Rather, it is guided by a series of prescribed measurement points and prescribed assessments, which, while the details may vary from firm to firm, are generic in future.

*Use of Both Internal and External Standards*—Despite the fact that any complex system should be evaluated in terms of the specific goals for which it was designed there are also bodies of external standards that can form a part of any comprehensive system assessment Such standards may complement the internal standards that are used in making an assessment of a system relative to its unique objectives.

*Analysis of Multiple System Stakeholders*—Since anything that is as comprehensive and complex as an SPS must serve a variety of interest groups within (and possibly, outside) the organization; it must be assessed in terms of the interests of a variety of "stakeholder" groups. Clearly, a system may be serving the parochial interests of one group, such as staff planners, while not serving others. If this is so, this must be "captured" in the assessment process.

"Stakeholder analysis" has been primarily applied at the business and corporate levels (Emshoff and Freeman 1931). However, it has also been applied to information systems (King, 1978). It involves the identification of stakeholder groups and the development of criteria and measures that can be applied to the interests, "claims," and objectives of each group. In one evaluation of a SPS, the SPS stakeholders were identified as:

(a) corporate top management
(b) corporate planning staff
(c) other corporate staff groups
(d) business unit top mangement
(e) business unit planning staff
(f) other business unit staff
(g) other business unit line management

Each of these stakeholder goups was perceived to have a specific interest in the SPS that was reasonably

homogeneous within the group but different from group to group. As such, the SPS had to be evaluated in terms of the degree to which it met the needs of each group.

*Use of Judgmental and Objective Assessments*—A wide variety of assessments are required to collectively form the comprehensive SPS assessment that is ultimately desired. These assessments will invariably involve both the collection of objective data and the making of subjective.

The operating precept is that both can be made and used so long as the judgment are obtained in a structured fashion (e.g., using structured interviews or a predetermined questionnaire) that facilitates aggregation and comparison.

King and Rodriguez (1978) have described a variety of such assessments in the MIS context. Dutta and King (1830) applied them to a strategic decision support system. Here, the general approach is extended to the assessments made of SPS.

**Elements of the Assessment Framework**

The various elements of the direct assessment framework are represented with circled letter designations in Figure 2. The various assessment are of the:

A. Effectiveness of Planning
B. Relative Worth of the SPS
C. Role and Impact of the SPS
D. Performance of Plans
E. Relative Worth of Strategy
F. Adaptive Value of the SPS
G. Relative Efficiency
H. Adequacy of Resources
I. Allocation of Planning Resources
J. Appropriateness of Planning Goals

Each of these elements of the direct assessment framework are discussed and illustrated below. After each has been discussed, the making of overall assessments of the planning system will be treated.

**Effectiveness of Planning (A)**

The evaluative dimension that is termed "planning effectiveness" represents a set of measurements that can be made to address the issue of how well the SPS has met *its* goals. Every firm begins to do strategic planning, changes to a new SPS, or to a new approach to planning with some *planning goals* in mind. Often, these are communicated in the form of a proposal for a new system or for the hiring of a consultant.

Although the logic of evaluating a system in terms of the specific goals that were established for it is irrefutable, the fact is that it is seldom done. In fact, this is a common omission in complex systems of many varieties (King and Rodriguez, 1978).

In one company, this variety of assessment was performed by first identifying the planning goals and aspirations that had been articulated five years previously when a more extensive planning effort had been undertaken. This was accomplished by retrieving and analyzing a number of memos that had been sent by and to top management as well as a task force report that had been prepred and on which the decision to undertake a higher level of planning had been based.

These tentatively-stated goals for the SPS were then reviewed with several individuals who had a long history of association with the planning system. In several cases, the statements were modified to account for changes that had occurred since the original goals had been stated. In one case, a change was confirmed directly by a document. In several other instances, the changes were confirmed through independent discussions with several relevant people.

Members of each of the stakeholder groups were identified and asked to complete a survey instrument in which they evaluated the SPS in terms of the degree to which they preceived it to have attained the goals that had been prescribed for it.

This was initially done using scales in which individual indicated his or her degree of agreement or disagreement with such statements as—"The SPS has served to identify many new business opportunities that might otherwise have been overlooked" and "The SPS has led to the better evaluation of strategic programs."

Subsequently, personal interviews were conducted

with these individuals to validate their responses as well as to obtain, where possible, judgmental assessments of the magnitude of the benefit accruing from the extent to which each goal had been achieved. In those sessions, the interviewer asked questions such as, "what was the profit impact of the acquisitions that have been made as a consequence of the SPS?"

**Relative Worth of the SPS (B)**

This element of the assessment relates the features and characteristics of the SPS to external standards for good planning. Such standards can be based on those developed by Steiner (1969) for instance.

This assessment may be made in a fashion similar to that just described for the effectiveness of planning except that "standards of the field of planning" are used instead of the unique planning goals of the firm. Holloway and King (1979) have presented a way of doing this that is based on "issues" and the development of profiles. Among the criteria that may be sued involve the degree to which the SPS facilitates or necessitates:

(1) precise identification of business *strengths and weaknesses.*

(2) the specification of existing and potential *comparative advantages* for the business.

(3) the assessment of the *risk* involved in strategic alternatives.

(4) the explicit evaluation of the *internal consistency* of strategic elements.

Closely related to these planning criteria are general external criteria related to the notion of system implementation (Churchman & Schainblatt, 1965). The issue of systems implementation deals with the degree to which a system, in this case the SPS, is actually used. Such issues might well be thought of as being an appropriate element of the SPS goal statement. In most cases, they are not so spelled out, presumably because it was not considered necessary to explicitly state a goal related to system use.

However, since the degree to which complex management systems are truly effectively used has come into question and study in the past decade, such implementation issues are probably best dealt with as external standard. Various instruments have been developed to assess the degree to which complex systems are effectively implemented and to identify impediments to implementation (Schultz & Slevin, 1975).

**Role and Impact of the SPS (C)**

This assessment addresses a set of issues that may be summarized as addressing the question:

Is the plan really used to guide the strategic direction of the firm ?

This question has to do with the degree to which the "strategic choices", which are the outputs of the SPS, truly guide the firm. In some firms, a spohisticated planning process is carried on, but many of the firm's strategic moves—such as acquisitions—are, in fact, opportunistically arrived at through the actions of a chief executive or other high officials. In such cases, planners often believe that the SPS, however good it may intrinsically be, is devalued, because it is not truly guiding the most important choices of the firm. In one company this was assessed using a survey instrument such as that discussed in A. The perceptions of top managers and those of middle managers and planners were found to be quite different. Top managers believed that the SPS was, in fact, guiding the firm's strategy and its strategic actions, whereas middle managers, (to some degree), and staff planners, (to a large degree), felt that it was not.

A set of interviews with those that had responded most negatively revealed that there was little feedback provided on recommendations that were not accepted and implemented. The lower-level managers and staff were largely left to infer the reasons that plans were not incorporated into the overall strategy of the firm. This resulted in the identification of a need for feedback from top management to those who were intimately involved at lower organizational levels in the process of formulating alternative strategies and making recommendations based on them.

**Performance of Plans (D)**

The ultimate test of the strategic choices made by a firm is business performance. However, unlike the

"black box" relationship that is postulated in the indirect evaluation approach, the direct approach inlvoves a more detailed and specific view of the strategy-performance relationship. In particular, it:

(1) focuses on the specifiic impact of *each* strategic choice element, not merely an aggregate business performance;

(2) requires performance to be assessed relative to what may be a number of different measures of peformance reflecting diverse business goals and objectives, rather than merely in terms of an aggregate measure.

In making such assessments, such things as the specific goals and targets for strategic programs need to be established and used as a standard for comparison. A company that has a system such as that of Texas Instruments, in which various levels of strategy are delineated and managed (Texas Instruments, Inc., 1975) has a clear basis for doing this. It is more difficult to do at the "higher" levels of strategy, but it is feasible at the strategic program level (King, 1980).

The methodologies that have proved useful in this regard involve the comparison of strategic program goals and expectations with actual performance. Just as it can be enlightening to look back on the aggregate-level sales, profit and other forecasts contained in historical plans, the quantitative comparison of actual strategic program results with projected returns on investment can be of great value. There is a tendency for people in organizations to "forget" their past optimism——or at least to forget its degree of intensity, if not its existence. Such a formal program-by-program comparison provides insights into the worth of past decisions that are direct, objective and useful in profiling the overall worth of planning.

However, such aggregate measures as "earnings per share" and the "value of the business," as are emphasized in the indirect approach to planning evaluation, are indeed also relevant. For this reason, the lower-case letter "d" is shown in Figure-2 to indicate that the direct measurement of the performance of each strategic choice element relative to its goals (D) may be complemented by the assessment of business performance relative to external industry and market standards (d). This merely means that one also may compare business performance with that of comparable firms using traditional financial and earnings measures. The PIMS data base (Grant & King, 1982) develops "PAR" reports which make this sort of comparison.

**Relative Worth of Strategy (E)**

In addition to the performance basis for assessing strategy, there are some external standards that may be applied to strategy. For instance, "internal consistency" is an important general standard that is widely applied (Grant & King, 1982). Rumelt (1979) has proposed a wide variety of such criteria that may readily be sued.

The contingency theory of strategy that has developed in recent years reflects an emerging body of broad external standards that may also be applied in this regard. For instance, Hofer (1975) summarizes a variety of studies in this area that deal with the specification of appropriate strategies for various contingencies. The contingencies reflect such things as the stage of the market life cycle, and the business status as reflected by its existing market share, experience, and the environment that it faces.

Such standards can be used as a check list against which a preliminary assessment of the strategies can be made. This can by done by identifying the business situation and then judging the appropriateness of the strategy to the situation. In one business in which this was done, outside consultants were initially asked to make an ressessment of the appropriateness of existing strategies by making explicit use of such formal prescriptive standards. Then, executives were allowed to review these outside evaluations to explain special circumstances and to critique the logic and application of the standards. These reviews were fed back to the consultants, who were asked to revise their evaluations appropriately.

One other important "external standard" that is not directly captured by any traditional assessment of business performance is that which has to do with *strategic opportunities.* In one company, such an assessment was made on the basis of the question:

What opportunities have been available or considerd that have been foregone and not enacted into strategy?"

The varieties of such opportunities are relevant:

(1) those good opportunities that were either not identified or not recognized to be good;

(2) those bad opportunities that were foregone after having been identified and assessed.

The former are clearly "missed opportunities" which serve to devalue the performance of the SPS. The latter represent an important output of formal planning that is seldom discussed or identified——those bad ideas that the SPS led the firm *not* to pursue.

In the company in question, the assessment in this area was done by the author as a consultant because it was believed that outside objectivity was necessary. The assessment was necessarily incomplete, because some records were not available and because the former category involves the identification of opportunities that were not previously identified. However, through a process of interviews, of searching through the files of some parties who had retained documents regarding program and strategy proposals, and by assessing the innovative strategies of competitors during the relevant time period, this assessment was made possible.

**Adaptive Value of the SPS (1)**

One important dimension of a SPS is its adaptability to changing circumstances as well as its ability to be improved as it is being operated and evaluated. while this may be considered to be one of the external standards for B, it is so important that it is specifically identified on the "feedback loop" portion of Figure-2.

That feedback loop represents the SPS's ability to adjust its own goals, characteristics or inputs to its outputs and the business performance that they produce. For instance, if a SPS has produced high-risk strategies as outputs, and if those strategies do not produce the desired business performance, can the system be adapted so that it does not continue to do so ? Moreover, has this in fact been done?

In one situation in which this was the case, it was determined that a group decision making process was producing risky recommendations that, when enacted by the firm, did not frequently produce the anticipated results. When this was discovered through an audit of the process that had led to these strategies, it was determined that the group process should be changed. In another case, the SPS was found to have made inadequate use of available information. This led to the development of a new computerized competitor data base. The evaluation of the adaptive value of the SPS was rated positively in both of these cases since the system itself had identified the problem and acted to correct it through improvements in the system.

Some systems have not been evaluated positively in this regard, for instance, one in which the rewards provided to managers did not motivate them to follow the prescribed business strategy. When this was recognized, no changes were made in either the reward structure of the strategy, presumably because of the perception that both elements were so fundamentally entrenched in the company's culture that changes would create additional difficulties.

Such anecdotal evidence of adaptive value can lead to the identification of characteristics that contribute to this element of value. For instance, a system that is sufficiently well documented to provide an "audit trail" that can be used to diagnose the cause of deficiencies in system outputs would be relatively highly-valued, if the audit trail were, in fact, used.

In effect, these more general characteristics represent a kind of external standard that is applicable to the feedback element of the SPS. It is not shown as such on Figure-2 because such standards are not well developed for the SPS context.

**Relative Efficiency (G)**

Little attention is often paid in planning circles to the resources that are consumed by planning. Questions of the efficiency with which resources are employed are often shunted aside. One planner was recently heard by the author to remark that to apply such a criterion to an activity that deals with such important issues is "nit picking." Yet, at the same time, the resources of planning departments are often cut substantially during periods of business downturn.

External standards for the relative efficiency of planning can be readily developed by a firm. For example, how many man-years are put into preparing the plan for each million dollars of sales? It is rather easy to estimate "industry standards" as well as standards for "well managed" firms to which a firm might wish to be compared. Indeed, in one such case, in which the author participated, direct requests to other firms resulted in the provision of a wealth of data concerning their planning expenses.

**Adequacy of Resources (H)**

A related measure is that of the adequacy of resources relative to the goals for planning. Sometimes, unrealistic expectations are implicitly established for planning in terms of both the quantity of SPS outputs. For instance, if staff planners are frequently assigned to perform "special projects" as they are in many firms, the planning resource base may be so diluted that planning goals cannot be met.

In one case, the mere quantity of proforma financial statements that were required in the planning document was so great as to tax the capabilities of the planning department's clerical and secretarial staff. When this was formally demonstrated through such an assessment, a commercial computerized financial planning language was purchased to serve (initially, at least) merely as a "high speed printer" making it possible to efficiently produce those documents which were to be included in the plans and thereby freeing resources for more significant tasks.

**Allocation of Planning Resources (I)**

A third variety of planning resource assessment has to do with the *allocation* of the resources to the various funtions and activities of planning. One way of assessing this is to develop a description of the various planning activities and to survey both planners and managers in terms of the time and resources spent on each activity. (Zutshi, 1981). In one case, this was done in terms of "actual" versus perception of "desirable" proportions of total planning effort with results that implied that much greater effort was being devoted to the "description of the current state of affairs" aspect of planning than to the creation and evaluation of alternative strategies. The perceptions of virtually everyone led to the conclusion that this was a misallocation of effort, and actions were initiated to reallocate resources appropriately.

**Appropriateness of Planning Goals (J)**

The evaluation approach of Figure-2 ends where it began—with planning goals. The appropriateness of these goals, in the context of the firm's environment and position, should be subjected to scrutiny using external standards.

While specific and precise standards of this kind may not be readily available, a good deal of research has been conducted in terms of the level of uncertainty in the firm's environment as well as in delineating "realistic expectations" for planning (Warren, 1965). These can provide the basis for a judgemental assessment, probably best conducted by someone external to the firm, of the reality and appropriateness of its planning goals.

**Overall Assessment of the Planning System**

There is a great deal of theoretical appeal to the idea of making multi-dimensional assessments and then of aggregating them into an overall measure of utility (Bell Keeney and Raiffa, 1977). However, there are significant practical problems involved in doing so (Zutshi, 1981), and the usefulness of the result is questionable because the practical use of a planning system evaluation is *not* the comparison of its overall worth with that of others. The practical use is more in terms of the various elements of the assessment (A through J).

For instance, the various assessment, A through J, identify areas of weakness in the planning system. They are, therefore, of great diagnostic value. Even the accountability issues are best dealt with in this way, since accountability is probably best with respect to specifics rather than to a single abstract index.

However, composite assessments are indeed necessary since it is not at all clear that certain values of some of the assessments are necessarily bad or good, except in the context of the other assessments. For instance, if the planning function is assessed to use greater resources than would be prescribed by an external standrad, its "relative efficiency" (G), would be low.

However, if most of the other assessments were quite high, this might merely reflect a greater investment in planning than is fully justified by better output.

Thus, in addition to being viewed individually, the twelve assessments (A-J) should be arrayed to form a *planning system effectiveness profile*. Such a profile permits the visual protrayal of these inter-relationships and provides a sound basis for the judgements that must necessarily be involved in an overall assessment.

**Summary and Conclusions**

Most of the evaluations that have been made of planning systems are either totally impressionistic or make use of an "indirect" approach to empirical assessment that is neither very satisfying nor useful.

A "direct" aproach to the evaluation of planning systems is presented here in terms of methodological framework. The framework involves twelve distinct assessments of planning system inputs, outputs, feedback mechanisms, and impacts that are made in terms of the planning system's goals and a number of bodies of external standards. Each of the dozen separate assessments that make up the methodology have been applied in business firms, although the overall methodology has not been applied in a single firm.

The methodology employs both the collection of objective data and the making of subjective judgements. One of its underlying precepts is that both can be made and used so long as the judgements are obtained in a structured fashion (e.g.,using structured interviews or a questionnaire) that facilitates aggregation and comparison. The other precepts on which the methodology is based are also discussed.

The evaluation approach ultimately requires that judgements be made of *overall* planning effectiveness. This is done in terms of a planning system effectiveness profile that permits judgements to be made concerning the interactions of the various individual assessments.

The approach is particularly valuable as a diagnostic tool, since it permits the direct identification of potential planning weaknessess as well as the identification of elements of the planning system that are unique or particularly productive.

For the field of planning to progress and to achieve its much-heralded potential will require that a formal evaluation methodology be developed and implemented. While further application experience is clearly necessary, the approach presented here appears to have the potential for providing such methodology.

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# Organisational Climate and Strategic Management

ARIE P. NAGEL

*Organisational Climate is one of the dominant factors which determine the effectiveness of strategic management. To improve the positive Organisational Climate and to make the Strategic Management effective the quality of managers should be improved. The paper also emphasises the importance of formal procedures in the Organisation.*

Mr. Arie Nagel is a Lecturer of Business Policy, Eindhoven University of Technology, The Netherlands.

## Introduction

The effectiveness of strategic management is determined by several factors. In Figure-1 we suggest a tentative conceptual framework which relate these factors. It is compiled from the works of Galweiler[1], Faure[2], Rhenman[3], Tregoe[4] and Thompson[5].

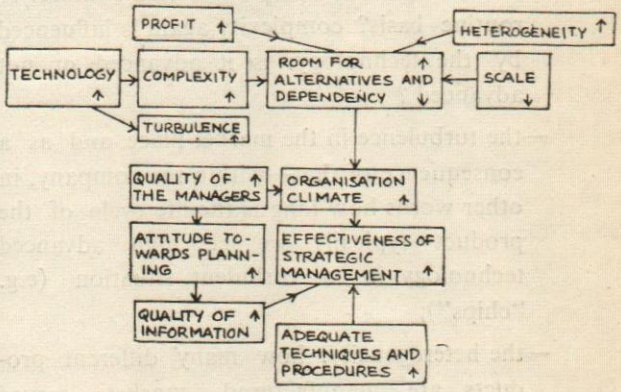


**Fig. 1 : A conceptual framework for determining the effectiveness of strategic management.**

In our opinion the organisation climate is one of the most important factors that determines the effectiveness of strategic management. In this paper we will not regard the organisation climate as such—as a sociological entity—but we will dwell on the factors that determine this climate. These are :

a. the quality of managers :

—their know-how of strategic management is crucial; therefore, a great deal of this paper will

be dedicated to common problems, misbeliefs and failures in introducing and executing strategic management;

—the more managers move upon the managerial grid of Blake and Mouton,[6] the more they will tend to be "strategically capable" (as indicated above), and also more social oriented and cooperative with people inside as well as outside the company. In this paper we will explain the extreme importance of cooperation with outside experts on strategic management.

(b) Room for alternatives—this is another key factor which determines the organisation climate which is quite reverse to the notion dependancy—to this we will refer several times in this paper :

* this margin itself is determined by several factors such as :

—the profit;

—the complexity; this refers to the organisational complexity; are the products and production methods unique or standard? i.e., are the decisions made on a non-routine or routine basis? complexity again is influenced by the technology: is it advanced or not advanced ?

—the turbulence in the market place and as a consequence of that—within the company, in other words how long is the life cycle of the product—typically we see high advanced technology in a turbulent situation (e.g. "chips");

—the heterogeneity: how many different products are manufactured, markets served (needs fulfilled) and is the production process versatile;

—the scale; once invested (capital goods—economies of scales!—or know how) it is difficult to change;

—the quality of managers; the better the manager the more room he will see—it is not only a matter of facts, but also of perception.

Completing the picture of Figure-1 we state that the quality of the managers influences the positive attitude towards planning. More quality results in better communication, more adequate information[8], a higher analytical level and a longer time-horizon of the managers. In short, more feeling for (strategic) planning.

Better planning results in better information and more adequate techniques and procedures. By adequate we mean-better adapted to the situation and certainly not necessarily more advanced, like computer corporate models.

Eventually, the effectiveness of strategic management is determined by the organisation climate, the quality of information and the adaptation of the techniques and procedures used.

**Some Beliefs, Misbeliefs about Planning**

The process of *strategic management* is directed to the reduction of uncertainty and eventually to take strategic decisions. This can be done either on a cyclic (yearly) basis or on an acyclic (project) basis. However, each company should be involved in strategic management. because there are always opportunities to evaluate and threats to cope with. In this process of strategic management the company will heavily bank on its strengths. Figure-2 gives the components of strategic management.

| *strategy formulation* | *allocation* |
|---|---|
| * analysing | * of resources and translation into financial terms |
| * prognoses | * eventually resulting in financial and manpower budgets |
| * alternative plans with its consequences | * action plans |
| reduction of uncertainty and preparing decisions | taking decisions |

strategic management

**Fig. 2: Components of Strategic Management**

*The aim is to reduce uncertainty. Of course this is possible to a certain extent. In a few cases the future will be completely uncertain or equally worse we know it perfectly but the "response-time" is too long. In these cases more information is useless and strategic management ineffective.

The first condition for the process, indicated above, to be carried out successfully, is that there is *room for alternatives*. If the margin for taking strategic decision is next to zero, the whole process would be a waste of time and money. More specific there should be a margin in financing, in time, in know-how (in the broadest sense) and last but certainly not least in willingness. An example: a cleaning company which just has invested in an automatic washing street, is tied to this decision for several years. The financial resources have been put into this expensive washing street. After having taken this decision it has little use to evaluate alternative actions in the *production* area for several years. This is by the way, one of the reasons why strategic management in smaller firms should be done on a project basis.[7]

Furthermore, *strategic planning* (see Figure-2) is a systematic procedure to sustain the process of strategic management. A *strategic plan* is the result of this and should address itself to:

- ☐ what is our scope or what kind of business(es) are we in: products, markets, technology, which customer-groups do we serve, which needs do we fullfil, . . .
- ☐ in which direction will we extend, diminish our scope
- ☐ what objectives do we have in doing this (objectives can either be an input or a result of the strategic process)
- ☐ how these objectives should be met: in what time with which person financial and material means (action plans).

*Objectives* should give the desired state in:

- ☐ financial and economic,
- ☐ social,
- ☐ commercial,
- ☐ technological situations,
- ☐ the field of management development and organisation structure,
- ☐ the productivity.

Objectives can be stated explicitily on paper, but can be implicitly as well and will be actual in case of concrete alternatives at hand. Smaller firms will tend to have implicit objectives, where larger firms will make their objectives explicit. This is simply because the more people are involved in the process of strategic management, the more necessary it is to communicate the views in a formal way.

*Objectives should be realistic.* They might be challenging, but should never be castles in the air. Nor should they be set too low, as people do in the communist countries, so they can meet the plan easily with an excess of ten or more percent. In setting realistic objectives, one takes the planning process serious. But even with realistic plans, objectives will be met only by accident. This does not mean that the process of preparing plans is a waste of time. Giving some room for alternatives, which are available most of the time (e.g., closing the business is almost always a possibility), one must choose. And to choose properly one should discuss the consequences of several alternatives with the information at that moment. Later-on, after the decision, it will show that things happened (slightly) different. Connected with the misunderstanding that objectives should be met and that otherwise planning is a waste of time, is also a belief that one should tell apart prognoses and plans. You need prognoses to make plans, but they are certainly not the same. Figure-3 gives the relationship between prognoses and plans within the whole process of strategic management. Figure-4 gives a very simple example to explain the difference between prognoses and plans. Even if the prognosis (weather-forecast) is rain, you can decide (i.e., plan) not to bring your raincoat with you. Maybe you don't mind a little rain, or you take the risk that it does rain at that very

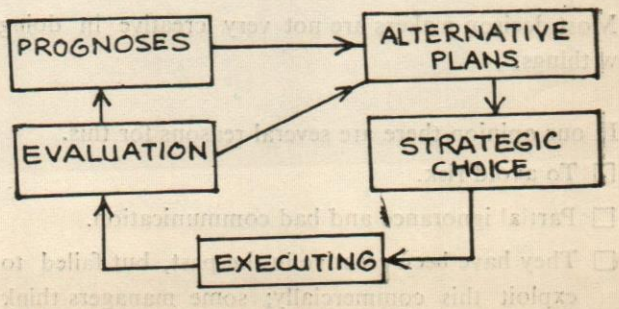


**Fig. 3 : Relationship between Prognoses and Plans.**

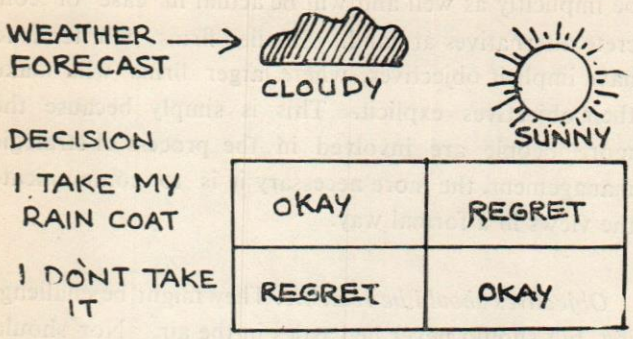


**Fig. 4 : Differences between Prognoses and Plans**

moment you are out, or you don't trust the weather forecast.

**Strategic Decisions have Severe and Long-range Consequences**

At the same time they are non-routine decisions, because one has to cope with new situations. So you are faced with a dilemma: on the one hand they are of vital importance, whereas on the other hand they are unique decisions. But even if it is very difficult to prepare such vital decisions, one has to do this in a proper way. Problems such as partial ignorance and time-pressure weigh heavily.

Later-on it is often so that the wrong decision had been taken. This does not mean however that you should not plan. At that time the decision was made with that information. Under that circumstances and with that knowledge it was a good decision; there has been a lot of thinking about it. And this is most of the times better than doing "nothing" or an impulse reaction. Evaluation of the decision and the actual situation is always useful. In doing this one could learn a lot.

Most decison makers are not very creative in doing new things.

In our opinion there are several reasons for this.

- ☐ To avoid risk.
- ☐ Partial ignorance and bad communication.
- ☐ They have been creative in the past, but failed to exploit this commercially; some managers think that new should be real new, a total different product, market or technology and in that small companies will fail most of the times.
- ☐ The room for alternatives is too little, especially in smaller firms.
- ☐ They think merely in terms of "solutions", more than in terms of "alternatives", decision making is done implicitly and intuitively and not in an analytical way.

In doing so one comes to obvious solutions or even worse jumps to conclusions.

A common belief is that strategic management has little to do with today; it mainly effects things in the far future. It is a vague philosophical process which deals with the long term. On the contrary strategic management deals with today, with today's decisions. Even if the decision is postponed, we have a decision NOW; the decision that the decision is postponed. And that decision can have dramatic consequences: Think of delaying a decision to merge. Later-on one could be glad that this decision was postponed until better information was at hand. Or that a feeling of regret arises because of the missed change.

Of all the possible mistakes in strategic management, there are *two serious mistakes made in practice* (see Figure-2).

(a) The allocation is started, while the strategy formulation has not been carried out :

- ☐ allocation degenerates to a longterm book-keeping, carried out by middle management and is not supported by top management
- ☐ so it has no "vision" in it and it will not lead to new ideas
- ☐ even worse there will exist or grow a hostile climate against strategy formulation—people will look at this as unnecessary and useless, certainly if things go different from the usual way
- ☐ the allocation has been done as a financial extrapolation; e.g., a 4, year plan.

(b) The strategy formulation has been done and the allocation is expected to be carried out spontaneously:

- ☐ top management has spread its ideas and leaves it to middle management to translate the ideas into action
- ☐ it is very difficult for middle management to do this if they don't know why; in rare cases they might even sabotage the ideas
- ☐ strategy formulation is quite useless if at the same time the ideas are not translated into action plans (who does what and in which time) and projects
- ☐ It is preferable if not essential that middle management is involved in the ideas from an early stage.

**The Organisation of the Strategic Management Process**

This brings us to the following question. Who should join the process of strategy formulation and allocation ?

- ☐ First of all the responsible top management; they have to take strategic decisions which determine the direction of the company (objectives—WHAT —and strategies—HOW—) and furthermore they should create conditions in such a way that the directions also can be followed; i.e., conditions in the field of contracting (or dismissing) personal, proper allocation of tasks and conditions for communications to middle-management, because they have to execute the plans; e.g., the sales director, the production director, one could also consider a representative of the labour-force
- ☐ One or more outsideres such as:
  - —a new (top) manager
  - —consultant
  - —someone from a bank
  - —an accountant
  - —a competitor, e.g., when there exists a regional separation between the markets served.

We like to go further into detail concerning the *outsider*. What are the criteria for choosing one and why should we involve an outsider ? First some criteria.

- ☐ the outsider should have the confidence of top management and all the others who are involved in the process of strategic management
- ☐ must have experience with this process
- ☐ must have the "art" of putting appropriate questions to the managers, who on their turn should be prepared to discuss things frankly, e.g., to come forward with their doubts.

Before giving more criteria, we like to answer the second question, why an outsider ?

Experience teaches us that most managers can only get a 'breakthrough' in strategic thinking if an outsider is involved. The reasons for this are rather obvious:

- ☐ an outsider brings in new ideas and approaches
- ☐ most managers have good ideas, but have a—in their lonely reflections—great need for someone, which brings some ordering in his/her throughts; in other words, a 'sounding board' is needed.

This is connected with the fact, earlier mentioned, that a manager merely thinks in terms of "solutions" than in terms of "alternatives". If so, it is very useful sombiosis to join the manager with an outsider.

In addition, this outsider should:

- ☐ have the task to schedule the strategic procedure i.e., strategic planning; without "phasing" it often deteriorates
- ☐ be aware not to push his ideas; this is quite useless, because it is the manager who decides and he will—at the end—only decide that in which he believes.

Strategic management also shows that the results count and not the brillant ideas.

- ☐ keep in mind what the organisation can bear; strategic planning surely is a tedious and long-range job:

How to organise it ? Here, great differences between smaller and larger firms arise. *In larger firms* strategic planning is done on a yearly basis; e.g., from the consolidation point of view. Sometimes it is completed

by some sort of issue management. At the top level there are generated ideas, whereas at the middle level there are generated facts which are complied then to form proposals for plans. These plans are tested against

In smaller firms the organisational set-up is easier. As there is a narrow margin left for alternative action, strategic decisions are not as frequent as in larger firms. If a firm has up to 500 members, strategic decision

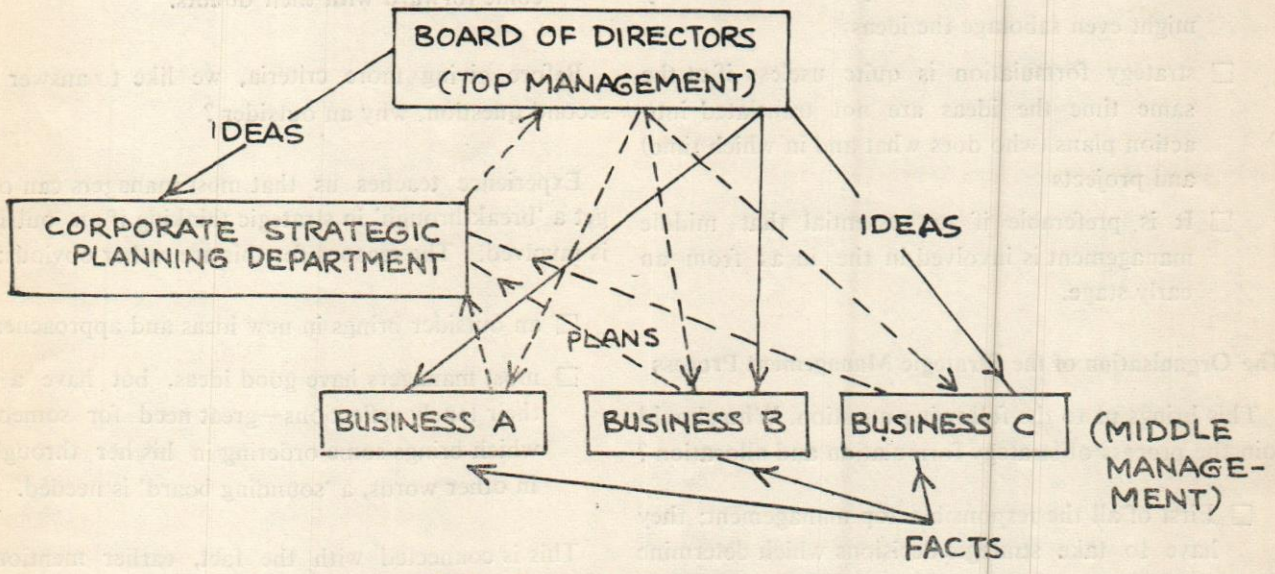


**Fig. 5 : Strategic Planning in a Large Firm**

the ideas and norms by a corporate planning department. Finally the plans are confirmed by top management and are implemented.

The tasks are divided as follows :

- ☐ top management should provide for ideas and the conditions mentioned earlier and confirm the business plans
- ☐ middle management should gather facts and prepare the business plans and execute them
- ☐ the corporate planning department should develop procedures, consult top managements and the businesses, develop planning norms, carry out board environmental surveys, compare the business plans with the norms, carry out special projects, e.g., product innovation, manpower planning and the like.

The members of this department should have a thorough knowledge of the firm and a substantial part of the department should consist of people, which are bred in the company and have seen the company from different angles.

making on a project basis will be quite sufficient. The project-team should consist of 3 to 8 members. The chairman should be the director of the firm, because he makes the decisions. Working groups, committees or experts can be attached to the project-team on an agenda basis. The chairman of these groups should be a member of the project-team.

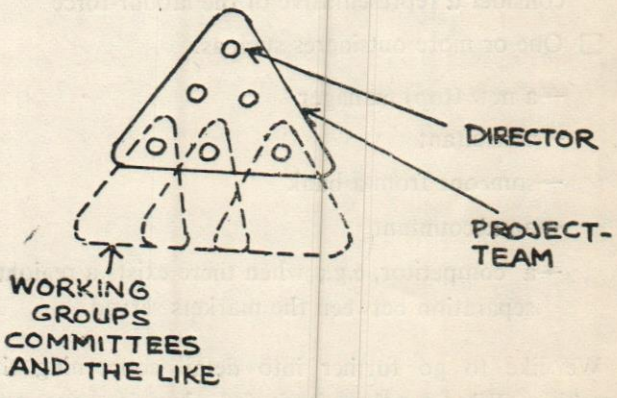


**Fig. 6 : The Linking pin idea applied to Organising Strategic Management in Medium Sized Firms**

It is important to agree on a limited time for the project-team. Say one or two years. Moreover, it is

very important to do everything together in the team. For the following reasons:

- ☐ it motivates people to execute the plan later-on
- ☐ they will have a better idea what it is all about and so they will make better plans and execute the plans in a better way
- ☐ it improves the communication among the members
- ☐ it shows quickly the difference in ideas such that the decision can be more to the point and will hopefully lead to consensus which is not the same as compromise
- ☐ the decisions will delay the decision making in the beginning, but time will be gained later-on, because the execution will take place without confusion or discussion.

A drawback could be that the project-team is regarded by the rest of the organisation as an elite and this can result in misunderstandings between the project-team and the rest. Therefore, a proper introduction of the project-team is a must, and adequate information from the project-team to the organisation should be provided.

How should we start with strategic management? To a certain extent one can do strategic management intuitively, but as the situation grows more complex (i.e., more products, more regional areas and the like), it is almost a necessity to make use of a procedure. This means that it is desirable to consider subjects and/or aspects of the organisation step by step. Although it is true that everything coheres with everything one cannot possibly consider everything at the same time; knowing this one deals with the problem in parts so that it will be more tractable. This dealing with the problem parts is a must when strategic management is being carried out by—say—more than three persons.

Putting strategic management into a procedure—a planning schedule—it will be clear for each member of the project-team what the subject for discussion is at that very moment. Doing so it works much the same way as an agenda does for a meeting. Furthermore this procedure will put time-pressure on the members and hasten the process.

So we see that strategic management is a pre-eminent means to policy making and communication in the company:

- ☐ as we have seen before it is a way to get consensus
- ☐ and it motivates people.

Moreover:

- ☐ it is a way of learning for the individuals as well as for the company as a whole
- ☐ it is a way of preparing and executing strategic decisions
- ☐ it helps to make the policy clear to the members in the organisation
- ☐ members can then give more adequate information to management on their turn
- ☐ and they can show one face (image) to the outside world; e.g., with Public Relations.

If there are areas which have no strategic problems (e.g., purchasing or production), there is no need for strategic management in these areas.

It is desirable to emphasize only one or two areas per year. Of course it should be those areas that call for strategic decisions, i.e., where there are problems. Actually, it is wise to stress one area per year; for example:

1982 : purchasing
1983 : the international division
(with a wink to George Orwell)
1984 : manpower planning and personal development
1985 : product-market combination number 12 (whatever that may be)
1986 : production technology
etc.

So now we created a continuum between project planning and cyclic planning.

See Figure 7.

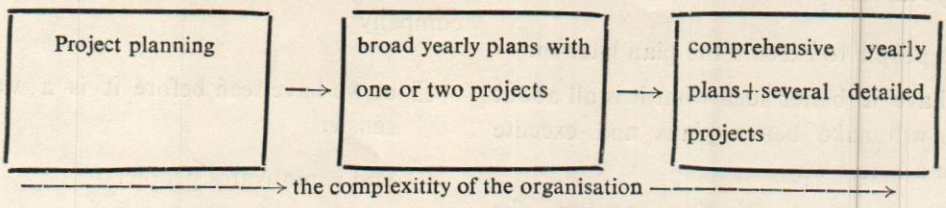


**Fig. 7 : A Continuum at Strategic Management Approaches**

**Concluding Remarks**

Do we really need formal planning ? Research shows that companies which have formal planning procedures perform better than those who don't have it. Moreover, if the informal planning is substituted by formal planning, the performance raises.

The quality of the planning results according to Galweiler[1] out of three factors:

- ☐ the quality of the people involved in planning
- ☐ the quality of the information and
- ☐ the quality of the methods and procedures used.

In our opinion the quality of the procedure is not the most important factor; it is only the factor which can be influenced easiest. As we stated already: start simple, start with a simple procedure—it is the agenda for the meeting, no more no less...

Any procedure which is simple and agreeable for the members of the project planning team will do for a start.

For convenience one can find the fundamental pattern of all procedures in Appendix-1.

## APPENDIX 1

**Ground pattern for strategic planning procedures.**

1. WHAT IS OUR POSITION ?
   Strengths, weaknesses relative to the competitor.
2. WHAT ARE THE POSSIBILITIES FOR THE FUTURE ?
   Opportunities, threats and risks in the market place and within the company.
3. WHAT IS THE CURRENT FORECAST ?
   Where would we be, if we don't change our strategy.
4. WHAT DO WE WANT TO DO, WHERE DO WE WANT TO GO ?
   'leitmotiv' and goals and objectives.
5. WHAT ARE THE ALTERNATIVES ?
   Which are the alternative possibilities for our company ?
6. WHAT DO WE CHOOSE ?
   And what alternatives do we have to fall back on?
7. WHAT IS OUR ACTION PLANNING ?
   Who does what and when and with what financial, material and personal resources ?
8. EVALUATION AND CONTROL
   During and after the planning process.

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*Productivity*
*1983, XXIV, 2, 155-163*

# Developing, Monitoring and Evaluating A Corporate Strategic Plan—BHEL's Experience

K. R. PARMESHWAR

*This paper in a brief manner describes the history of Strategic Planning in BHEL, a pioneer Public Sector Undertaking in India. BHEL case proves beyond any doubt, organisations must be prepared to reorganise and adapt themselves to the changing environmental conditions, for long time survival and growth.*

Mr. K. R. Parmeshwar is Executive Director, Bharat Heavy Electricals Ltd.

Over the years, BHEL in India has emerged as a diversified and divisionalised company operating in high technology areas. Today, it comprises of eleven major manufacturing and service divisions and is active in the fields of energy, industry, transportation and electronics. It's turnover exceeds one billion dollars and the employees are over 70,000. (BHEL's organisation chart is enclosed in Annex. 1). This development has been the result of systematic planning. Since there is a very dynamic relationship between strategy and structure, at different phases of the company's growth, the organisation's structure, content and concern for planning have undergone considerable change.

BHEL's history has certain features common to all public enterprises in India. As would be apparent, these enterprises were set up as part of a national perspective plan for industrial development. In many cases, self-reliance and import substitution in the vital sectors of economy were the major goals.

In the area of high technology, the public sector companies were the only enterprises of the kind in the country. At the stage of their conception, their goals were specific and certain. It is only when the environment changed with varying market needs and technological obsolescence that the enterprises felt the need for a second look at their technology base, product profiles and the organisation structure.

The history of planning in BHEL spans over four phases. These are depicted in Fig. 1. In the formative

phase of BHEL, major importance was given to the planning, review and monitoring of projects. The Chairman's Office consisted of a Secretary to the Board of Directors, Chief Planning & Development (CPD) and Deputy Financial Adviser and Chief Accounts Officer. CPD was assisted by two Chief Project Co-ordinators who dealt with the work on new projects being set up with Soviet and Czech assistance. Consequently, planning activity was limited to monitoring and review of projects, providing coordination among divisions and linkage with Government agencies.

It is in the later years of Phase II that systematic planning started emerging in BHEL. To most of us, it is this phase that would be of interest. The year 1974 is important in the history of BHEL, as in this year the formal marger of HEIL with BHEL took place. Also a comperhensive outline for future course of action for the corporation was prepared in this year keeping in view the needs for continued survival and growth of the company.

The key elements of the Corporate Strategic plan of 1974 were :

* Product Rationalisation
* Engineering reorganization
* Corporate R & D Group
* Indigenisation
* Ancilliary development
* Export Drive
* Non conventional energy systems group
* Nuclear engineering group
* New Service Divisions

—New manufacturing centres

* New location for existing products
* Vertical integration
* New Products

Management Development

Steps for implementation and monitoring :

To implement and monitor the Corporate Plan goals, several steps were taken. Some of them were :

* Organisation restructuring
  —functional differentiation
  —engineering reorganisation
  —product grouping
* Venture management for oil rigs and export.
* Introduction of product planning as basic unit for corporate planning, thus linking strategic plans with operational plans.
* Integrating capital and revenue budget.

Among the very first steps taken for providing an integrated view in all matters, was the setting up of a Corporate Office at New Delhi to assist the Chairman in generating and evaluating alternatives and integrating the programmes of the Divisions. Corporate R & D Division was set up to strengthen the capability in the field of research. A Services & Spares Division was set up to provide adequate after-sales service. Adequate attention was given to finance, systems and management reporting by appointing a full time Finance Director. Personnel function was also given the highest attention with the appointment of Director (Personnel). An independent Division for Corporate Planning & Development was created.

Corporate Executive Committee was formed in 1976 to assist the Board of Directors in formulating long term directives, policies and strategies and for promoting optimum utilisation of resources. As the number of Divisions and spectrum of activities increased, Corpo-

**Fig. 1 : Four Phases of Planning in BHEL**

| | | |
|---|---|---|
| 1 | Project Implementation and Initial Production Phase Upto 1969 | Project implementation. Annual Budget. Annual Programme |
| II | Preparation for developing Corporate Plan 1969-74 | Stretching the time horizon. Broad Objectives. Preparation for Planning |
| III | Implementing the first Corporate Plan 1974-80 | Diversification. Organisation Planning for Development. Streamlining Planning process. Development of Strategic planning capability. |
| IV | Corporate Refounding for the 80s | Strategic Management. Technology upgradation. Entry into high technology areas. Decentralised participative planning. |

rate Office became full-fledged with functional Directors and nearly 100 executives to support planning, review and implementation of various programmes of the Company. The Corporate Finance Department had separate groups for development, installation and auditing systems. Personnel Department was responsible for manpower planning and career planning, designing and guiding training programmes and recruitment programmes in addition to assisting in the preparation of policies and systems. Marketing group assisted Chairman in framing marketing policies for the company and in installing total marketing system of BHEL. The need for structured integrating devices was fulfilled by setting up a number of forums such as Corporate Functional Committee, Corporate Product Committee, Project Review meetings etc, cutting across divisions, products and functions of the Company. The functions of such integrating devices was to monitor various short term and long term plans arising out of Corporate Plan.

A major element of reorganization has been the assignment of long term planning in specific product or functional areas to each Executive Director. As the product range of BHEL was expanding, it was felt that strategic planning should not be left alone for Corporate P & D set up. So attempts were made to use the experience and expertise of senior executives who had a wide-based knowledge of many functional/product areas by involving them in planning for products/systems at Unit level. The idea behind creating some of the organization devices was that gray areas which were too important to be neglected would be looked after until stable organization evolved for such function.

**Organisation of Planning & Development Division**

By the middle of Phase III, a full-fledged Corporate Planning & Development Division was established. This group had counterpart supportive groups at Divisions viz. Bhopal, Trichy, Hardwar, Hyderabad and Power Projects and Services Divisions. The organization of P & D Division was broadly structured around following groups :

—Investment and Facilities Planning
—Operation Planning
—Long Range Planning
—Optimisation & Modelling

Investment and Facilities Planning : This group is responsible for coordinating the companywide investment programmes. The activities include preparation of five year plans, annual capital budgets, modernisation and rationalisation schemes, township schemes, scrutiny of investment proposals and linkage with concerned Government agencies. Work done by this group includes maintenance and updating of data availability and utilisation of various facilities and machine tools. It has undertaken studies in productivity at various Divisions and formulation of policies for replacement and fresh investments.

Operation Planning : This group is associated with formulation of broad objectives and analysis of performance budgets. The group is organized around multi-functional groups for each major division. These desk activities include monitoring of unit performance, assistance to Units, top management reporting etc. The operations planning group along with Corporate Finance Coordinates, Operational review meetings of various Divisions.

Long Range Planning : This function reviews the planning system in the company, updating and formulation of Corporate, Sectoral and Product plans. This group has undertaken studies in organisation development and has also been assisting the company's in-house Management Development Institute in seminars on strategic planning. This group also reviews licensing and collaboration.

Optimisation and Modelling : Considering the increasing use of quantitative methods, a separate group named 'Optimisation and Modelling Group' was created at Corporate Office in 1978. This group has undertaken development of various models using quantitative techniques. The group has completed studies relating to optimal utilization and scheduling of machining facilities, investment appraisal techniques, portfolio analysis and energy modelling.

The organisation of planning set-up at Corporate Office and Divisions is given in Fig. 2 and 3 respectively. The changing complexion of planning activity is depicted by Table 1.

**Fig. 2 : Organisation of Planning and Development Division in Corporate Office**

Head Planning and Development

| Investment Planning | Operations Planning | Long Range Planning | Acquisitions Technology, etc. | Engineering Coordination |
|---|---|---|---|---|
| — Project formulation and appraisal. | — Reviewing of MIRs | — Review and appraisal of long term plans. | — Acquire units divisions. | — Product Engg. & Development programmes. |
| — Coordination of project Review committees. | — Analysis of performance budgets. | — Technology transfer. | — Facilities planning. | — Research Facilities |
| — Project monitoring. | — Coordination of operations monitoring committees. | — Collaboration | — Productivity services. | — Engineering Organisation. |
| — Annual capital budgeting. | — Material management. | — Sub-licensing | — Technical Development. | — Quality Assurance. |
| | — Production coordination. | — Organisation planning. | — Modernisation & Rationalisation, | — Documentation. |
| | — Project management studies for Industrial projects. | — Training. | | — Technical Publications. |
| | | — Review of integrating devices. | | — NCST Interaction. |
| | | — Environment Analysis. | | |

**Fig. 3 : Organisation of Planning Division at BHEL Units**

| Unit | Main Tasks | Other Groups Associated with Planning |
|---|---|---|
| 1. Bhopal Complex | 1. Long Range Planning<br>2. Product Planning<br>3. Collaborations<br>4. New Projects Planning<br>5, M I S; System and Procedures. | — Central Planning.<br>— Project implementation Group.<br>— Product Planning.<br>— Jhansi Planning Group. |
| 2. Hardwar Complex | 1. Long Range Planning<br>2. M I S<br>3. Systems & Methods<br>4. Quantitative Methods<br>5. Computer Systems<br>6. USSR Coordination<br>7. Manpower planning | — KWU Cell.<br>— CFFP Planning Group. |
| 3. Hyderabad | 1. Long Range Planning<br>2. Collaboration Coordination<br>3. Investment Planning & Capital Budget<br>4. Operations Monitoring, M I S. | — Management Services.<br>— EDC (IT & C), EDC (SWG) |
| 4. Tiruchi Complex | 1. Long Range<br>2. Collaboration<br>3. Investment Planning<br>4. Organisation Planning | — Systems & EDP<br>— Data Base Group<br>— Indigenous Development Group<br>— W R I<br>— BAP Planning Group. |
| 5. PP & SD | 1. Project Planning<br>2. Systems | — KWU Coordination Cell.<br>— Regional Planning Groups<br>— Site Monitoring Groups |
| 6. Bangalore Complex — C E D | 1. MIS<br>2. General Coordination<br>3. Broad Objectives | — Projects Group. |

Fig. 3 (*Contd.*)

| Unit | Main Tasks | Other Groups Associated with Planning |
|---|---|---|
| — I S G | 1. Drawing up functional plans from Budget.<br>2. Analysis of data for Internal Management Reports.<br>3. Monitoring progress in new business areas. | — Business Development Group<br>— Systems Development Group |
| — E P D | 1. Collaborations<br>2. Investment Planning<br>3. MIS. | — |

EDC—Engg. Devp. Com. WRI—Welding Research Instt.
BAP—Boiler Accessory Plant.

**Table 1 : Function and Planning Division in BHEL Over Phases**

*PHASE—I* (1964—69)

*Functions* :

— Monitoring and review of new projects.
— Maintenance of Liaison with Govt. agencies, collaborators, site organisations.
— Planning for Projects.
— Sales Coordination.
— Strategies for pricing

*PHASE—II* (1969—74)

*Functions* :

— Assist Chairman in generating and evaluating alternatives.
— Integrating programmes of divisions.
— Organisation Development.
— Improving communication and coordination.
— Preparatory work for first Corporate Plan.
— Establish data base for planning and developing the planning systems.

*PHASE—III* (1974—79)

*Functions* :

— Structuring planning function and defining responsibility matrix.
— Assist in development of strategies.
— Studies for fulfilling the planning programmes.
— Environment analysis.
— Monitor implementation of long term and short term programmes.
— Stimulate formal planning in divisions.
— Bring out formal planning documents.
— Monitor transfer of know-how and overseeing.
— Organisation design.
— Assist various functional/product committees in drawing programmes.
— Secretariat for executive committee.
— Dove-tailing operational planning with strategic planning.
— Liaison with Government agencies.

*PHASE—IV* (1980—90)

*Functions* :

— Plan for modernisation and expansion of manufacturing base.
— Develop technology management capability in view of the rapid rate of technological obsolescence.
— Assist in the development, review and evaluation of product plans.
— Synthesising divisional plans and product plans into the sectoral plans and weaving them together as Corporate plan.
— Introduce contingency planning in all areas of business operation.
— Raising planning capability at divisions by conducting workshops on strategic plng, planning managers' mtgs., etc.
— Assist in preparation of functional plans, viz. Engg. plan, Technology plan. etc.
— Study reorganisation needs.
— Strategic management development.
— Monitoring performance at divisions.
— Enhance information processing capability.
— Environment analysis,

**The Current Scene**

The fourth phase from 1980 to 1990 is the period in which BHEL is trying to cope with a turbulent environment. The threats and opportunities faced in this phase are :

* Severe resource constraints particularly during VII plan period.
* Trend towards external financing of projects, particularly through inter-government loans.
* Export earnings would be required to balance foreign exchange gap.
* Increasing difficulty to retain specialists and highly qualified personnel under current economic environment.
* Widening of technology gaps due to high cost of development and acquisition.
* Need for innovative approach to Industrial Relations management.
* Increased emphasis on internal resource generation, improvements in productivity, over all efficiency and better cash management.
* Continued emphasis on infrastructure development.
* High growth envisaged in industrial production and technological upgradation.

To cope up with such an environment, key elements of planning should be :

* Modernisation and expansion of manufacturing base, technology upgradation.
* Marketing thrust
* Development of strategic management capability
* Information processing capability
* Flexibility – Resilience
* Contingency planning.

That is, the organisation in 80s must be flexible, adaptive and proactive. A major step in this direction has been the decentralisation of planning activity. Though Corporate P&D group continues to direct & coordinate planning activity in the organisation, basic inputs are generated by unit planning set-ups. In this bottom-up approach, divisions are to prepare unit perspective plan; keeping their microenvironment in view.

Divisions have also the responsibility for developing product plans for products within their purview. The linkage between product plan and other plans in the company is given in Fig. 4. A major ingredient of product plan is the technology plant This details out know-how and know-why gaps and inputs required for bridging these gaps. Based on all these technology plans, a Corporate technology plan is prepared which gives directions for corporate R&D programme. These plans and programmes are reviewed and evaluated in product committees and technical committees. A list of product committees and technical committees as existing today is given in Annexure 2.

A major change in phase IV has been the orientation of planning towards sectors and systems. Product plans and divisional plans are integrated into sectoral plans. The concept of organising a company's business in the form of Strategic Business Units (SBUs) and

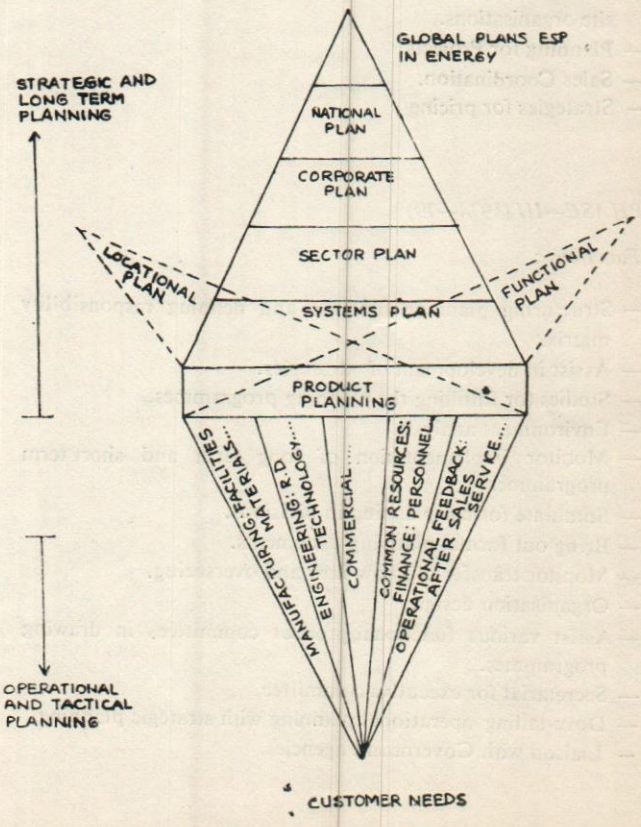



**Fig. 4 : Product Planning in BHEL—A Link between Strategic and Operational Planning**

grouping SBUs into sectors of business for their integrated and effective management was first developed and adopted by General Electric, USA. In BHEL, even while product plans were being developed, it had become clear that considering from the market point of view, BHEL's business lay in distinct sectors and many of the products served more than one sector. As an industrial product does not usually satisfy a customer's need in isolation, but only as part of a larger integrated system of manufacture, process or end service, systems approach became necessary. Moreover, this will be in line with BHEL's Corporate outlook of 'More than Products, A Total Service".

The above requirements have led to various measures like task forces, committees, special linkages etc. In short, a strong and widely dispersed need has been felt for taking a look at technological, market and organisational needs for serving a segment larger than a product and some times even a system. This segment has been termed as Business Sector and at present there are three major sectors existing in BHEL, viz. Energy, Industry and Transportation Sectors. Fig. 5 gives the constituent products and systems of major business sectors.

When properly implemented, these sectors take over many of the responsibilities of corporate level for review

**Fig. 5 : Business Sectors—Constituent Systems & Products**

| | | | | |
|---|---|---|---|---|
| *I. Energy Sector* | *Thermal/Nuclear* | *Hydel System* | *Transmission/ Distribution System* | *Non-Conventional Energy Systems* |
| | * TG sets and auxiliaries<br>* Boilers<br>* Boiler House auxiliaries<br>* Pumps<br>* Motors<br>* Heat Exchange<br>* Equipment<br>* Valves<br>* Pipes and Fittings<br>* Control Equpt.<br>* Controlgear | * Hydro sets & auxiliaries<br>* Pump turbines<br>* Micro Hydel<br>* Bulb turbines | * Transformers Switchgear<br>* Capacitors<br>* Insulator<br>* Control Equpt.<br>* Controlgear<br>* Meters @<br><br>(@ Predominantly loose sales) | * Solar Heating system<br>* Solar Power General System |
| *II. Industry Sector* | *Thermo-Mechanical System*<br>* Industrial TG sets and auxiliaries<br>* Compressors and drives<br>* Industrial boilers and BHA<br>* Valves<br>* Pumps<br>* Motors<br>* Control equipment<br>* Controlgear | | *Electric Drives & Control System*<br>* AC machines<br>* DC machines<br>* Control Equipment<br>* Controlgear | |
| *III. Transportation Sector* | * Traction equipment<br>* Control equipment<br>* Controlgear | | | |

and approval of product plans. Sectoral plans are based on the constituent product/system plans. Sector planning includes sector strategy development, product strategy review and operating plan development/review within a cycle consistent with the company planning cycle.

To make sectoral strategy identification more meaningful, different segmen ts of market having varied attributes e.g., in the thermal sector, two segments that could be considered are 200/2I0 MW sets of 500 MW and above are being identified. Thus, an attempt is being made to draw broad segmentation to facilitate strategy identification depending upon the specific segment of the business. Following are typical business segments identified.

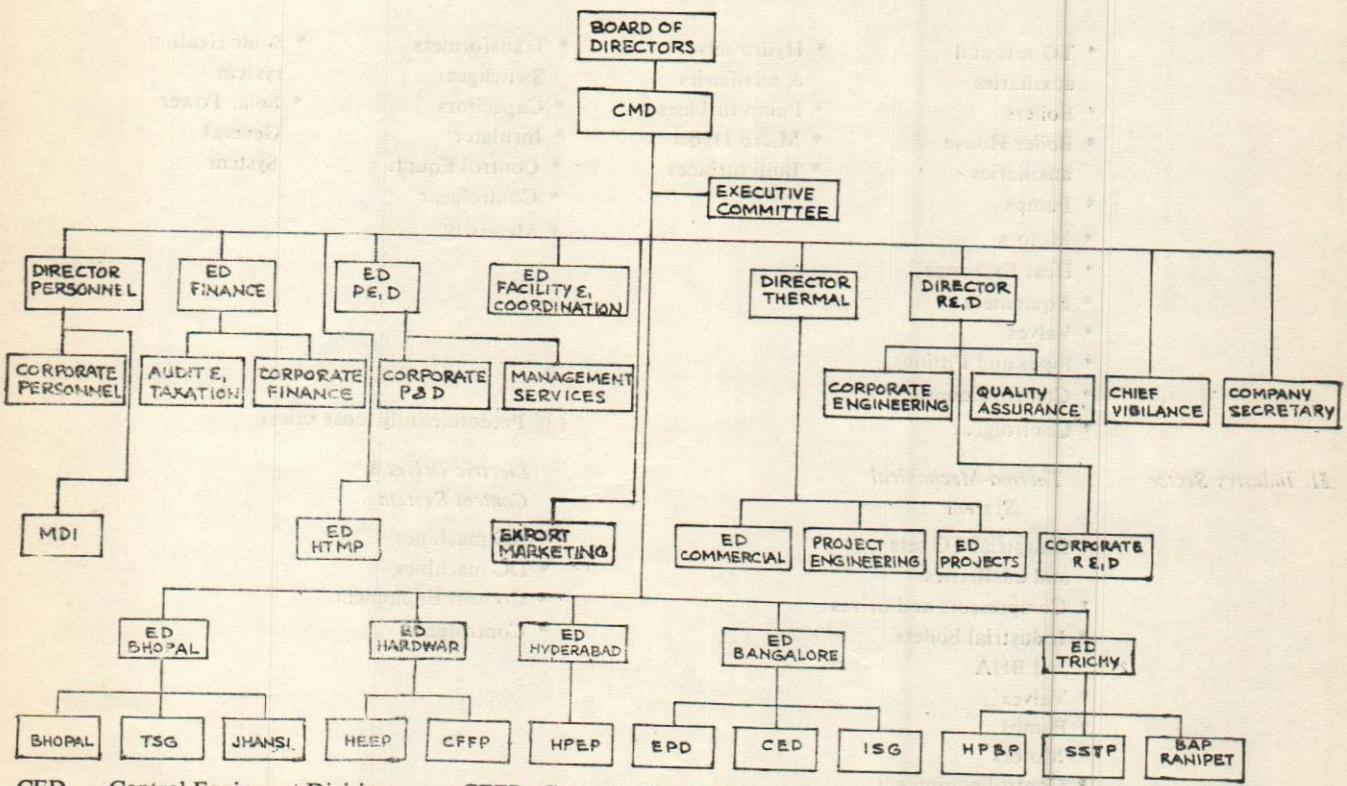
1. Existing products/systems/services which will be strengthened/may be discontinued.
2. Related products and systems which would be taken up.
3. New business areas in the sector which will be taken up.
4. Futuristic business applications in which preliminary work would be started by 1990.

As organisation development is a continuous process, BHEL can not rest content with the organisational devices and mechanisms created so far. Despite these devices, there are bound to be problems in achieving transparency among all these forums.

Every change has brought in its wake new issues and challenges to be faced. But to avoid change and opt for status quo is detrimental to the long term interests of an organisation.

For long term survival and growth, organisations

**ANNEXURE-1**




| | | | | | |
|---|---|---|---|---|---|
| CED | Control Equipment Division | CFFP | Central Foundry Forge Plant | CMD | Chairman & Managing Director |
| ED | Executive Director | HEEP | Heavy Electrical Equipment Plant | HPBP | High Pressure Boiler Plant |
| HPEP | Heavy Power Equipment Plant | ISG | Industrial Systems Group | MDI | Management Development Institute |
| EPD | Electro Porcelains Division | BAP | Boiler Auxiliaries Plant | SSTP | Seamless Steel Tube Plant |
| P & D | Planning & Development | HTMP | Hydro Transmission & Motor Products | R&D | Corporate Research Development |
| TSG | Transportation Systems Group | | | | |

**Annexure 2 : List of Product Committees and Technical Committees**

| Product Committee | Technical Committee |
|---|---|
| 1. Steam Turbines | 1. Rotating Electrical Machines |
| 2. Turbo Generators | 2. Mechanical Rotating Machines—Thermal Plant. |
| 3. Boilers | 3. Static Electrical Equipment |
| 4. Boiler House Auxiliaries | 4. Boiler, Boiler Auxiliaries and Coal Programmes |
| 5. Valves | 5. Non-conventional Energy Sources, Specialised Engineering Areas and Futuristic Projects. |
| 6. Piping | 6. Mechanical Auxiliary Equipment/Thermal Plants. |
| 7. Hydro Turbines | 7. Power Controls and Systems |
| 8. Hydro Generators | 8. Hydro Turbines and Hydro Systems Engineering |
| 9. Capacitors | 9. System Engineering. |
| 10. Traction Equipment | |
| 11. Transformers | |
| 12. Compressors | |
| 13. Industrial Turbines | |
| 14. Pumps | |
| 15. Heat Exchangers | |
| 16. Oil Field Equipment | |
| 17, Control Equipment | |
| 18. Controlgear | |
| 19. Ceramics | |
| 20. Meters | |
| 21. Switchgear | |
| 22. Motors | |
| 23. Spares & Services. | |

must be prepared to reorganise and adapt themselves to changing environmental priorities and constraints. It is in this spirit that so many changes were introduced in BHEL over the years. Organisations are composed of people which makes organisational development process complex yet exciting to tackle. This creative element has been in the forefront in BHEL in keeping the corporate strategic planning alive and vibrant. we, in BHEL hope the same will help us tide over the uncertain future with creditable performance.

*Productivity*
*1983, XXIV, 2, 165-173*

# Strategic Planning in a Small Firm

K. KITTAPPA

*The performance of an organisation, this paper emphasises, depends on the 'Strategic Thrust' that the organisation can exercise to counteract the environmental dynamics. Strategic budget is a factor of importance to Strategic Thrust and is a product of managerial capabilities and the managerial perception of the environment and the managerial aspirations. In this paper is described the performance of a Small Industry and development of a Strategy Plan for its growth and development.*

Mr. K. Kittappa is a Director, National Productivity Council.

## Strategies, Objectives & Small Firms

The economic results of an organisation depend on the 'Strategic Thrust' the organisation can exercise to counter the environmental turbulances. The magnitude of strategic thrust is decided by the strategic budget developed and the quantum of resources that could be committed. The economic result is then the result of the matching between the strategic thrust and the forces of environmental turbulances.

The strategic budget level in turn is a product of the organiation's perception of the environment, aspirations, the individual and group leadership, the organisational culture and more of the managerial and logistic capabilities. These factors are not totally exclusive and the factors like individual or group leadership and capabilities influence the aspirations which in turn affect the acquisition of capabilities.[1] The leadership more often than other factors affects the 'strategic behaviour' of the organisation. The management changes are not unusual. When the power shifts at the top, the strategic behaviour as well shifts; it may be as small change as change in budgetary behaviour, adaptation in strategies or a total shift or strategies. When Mr R.C. Geigueta took over as Chief Executive of Coca-Cola (U.S.) (1981) which was loosing its market leadership to Pepsy in U.S., and was hitherto increasing the thrust to improve the market share and saw a shift in strategy. The change was to search and stabilize in new markets rather than spending the resources on recapturing the market share!

The strategies are not merely for achieving profit.

The main objectives for which the long range planning and strategic planning are developed are 'Growth and Stability' of the organization.[2] The enterprises cannot afford to stay stagnant at the same level of business operations. They have to grow not only due to internal stresses like better dividends and frustration among employees (stagnation in posts and grades etc.) but also due to life cycles of product, technological changes in process and product, changing policies of the control factions like Government and Financing Agencies. Above all 'growth' becomes the main objective in organisations whose leadership have high aspirations, ambitions and innovative capabilities.

There can be no business without risk; especially growth plans encounter more risks, than normal operation. But a business plan cannot be developed to take blind risks; the enterprises take calculated risks in selecting their venture programmes. Many maintain a part of the existing—even though only moderately paying—business till they stabilise in new ventures. They also develop strategies to stay at the grown level of operation. All these are done to ensure 'stability'. Hence in most organisations the objectives are 'growth and stability'. Problems of small firms: These arguments on strategies and objectives suit larger firms more aptly. But the picture is very different in smaller firms. The problems of smaller firms are very different than the larger ones. The smaller firms are also constrained on the options available. A brief discussion on constraints experienced by small firms in respect of long range planning may be useful at this stage to understand their behaviour.

The work load on the owner/partner is usually heavy. He has to do almost all functions of management. Since he cannot afford to have many tiers of management, he is bogged down with day-to-day operations and trouble shooting and he finds very little time for any conceptual exercise on long range planning.

The turn-over of skilled technicians is very high especially in the trades of salesmen, designers and supervisors. In one company which produces industrial equipment this problem was very acute. In this company diploma holders and degree holders used to join the company in design cell/sales cell and after a year or two of experience they used to leave the company to join medium or large industries. This affected the progress of the company to a great extent. The reason for the turnover is not only the low remuneration compared to bigger industries but also less independence and therefore less job satisfaction due to top management's interference. Such frequent changes resulted in inadequate involvement of lower level management in the strategic management of the firm and also consume the time of top executives in selection for training etc. This also results in top management resorting to secrecy about designs, customers, financing etc. Retaining secrecy, excess interference, less job satisfaction and turnover then become a vicious circle. These factors form a positive feedback loop in which the values only increase with time.

The small firm operates with low capital. Very often managing cash flow for the normal operation itself is a big task. It is very difficult to commit resources/money for longer durations on venture strategies. Hence the strategies have to be for shorter durations and are limited by the quantum of resources available. The low level of operation does not allow experiments with risk capitals.

The market share of an individual small firm is very low. Only a few exceptional companies like the one referred in this paper have a good market share in one or two 'Product Market Combination (pmc)'. This results in heavy competition in the pmcs. Management of majority of smaller firms have reconciled to the fact that the low strategic budget—the resources and money they can afford to commit for development, promotional activities etc. will have very little influence on the turmoils of the market generated by changing market conditions/competition.

The other handicaps are information and perception. Very little information is generated and collected inside the firm. When information structures like even budgeting and costing are totally absent in these firms, we cannot speak of 'strategic information base' and 'competitive information system'. The managements are not exposed to such new ideas and suffer from perceptual limitations of not being able to see beyond the budgetary period of one year.

So it is the Operational Plan which has the higher priority than the corporate Strategic Plan in such firms.

**Going in for Strategic Planning**

Inspite or all the handicaps the small firms have, some are very successful, A few of them even have well drawn-out plans for a longer duration than the budget horizon. Why do they go in for long range plans ? The management which is ambitious, who have bigger dreams cannot be satisfied with limited results they have been achieving. They would like to widen their vista of operation and improve the performance of the firm.

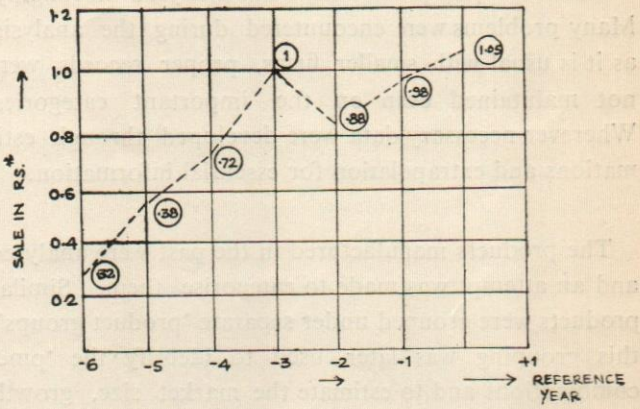
The management who think they are capable of performing better, have higher capabilities than what the firm demands to-day and better knowledge and skill cannot allow their skill to rot. They thrive for better performance and this leadership creates a 'strategic shift' in the firms behaviour.

Some others are motivated by the success others have achieved as compared to their own stagnation. Usually they resort to long range planning when major crisis strikes the firms.

**The Firm**

The firm whose case is discussed in this paper is registered as a small industry. The factory was originally a cycle parts manufacturing unit. The present owners, with capital raised through friends and relatives, floated a partnership company and bought the factory in 1971.

The cycle Manufactures and retail outlets were the customers for the products at the time of taking over. The Cycle Manufacturers in the region were patronising their own ancillary units and as such large orders from them were only ad hoc. The competition in the retail market was high. Further the retail market being very widely scattered (topographically) it needed a huge sales force. One of the four brothers who took over this company, an engineer, also had some experience in the design of material handling equipments. Hence the new owners decided to diversify into fabrication and material handling equipments business and discontinue the old products. So the reliable handling equipment company was born. We will refer to this company in short as RHE henceforth.




Sales figures are expressed as decimals of sales year under reference.

**Exhibit 1—Actual sales in the past**

In the past years the firm tried many businesses and there were many additions and deletions to the product line. Many of these changes were not planned but purely accidental. In spite of such variations in product lines the company registered a continuous growth. The management was always trying for higher sales because they knew that higher sales mean higher profit. So the management was not worried about stablising in any product or market or channelising the operation. But in the three years, prior to the year under reference, the steady growth pattern in sales was not maintained (Refer Exhibit-1). All figures in this exhibit and others are express in terms of sales in the reference year. There was a growing concern about the dip in sales value especially in the past two years. This prompted the management to seek outside assistance in analysing the situation.

The main idea behind seeking external experts help is to analyse the reasons for the failures of past and to develop sound policy for growth. The outside consultants, analysed the situation and agreed to provide consultancy. It was decided that the consultant will provide only the process and steps of planning and all the data collection, analysis etc. will be carried out by

the company personnel only. It was thus a 'process consultancy'.

**Product Growing**

The firm's past performance was analysed thoroughly. Many problems were encountered during the analysis, as it is usual with smaller firms, proper records were not maintained even on the important categories. Wherever necessary data were developed through estimations and extrapolation for essential information.

The products manufactured in the past were analysed and an attempt was made to categorise them. Similar products were grouped under separate 'product groups'; this grouping was later used to identify the 'pmc' combinations and to estimate the market size, growth rate, special characteristics of market etc. This exercise led to the identification of nine distinct product groups. The group wise sales for the past years are shown in Exhibit-2.

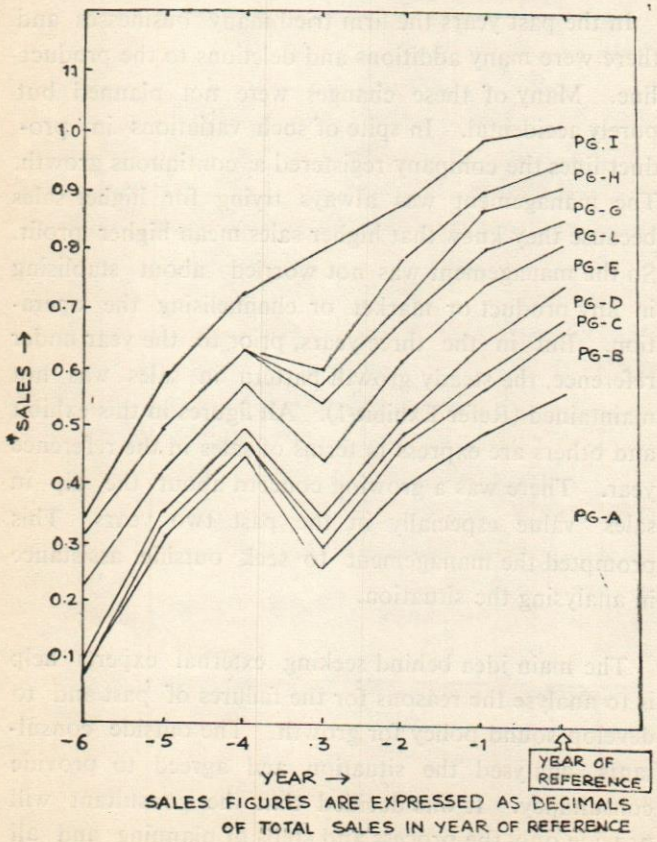



**Exhibit-2—Productwise Sales**

**Present Scene : Product, Market, Management Approach**

*Product Group-A*

Product : This is an equipment used for cleaning of underground sewer lines. It consists of two structures with drive motors which are placed above two adjacent manholes of the sewer line. Buckets attached to wire rope are pulled by the motors to clean the sewer line.

Market : The management has identified about 80 municipalities and corporations as the users.

Management Approach : RHC is the pioneer in this products. It was a monopoly product of the company for many years. Only in the last two years or three, other firms tried to market the product and only one of them succeeded in selling two units each year taking a market share of 10 per cent. The total number of machines sold is steadily increasing. In the previous year RHC and its competitor totally sold 18 equipments. But this is no indication of the market potential. Later on it was accepted that only a small portion of the market has been exploited so far. The management is too happy that they are the market leader and decided to stay at that position.

*Product Groups-B & C :*

Product : PG-B is an equipment with motor used for cleaning any blockage in the sewer line. This can be hanged from the shoulder of a man and with required length of chromoflex rods (PG-3) and special attachments at the other end of rod, the blockages can be cleared. PG-3 is rods used for this equipment and also sold as accessory and replacement.

Market : Same as Product Group A

Management Approach : Same as PG A

*Product Group-B .*

Product : This group is small wheel barrows supplied in large quantities usually above 50 nos.

Market : Large industries and civic bodies.

Management Approach : The internal work load is much less and the profit margin is also good. Management does not try hard to get the orders but never refused any enquiry received.

*Product Group-D :*

Product : This group is winches of different sizes. No standardisation has been attempted. Each time the product is designed and manufactured as per order specification.

Market : There are two markets for this product. One is railways where the winches are used to haul wagons for shunting. The other is shipping where it is used for handling shipways and ladders. There is recession in this market.

Management Approach : Comparatively the volume of sales is low but would like to continue.

*Product Group-F :*

Product : This group is cranes. The company tried many types of cranes and faced technical design problems. Finally they settled down for overhead travelling cranes only. Recently there developed a stiff competition for this product.

Market : The customers for this type of cranes are the medium and small industries. Since the product is simple to manufacture tiny industries started under 'unemployed graduates scheme' have entered this market. With their low overheads they are able to quote low and bank most of the orders. RHC has realised the slipping of the market and has been quoting low to establish itself back in the market. RHC is successful in winning a few tenders.

*Product Groups-G & H :*

Product : Recently the firm had a few orders for the manufacture of Screw Conveyors and Bucket Elevators for handling powdery material from sugar and other sectors.

Market : Sugar and chemical factories.

*Product Group-I*

Product : This group includes all miscellaneous orders handled by the company like fabrication of air conditioning ducts, water tanks, etc.

Market : Miscellaneous and difficult to specify as the jobs are accepted from all sectors including construction sector.

Management Approach : The profit margin is very high with this product but acquiring orders is difficult. The management likes to continue this product and more so to increase sales in this field.

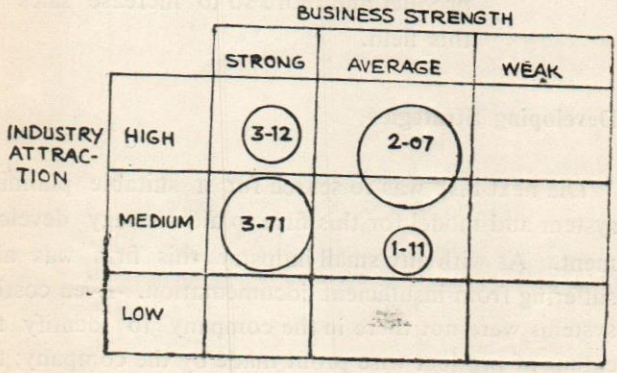
**Developing Strategies**

The next task was to search for a suitable planning system and model for this firm to aid strategy development. As with any small industry this firm was also suffering from insufficient documentation. Even costing systems were not there in the company to identify the extent of product wise profit made by the company; the consultant had to generate information to compute the input resources requirement for each product and the profit. Further the company cannot afford to generate information and maintain any elaborate planning system. Forecasting for a longer horizon like 5 to 10

years may produce too hazy a picture which may not be useful.

A few approaches in strategic planning models have already been tried world over for decision making on 'business operation level adaptation' and integrating planning needs successfully. To name a few, Business Screen Matrix developed by General Electric Company, Business Portfolio Matrix by Boston Consulting Group, Model for small firms by Lemmens smeet, and TOWS Matrix by Heinz Weihrich. There is also another simpler approach which recommends writing down the strength weakness etc. separately and listing down the appropriate strategy and the strategic implication and later evaluating the strategies. These methods are briefly described in subsequent paras.

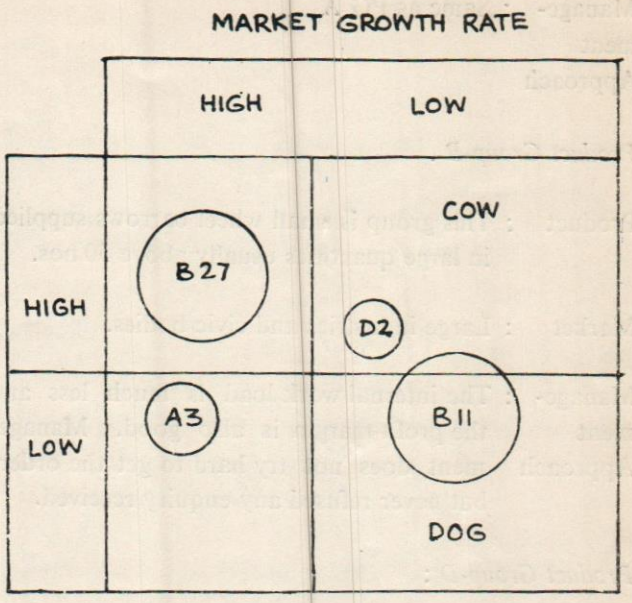
Business Screen Matrix: General Electric developed and used a matrix[3] to aid the strategy designers in developing and evaluating strategies. Exhibit-3 shows GE's Business Screen Matrix. Basically it consists of two sets of critical variables. Business Strengths and Industry Attractiveness. Each variable is divided into three ratings-high, medium and low-with a result it is a nine cell grid. The position of any product of the company in any specific grid cells is its comparative position in the two variables—Business Strength and Industry Attractions. A few factors used to evaluate the product position against the two variables are listed below :




BS—Relative Mkt share, price competitiveness, product quality competitor information, sales effectiveness. share of market

IA—Market size/growth rate, profit margin, competitive intensity, cyclicality, seasonality, scale of economics

**Exhibit 3—Business Screen Matrix (GE)**




**Exibit 4—Business Portfolio Matrix**

| | |
|---|---|
| Business strength | Industry Attraction |
| Relative market share | Market size |
| Price competitiveness | Growth rate |
| Product quality | Profit margin |
| Knowledge of customer | Competitive intensity |
| Sales effectiveness | Cyclicality |
| Geography | Scale of Economy |

This model needs a strong information base, to feed the factor and locate the product in the grid cells. Further this matrix analysis does not give adequate attention to new industries that are beginning to grow.

Business Portfolio Matrix : Boston Consultancy Group developed another matrix (Exhibit-5) which essentially shows the linkage between the business growth rate and the relative competitive position of the enterprise (identified by the market growth rate and relative market share) (3,4). This matrix is also called as Growth Share Matrix. As shown in Exhibit-4 it contains only four grid cells. However, this approach has been criticized as too simplistic and the growth rate criterion has been considered insufficient for evaluating the industry's attractiveness. Similarly the market share as a yardstick for estimating the competitive position may be inadequate.[5]

TOWS Matrix : To overcome the handicaps of the above two matrices and also other matrices like 'competitive position, vs stage of product/market evolution carrying out a situational audit and writing down a few important strengths, weaknesses, opportunities and threats. Then they are incorporated in the matrix

| INTERNAL → FACTORS / EXTERNAL FACTORS ↓ | INTERNAL STRENGTHS | INTERNAL WEAKNESSES |
|---|---|---|
| | S1 — ..... | W1 — ..... |
| | S2 — ..... | W2 — ..... |
| | S3 — ..... | W3 — ..... |
| | ↓ | ↓ |
| EXT-OPPORTUNITIES | → SO : MAXI-MAXI | → WO : MINI-MAXI |
| E1 — ..... | 1) | 1) |
| E2 — ..... | 2) | 2) |
| E3 — ..... | 3) | |
| E4 — ..... | | |
| | ↓ | ↓ |
| EXT-THREATS | → ST : MAXI-MINI | → WT : MINI-MINI |
| T1 — ..... | 1) | 1) |
| T2 — ..... | 2) | 2) |
| | 3) | |

**Exhibit 5— Tows Matrix**

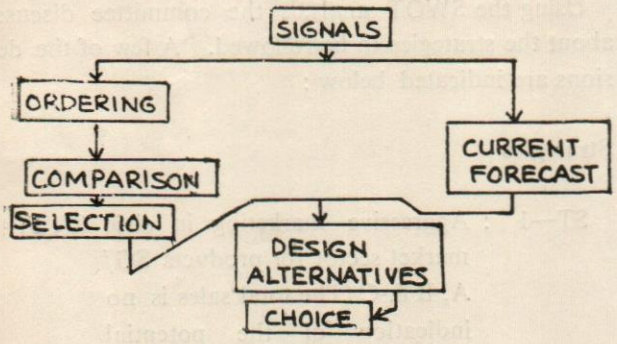



**Exhibit 6—Lemmens Smeet Model in Strategic Decision Making**

Matrix' (CW Hofer & D Schendel), 'Structural pressure Vs Financial Pressure Matrix', 'Degree of discretionary response potential *vs* Degree of predictability Matrix', which are developed for different specific purposes, Professor Heinz Weihrick[5] suggest TOWS Matrix for strategy development. The general format of this matrix is shown in Exhibit-5. This involves and the strategies are then thought of and written in the four grids. In the grid '50' strategies to maximise the use of strength with any matching opportunities (Maxi-Maxi) are written and so on. This helps in developing strategies to use the opportunity or strength and at the same time ensure 'synergy'. Further it helps in eliminating those which contravene with the threats/weaknesses vice versa.

Lemmens Smeets model for small firms : Mr Arie Nagel in an article based on the work carried out in about 50 firms presents a much simpler model for strategy formulation for the smaller firm (b) The model is shown in Exhibit-6.

**Approach Adopted and Findings**

The firm under discussion is a small firm with almost no information documented about the past. As usual

with smaller firms, here also management have thought of policy planning due to a signal-in this case it is stagnation in sales etc. The planning process may be acyclic. Hence the management and the consultant agreed to avoid any elaborate planning procedure and use a simple system which could be maintained by the internal personnel after the consultant leaves. For the purposes of developing the strategies and integrating a simple approach similar to Lemmens Smeet model and TOWs Matrix was originally adopted in this case.

**Exhibit 7—Productwise analysis**

| Product Group | Price Rs. 1000 | Profit Contribution | Own Sales | Market Share | Growth in Demand |
|---|---|---|---|---|---|
| A | 80 | High | High | High (90%) | High |
| B | 25 | High | High | High (80%) | High |
| C | | Medium | High | Medium | High |
| D | 0.5 | High | Low | Low | Medium |
| E (Ships) | 30 | Medium | V.Low | Low | Low |
| (Railways) | 50 | Medium | Low | Low | High |
| F | 80 | Negative | V.Low | Low | Medium |
| G | 200 | High | Low | V. Low | Medium |
| H | 180 | High | Low | V. Low | Medium |
| I | | High | Low | V. Low | Medium |

Simple models ( manual ) were first developed to compute the work load, cost of material etc. required for each of the product group and to estimate the profit contributions. Past records were analysed to get the number of tenders received, quoted, matured and to compute the maturity ratio. Information were collected on market conditions through discussions with outside agencies, salesman and secondary information sources. The same are given (without figures) in Exhibit-7.

A series of management meetings were conducted to carry out SWOT analysis. The findings are listed below:

**Strengths**

S1 Good design capabilities.

S2 Comfortable cash flow position with bill purchasing facility from bankers.

S3 Market recognition in products PG/A, B & C and high market potential.

S4 Company's present status—registered as small industry.

**Weaknesses**

W1—High turnover of technical personnel

W2—Disorganised Sales force

W3—Costing & Labour control information

W4—Products are easier to copy.

**Opportunities**

Q1—Growing markets for products PG/A, B, C, E (Railways) G & H

Q2—Competitors for products PG/A, B & C are not very aggressive

Q3—Acceptance and success of PG-G & H by customers

T1—Imitators entering the market in PG/A, B & C

T2—Competitors with small overheads for product PG-F

T3—Competitive market structure generally for all products

Using the SWOT analysis the committee discussed about the strategies to be followed. A few of the decisions are indicated below :

**Strategies**

ST—1 : Aggressive marketing in civic *01*, *S1* market sector for products SG/A, B & C (The total sales is no indication of the potential demand which is much higher. Conduct demonstrations, participate in exhibitions, advertise the name of present users and and regular sales cells)

ST—2 : Develop the new market for *S1*, *W4* product Sh—A, i.e., with big *01*, *T1* housing colonies of industries,

Develop industrial use market for product SG-B and C, i.e., chemical/process industries.

ST—3 : Make sub-assemblies of SG-A & B and keep ready instead of of manufacturing to order *S2, 01*

ST—4 : Introduce special technical features and patent them for product PG-A & B. Develop total wagon handling systems and sell to Railways instead of selling only the winches. *S1, S3, 01, T1, $T_3$*

ST—5 : Discontinue sales to shopping market (SG-E) and sales of product PG-F *T4, W5 T2, W5*

ST—6 : Reorganise sales force. Train & have 'product salesmen' for PG-A, B & C and 'common salesmen' for all other products regionwise & sectorwise. *W2, 01*

**Long-Range**

ST LR : Develop PG-G & H for perfection Obtain collaboration for products like load markers cleaners, etc. for civic market.

Based on the above and other strategy guidelines a plan was prepared. All the input expenses required including additional manpower, sales expenses etc. were incorporated and the total short term and long term loan and capital restructuring required were worked out. A series of discussions were held with the partners/ bankers to see the feasibility of raising funds. Bankers agreed to raise the bill purchasing facility limit but not to the extent the company required. The plan was revamped taking into consideration all the constraints.

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# Perceived Role Stress and Employees' Productivity

DR. A.K. SRIVASTAVA

*The study aimed at determining whether or not the employees' potentiality to produce comparatively more influences their perception of role-based stress. The results indicate that the employees belonging to high and low production groups significantly differed from each other, with regard to their indices of perceived role stress. The employees producing more were observed to perceive lesser ambiguities, conflicts and workload with respect to their job roles as compared to those belonging to low production group.*

Dr. A.K. Srivastava is in Department of Psychology, Banaras Hindu University, Varanasi–221 005.

The employee in organization is not absolutely independent in performing his prescribed job activities. He has to perform in accordance with various relevant communiques and expectations of the others around him at job. Thus, performance in organization is not contingent upon only the task activities and behavioural settings, but also upon patterns of 'interpersonal connectedness' within which those task performances take place. The prescribed job activities that get to be performed in context of the organizational interpersonal connectedness are referred to as 'job role'. But on certain occasions and to certain employees the demands of the job roles might prove to threaten to exceed occupants' capabilities. A psychophysiological state of the employee resulted in by the demands imposed by job roles which threaten to exceed his capabilities may be denoted as role stress or role-based stress. Analysing the dimensions of role stress Kahn et al. (1964) and McGrath (1976) identified 'role conflict' and 'role ambiguity as its two major sources. Besides the two, perceived 'role overload' has also been reported to be a subform of role conflict.

Role stress is not an absolutely objective phenomenon, rather it is subjectively experienced, as it is contingent upon the employee's cognitive appraisal of the stressing agents. The emotional, physiological and behavioural responses viewed as indices of subjectively experienced stress are greatly influenced by employees interpretation of the objective stress situations, which, to a great extent, depends upon his relevant personal attributes

experiences. Among others employee's production capability might prove to be a prominent factor to extend significant effect on his perception of and reactions to role stress.

In the present era of high stress and anxiety there has been much emphasis in research on organizational stress : its causes, correlates and effects on job behaviour. A number of studies have highlighted the effect of stress, general as well as specific, on task performance (Hebb, 1955; Easterbrook, 1959; Cofer & Appley, 1964; Lowe, 1971; Lowe and McGrath, 1971; Greene & Organ, 1973; Schuler, 1977; Srivastava, 1980). But the proposed study purports to alternatively conceptualize the stress-performance (production) relationship, considering the second as the determinant of the first rather than vice-versa. In the framework of theoretical propositions, it is hypothesized here that the employees attributed with high productivity, due to his high motivation and confidence to adequately meet the exceeding demands of job role, would be perceiving and experiencing mild role stress as compared to those possessing low production capacity.

## Methodology

*Sample* :—The sample of the study consisted of 60 skilled workers from the mechanical section of the Diesel Locomotive Workshop, Varanasi. The subjects were randomly selected from two specific groups, i.e. constantly high producers (N=30) and low producers (N=30) from the high and low production groups. The categorization was made on the basis of personnel production records of last one and a half year. The recorded production indices were also verified by the employees' assessment by their supervisors. The average of the "hour-saved" by the high production group has been 84.772 ($\sigma$=4.058) while it was only 39.712 ($\sigma$=8. 569) for the low production group. The two groups were kept comparable to each other with respect to the average age, length of service and salary of its members.

*Variables and Measures* :—The study involved measurement of two variables, i.e. productivity (I.V.) and role stress (D.V.). The official production record' was taken as an objective criterion for determining employees' productivity. The 'hours saved' by the employee in completing his assigned task in a period of six months was taken as an index of his productivity.

To ascertain the extent of employees' perceived role stress three sub scales of the Occupational Stress Index (Srivastava & Singh 1981) were used. The stress arising from role overload, role ambiguity and role conflict were taken into consideration to work out an index of role stress. The high and low production groups were compared with each other with regard to their indices of perceived role stress.

*Results* :—The results obtained out of the statistical treatment of the data are recorded in the Table 1 and 2.

## Discussion

A perusal of the results of the present study categorically establishes that the employees maintaining a constantly high production level by virtue of their attributed productivity perceive and experience lesser stress arising from their job roles, whereas, the employees producing constantly low do contrarily. It is apparent from Table-1 that the high and low production groups of the employees significantly differ from each other with regard to their indices of perceived role stress arising from role overload, role ambiguity and

**Table 1 Comparison of the High and Low Production Groups with regard to their Perceived Role Stress**

| Production Groups | Perceived Role Stress | | | |
|---|---|---|---|---|
| | N | X | $\sigma$ | C.R. |
| | *Perceived Role Overload* | | | |
| High production group | 30 | 15.00 | 4.04 | 3.55** |
| Low production group | 30 | 18.57 | 3.73 | |
| | *Perceived Role Ambigutiy* | | | |
| High production group | 30 | 10.03 | 2.69 | 3.89** |
| Low production group | 30 | 12.97 | 3.12 | |
| | *Perceivcd Role Conflict* | | | |
| High production group | 30 | 12.40 | 3.14 | 3.86** |
| Low production group | 30 | 15.63 | 3.36 | |

**p>.01

**Table 2 : Correlation between indices of production and perceived role stress of the employees of the combined group (N=60).**

| Variables | r |
|---|---|
| Production and perceived Role Overload | −.28* |
| Production and perceived Role Ambiguity | −.37** |
| Production and Perceived Role Conflict | −.37* |

**p>.01
*p>.05

role conflict. The results also indicate inverse relationship between the two variables studied here. The obtained results confirm the proposed hypothesis, and alternatively conceptualize the stress-performance (negative) relationship.

The findings of the study may be explained with reference to the fact that the cognitive appraisal of the objective role stressors of high producing employee is influenced by his positively prejudiced job attitudes, resulted from his self confidence to cope with exceeding, and conflicting demands of the job roles and his high n achievement. Atkinson and Feather's (1966) postulations that high n achievement generates attraction for the task and that people with high index of n achievement voluntarily use and get tested their abilities and are attracted towards comparatively difficult and risky tasks with less apprehension about failure, suitably explain and interpret the findings of present investigation. Besides, the employee frequently facing and successfully meeting with the exceeding demands of job roles becomes 'stress resistant'.

Another prominent fact which emerged out of the study is that the stress arising from role ambiguity is perceived and experienced is least as compared to the stress caused by role overload and role conflict by the employees belonging to high productivity group. The perception of role ambiguity has been observed to be moderated to the maximum by the effect of employee's high productivity. Since role ambiguity is a direct function of the discrepancy between the information available to the employee and that what is required for adequate performance of his job roles, a highly productive employee is more likely to be more competent, well informed, and quite clear and confident about his job role and its execution, and therefore, perceives the stress arising from role ambiguities in the least.

It may also be argued that the high producing employee, as being quite confident of retaining his job, as well as of getting due promotions, does not tend to be uncertain and anxious about his 'job security' and 'advancement-opportunities'. Ambiguity also comes from high rates of changes in job role, technology, and organizational environment. But the high capacity to adjust with the demands of new situations of the potential employee makes him "immune" to particularly such stress as arising from immediate changes in the job role and work environment.

The notion of a positive relationship between productivity and job satisfaction also helps explaining the present findings. Since the high production leads to job satisfaction (Locke, 1970; Porter & Lowler, 1968; Ford, 1969; Siegal & Bowen, 1971), and job satisfaction negatively correlates with stress arising from role conflict (Miles, 1975; Schuler, 1975) and role ambiguity (Lyons, 1971; Green & Organ, 1978; Miles, 1975; Schuler, 1975; Beehr, 1976), the employees' high productivity may also be supposed to be negatively correlated with their role stress.

McGrath's (1970) formulation that perceived reinforcement or consequences of the performance can operate to reduce the level of subjectively experienced stress seems to have applied here. As the highly potential employees, selected for the present study, have been receiving 'extra wages' for their excessive production. The perceived monetary reinforcement for their efficient performance would have operated to influence the employees' perception of stress arising from job roles and its subjective experience specially in the present times of economic predominance.

**Conclusion**

The results of the study enable us to conclude that the employees' potentiality for better job performance influences, their perception of work-load, ambiguities and conflicts relating to their job role. The employees producing more, by virtue of their high coping capacity

and motivation, perceive lesser role stress as compared to those maintaining low production level. Therefore, it may be established that not only the perceived role stress influences employees' job performance but their performance level also determines their perception of role stress to a considerable extent.

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# Management of Research and Development

Dr. G. C. BERI

*In recent years, research and development activity has been receiving increasing attention. However, mere quantitative expansion of this activity will not be enough. What is required is to ensure proper selection, completion and commercial application of research and development. In this respect, management can play an effective role. This article highlights the role of management in handling some major problems such as the selection of research personnel and research projects, research budgeting and linkage between technical innovation and marketing. It finally emphasizes the need for a forward looking management so that it can really be a catalyst for research and development activity.*

Dr. Beri is Professor and Head, Faculty of Commerce, Lokmanya Tilak Road, Baroda—2.

**R & D is Growing in importance**

In the modern world, there is an increasing awareness not merely of the importance of technological innovation but also of the various related problems. This is evident from a plethora of literature available on the subject. There is an imperative need for technological innovation in developing countries so that they can bring about desired improvement in the standard of living of their people.

Research and Development (R & D) activity leads to technological innovation. It can be undertaken by such agencies as business and industrial firms, research institutions and cooperative bodies like trade and industry associations. However, mere promotion of R & D activity in quantitative terms is not enough. What is required is that R & D activity should be meaningful, successfully completed and finally exploited commercially. In this respect, the role of management is crucial but it does not seem to have been fully recognised and understood. The present article attempts to highlight the role of management in R & D activity and discusses some major areas where management is required to do decision-making. Although its main focus is on R & D activity of industrial firms, many of the observations made here are also applicable to research and development undertaken by research institutions.

In view of the increasing magnitude of R & D expenditure in Indian industry, it has become all the more necessary to ensure that industrial units get the maximum benefit from it. An important factor that

does not allow them to take the fullest advantage of their R & D activity is its poor management.

Further, research and development is a joint effort where several persons are involved. In a team work, it is necessary that there should be proper understanding among the members. This calls for proper organisation, effective communication and purposeful direction of R & D activity. That is to say, principles of management become relevant for conducting R & D smoothly.

In the United States, an extensive study on R & D Productivity[1] was undertaken. It was carried out in two phases—1973-74 and 1975-77, the latter having a wider coverage. The study covered a large number of industrial organisations, R & D managers, prominent consultants, etc. Its findings clearly emphasize that productivity of R & D activity, *inter alia*, depends to a large extent on the management especially the top five percent of its technical staff—persons who possess deep insight in their areas of specialization, provide innovative ideas for further exploration to the staff, sound and crucial judgement and who are the decision-makers. It has emphasized that in the years to come greater professionalism in R & D management will be needed. At the same time, it should be realised that management of R & D activity is not so easy as it might seem at first sight. This is because it deals with something unknown and which has no existence at the moment. There is an element of risk in the very nature of R & D activity which makes its management all the more demanding and challenging. It is true that experts in a chosen field where R & D is to be undertaken would give serious thought to the extent of risk involved before finally deciding in favour of that activity. But the fact remains that there is an inherent element of risk in the very nature of R & D activity.

Management's first obligation is to recognise its own role as a catalyst for R & D activity. This implies a basic understanding of the R & D process. It has been observed by Michael Shanks that research has proved most successful where management has been most emotionally and intellectually committed to its success. It has also flourished where there is a certain fluidity and flexibility in the company structure, which permits the interplay of personality and ideas, and where management is psychologically ready to alter existing plans and patterns to accomodate change and innovation.[2] Thus management must be forward-looking and committed to research and development. If the management itself does not have its full faith in R & D activity, how can it inspire confidence amongst its technical personnel for research, development and innovation ?

**Need for Specific Personnel Policies**

The role of top leader in R & D is very important. There does not seem to be sufficient recognition of this. It is worth emphasizing that in many innovations it is the individual—a technical enterpreneur—who plays a key part. A study, based on ten innovations in the materials field, found that there was "a single champion who could claim responsibility and credit for seeing through the idea from germination to ultimate exploitation".[3] An organisation which offers sufficient freedom to the top people to pursue R & D activity in their own way would be more successful in innovation. Such an organisation should be people-oriented rather than product-oriented, and the people around whom the organisation is built enjoy the freedom to move about within their disciplines, from discipline to discipline, and from research to development to testing and engineering.[4]

In order to ensure that R & D personnel perform well and contribute their maximum towards the success of their research work, the firm must have a congenial environment. It is not merely physical facilities that form the environment but many other aspects should also be looked into. Officialdom and bureaucratic approach must be avoided. There must be freedom for exchange of views with each other on an informal basis. R & D personnel should feel that there exists a professional atmosphere which offers sufficient challenge. In the evaluation of their work, absolute objectivity must be adhered to and merit should be recognised and awarded. This will act as an incentive to hard working and competent people. Under such conditions, it will be possible to retain highly qualified and competent R & D personnel—within the organisation. At the same time, it may be desirable not to offer too much security of job. This may lead to complacency on the part of permanent employees; their services may continue on

the basis of their performance. Perhaps, it would be better to offer contractual appointment for a period of 3 to 5 years subject to renewal from time to time on the basis of a satisfactory performance. Too much security of job is as much harmful as excess of insecurity leading to continuous tension and anxiety on the part of the employees. The organisation should be able to develop a good system in this regard.

Many a time it has been noticed that there is lack of direction of R & D activity. While assigning the work to employees, they must be told the objectives behind it and how its fulfilment is important for the firm. Mere selection of certain problem for R & D and assigning it to the staff are not enough. There must be proper direction from time to time though excess of it is to be avoided. The latter will dampen the spirit of initiative and inquisitiveness of the employee which are so important in R & D activity.

Another aspect in regard to the human factor is that of technological obsolescence. In a society where new technical developments are taking place frequently, it may not be surprising if an R & D employee finds his knowledge obsolete unless he keeps himself abreast of such developments. Technological obsolescence will bring down the morale of the employee who will lose his self-confidence and will feel handicapped by such negative feelings. It would, therefore, be desirable for the management to impress upon R & D personnel to be up-to-date in their respective fields of specialisation. Occassionally, seminars and symposia may be arranged. It should be obvious that it is the R & D activity that leads to technological development and innovation, as such technological obsolescence cannot be tolerated in this activity itself. Persons, who tend to become obsolescent and thus are not able to contribute much to R & D activity should either be withdrawn from it or else be given some type of orientation. Suitable training programmes both within and outside the organisation should be devised for such people. Management should aim at developing them to the extent possible.

In this context, the findings of a study on industrial R & D may be cited. According to a study done by Ashok V Desai, most of the companies covered by it in a survey of industrial R & D in India have no personnel policy and "the idea of recruiting scientists with certain qualities and building up their capability overtime—of investment in human resources—is virtually absent. When questioned (during the course of the survey), most companies were of the view that turnover in their R & D departments was too high to permit long-term personnel development."[5]

These observations based on a field survey point out that Indian management has not made serious effort to develop a conducive personnel policy in respect of R & D activity. In fact, rapid turnover of R & D personnel should itself suggest that there is need for improvement in the environment in which they work. In this regard, a point that needs to be emphasized is that management should endeavour to increase creativity of the R & D personnel. A number of more or less formal methods[6] are now available for enhancing the problem-solving insight and creative capacity of individuals. These methods can be tried out and those which yield good results may be followed by management to encourage creativity of its R & D personnel.

**Basic or Applied Research**

A crucial issue in R & D activity is whether the management should promote only applied research or basic and applied research. In the latter case, a further question is how much of each type of research is to be undertaken. Though industry cannot be equated with university where most of the basic research is carried out, the former must do basic research as well. It must undertake enough basic research to keep its applied research healthy.

The emphasis to basic and applied research will vary from industry to industry and from one unit to another within the same industry on account of such factors as technical competence of the R & D personnel, availability of financial resources, size of the industrial unit, etc. It should be realised that basic or fundamental research, which does not give any practical advantage to the company in the immediate future, should not be given up altogether. This would otherwise lead to dissatisfaction among top scientists and engineers who may go elsewhere to have greater scope in basic research.

### Choosing A Project

Then comes the question of right selection of a research project. How does one identify a problem which is not only researchable but also has a growth potential for the enterprise ? Is it the top executive who identifies a problem to be taken up by his enterprise? In several cases, many persons are involved in the process of selection of a research project. It will be advisable to form a good team comprising engineers, scientists, marketing experts, etc., to identify researchable areas. It should also be clear that in the beginning only a broad area of research has to be ascertained. It is only when one gets along in that area and some work has been done that there will be greater clarity in one's thinking. This will then help the firm in identifying the problem on which work is to be carried out. Normally, the choice of a project will be dictated by a variety of factors such as the technical competence of the staff, financial resources available with the firm, market potential and profitability of the venture, etc. In almost all cases, technical-cum-market-oriented investigation has to be undertaken. This aspect is discussed later in this article.

### Social Responsibilities of Research in Business

There is an increasing realisation in the society that business should discharge its social responsibilities. Many enlightened business organisations have given serious thought to this aspect and come out with specific programmes to improve the social environment. Since R & D is an integral part of business activity, it is desirable that it is in conformity with the social objectives. For instance, our policy in recent years has been that of import substitution and export promotion. In view of this, management should give greater priority to projects falling within these categories. Similarly, research pertaining to control of air and water pollution should be given precedence over other types of research. The point to emphasize is that management's awareness of social problems and its concern to find suitable measures to overcome them should, as far as possible, be reflected in the priorities of its R & D programme.

### Budgeting in Research

In order to decide the funds for allocation to R & D, the first step is to formulate the broad guidelines of the R & D programme that fits into the overall objectives of the firm. To begin with, it may be advisable for the firm to set both maximum and minimum levels of funds that can be devoted to its R & D activity. These limits, in the initial stage, will be rather approximate and may be arrived at in consultation with R & D executives and the management of the firm. The final budget on R & D activity should be built up by carefully scrutinizing and assessing the requirement of each project. "The minimum programme must be large enough to insure that the company's desired competitive position within its intended industry niche is maintained. A maximum is set on programme size by the rate at which the company can organizationally and financially assimilate new technology."[7] Within these two limits, the firm may profitably use a few guidelines in making its initial budget estimate.

These guidelines are: (i) A specified percentage of sales may be decided. (ii) Budget may be mostly guided by the R & D effort of major competitive firms though many a time such information may not be available. (iii) The firm may apply the same rate for research budget as it has planned for its growth. For example, if the firm intends to achieve an overall 10 per cent growth in its operations, then it may enhance its research budget too by the same percentage. (iv) The firm may arrive at the overall research budget by aggregating the budget for all the research projects. Each project should be considered on its merit. This involves the estimation of overall budget by working from bottom to the top. (v) The firm may follow the "Strategic missions" approach, which involves first the setting of broad strategic goals by the firm such as market penetration and profit goals for each product line, cost reduction goals, public image goals, diversification and flexibility goals, etc. It then decides on the R & D activity which supports these goals. The firm continues to allocate funds to a particular R & D activity as long as it is satisfied that the activity will further the cause of its strategic goals.

The last two approaches are obviously far more comprehensive than the earlier ones. It may be mentioned here that many other methods are also used by firms to determine their research budget. These approaches are mostly based on formulae for estimat-

ing the profitability of new research projects. However, such approaches should be used with great understanding and caution. These should not be used simply because they are available. Generally, when numerical methods are used, one is likely to be carried away by their results in total disregard to experience and judgment.

Once the overall research budget has been determined, the question of detailed budgeting arises. This involves the allocation of funds to different items such as salary and allowances of R & D personnel, travel cost, material cost, etc. A large part of the funds is obviously in the form of salary and allowances of R & D personnel. Apart from this allocation, the firm is also required to draw a capital budget indicating the proposals for acquisition of capital equipment required for conducting R & D. It may be necessary at this stage to balance and reconcile various estimates to yield the overall figure. For this purpose, the management has to discuss various apects of R & D programme with the R & D executives and other concerned officials.

It may be advisable to undertake periodical reviews of the budget in the light of progress achieved in R & D and any other additional information that has become available. Management should critically appraise the progress attained and examine whether it is commensurate with the expenditure incurred and with the detailed programme formulated earlier. While review of progress is necessary so that necessary corrective measures may be taken before it may be too late to do so, it should not be very frequently undertaken. Sufficient time must be given to R & D personnel to carry out their work without any fear and tension.

A periodical review and appraisal of R & D activity by the management will avoid the wastage of scarce resources and ensure their effective utilization. In this connection, management should set up a system of accountability among R & D personel. This could be a very effective instrument of control.[8] Apart from this it is desirable to undertake an overall cost-benefit analysis of R & D activity on an annual basis. However, this cannot be taken up initially—sufficient time, say, three to five years, should lapse before it is undertaken. But, once it has been introduced, it may be undertaken on an annual basis. This too will enable the firm to avoid wasteful expenditure.

**Technical Innovation and Marketing**

Finally, it may be emphasized that market potential is an important factor contributing to the extension of R & D activity to commercial exploitation. Innovation is a two-sided activity which has been compared to the blades of a pair of a scissors. On the one hand, it is concerned with scientific and technical knowledge as a result of research. On the other hand, it involves the recognition of a need, more or less in economic terms, that is, market potentiality.

It may be noted here that the literature on innovation abounds in both the aspects. There are people who emphasize original research and innovation and disregard altogether the marketing aspect. Such an approach has been called as 'science-push' theories of innovation. In constrast, there are people who emphasize the demand aspect. This approach has been called as 'demand-pull' theories of innovation. Instead of entering into controversy as to which of the two approaches is correct, what is required is an attempt to combine both the approaches. Management of R & D should be able to see both technical feasibility and market potentiality and establish a meaningful link between the two.

However, there does not seem to be sufficicnt recognition of the market potential as an important factor for the successful innovation. Aaron J. Gellman observes that "the role of market analysis and marketing explicitly in support of technological innovation seems little appreciated by those involved as innovators and by senior policy-making and decision-making executives."[9] Though this observation was made in a symposium held in 1969, it still seems to be valid since marketing aspect is not yet fully appreciated.

In this connection, it is interesting to note that the size of market is important as it will ensure sufficient demand for the new product. In several cases innovation could not be commercially exploited in Britain because of the small size of its market. In contrast, the American market, being not only geographically large

but also richer than the British market, led to the commercial exploitation of innovations in both consumer and capital goods. It has been reported that this phenomenon "has been true especially of fast-moving technologies with rapid obsolescence, where the first into the market makes monopoly profits; with prices descending, the late comers find the going hard."[10]

While the availability of a large market is a must for commercial exploitation of innovation, one cannot say that large firms always have an advantage over small ones in respect of R & D activity. Many a time, a small firm has been found to be far ahead in R & D activity on account of certain reasons. First, its small size makes it more compact in the sense that more cordial relationship among junior and senior staff exists. Secondly, it has more effective communication system at all levels. This enables its employees to appreciate how a specific R & D activity fits into its overall objectives and strategies.

So far as the Indian industry is concerned, marketing aspect has remained rather neglected. Many findings of R & D have remained on paper and could not be commercially exploited mostly because of lack of market potential. It seems that R & D activity of research institutions is subject to this limitation in a greater measure than that of business and industrial firms.

**Concluding Remarks**

To sum up, management of R & D activity is a crucial input on which its success largely depends. However, it has not yet received the attention it deserves. This is especially true in case of developing countries like India. In regard to R & D, management has to address itself to various tasks. To begin with, it has to set its R & D objectives in keeping with the overall corporate objectives. This is to be followed by selection of research projects, recruitment of R & D personnel, their retention and development in the organisation. Further, management has to determine the overall research budget and its allocation to various projects. Also, periodical reviews are to be made so that progress made in R & D can be appraised and corrective measures, if necessary, can be taken. Finally, management has to assess the marketing potential and set up linkages between R & D Projects and marketing.

Since these tasks are complex and inter-linked, they call for detailed and almost simultaneous consideration of numerous factors necessary for a proper decision-making. However, management that is devoted to the cause of R & D can well look after these tasks provided it is competent and vigilant. A forward looking management can play a major role in hastening the pace of technological innovation.

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# Productivity Evaluation in Public Sector

S. A. KHADER

*This paper presents a formal mechanism to evaluate the Productivity Performance and also a case of application of the mechanism in a Public Undertaking.*

Mr. S.A. Khader is Director, National Productivity Council, New Delhi

## Evaluating Productivity Performance

Managements of organisations particularly in public sector have been striving to integrate productivity objectives with performance objectives and organisational goals. During recent years, the strategic plans of organisations have been including the establishment of Work Study/Industrial Engineering/Management Services/Corporate Planning functions in order to systematise and strengthen their efforts. Organisations and Institutions like BPE, SCOPE, PECCI, NPC, BHEL, FCI etc. have been organising seminars/workshops to analyse the 'state of art on the productivity subject from time to time resulting in consolidating their experiences and achieve new heights of performance and productivity. However, making the productivity efforts systematic and more effective appears an imperative need in the wake of the present global shortages of resources of all types. It is timely that organisations introspects and audits total efforts on productivity and evaluate the out-come with a view to identifying the factors impeding productivity improvement and take suitable corrective actions. Like other outputs, productivity performance also needs to be managed i.e. planned, controlled and appraised. The formal mechanism to investigate, evaluate and expose productivity practice for Key personnel accountable is known as Productivity Evaluation or Audit.

## Productivity Audit

Productivity auditing is a process of monitoring and evaluating organisational practices to determine whether functional departments/divisions, and the

organisation itself are utilizing their resources effectively and efficiently to accomplish objectives. Where this is not being achieved, productivity auditing recommends necessary action to correct and adjust short-coming, poor results, and system deficiencies.

This system tries to asses the vigour and thrust of productivity efforts in the organisations. It evaluates the quality of total productivity efforts and their effectiveness and brings out organisational factors responsible for poor use of resources and potential. problems. Such an evaluation would pave way to initiate appropriate remedial action and would lead to possible intra-firm and inter-firm comparison between all types of organisations/functions.

**A Mechanism for Evaluating Productivity Efforts**

Like any other evaluating system, the productivity Audit also has four distinct phases namely

(i) Deciding the purpose of audit (usually to improve productivity methods & practices)

(ii) Working out a structure or rational standards/ norms and bench mark performance in various factor components of productivity (like an evaluating plan)

(iii) Comparing performance with standards or bench marks (as an evaluation)

(iv) Identification of weaker areas and implementing corrective measures for deviations/variances.

The method of evaluating productivity is some what similar to the method adopted in traditional quantitative job-evaluation systems like "Point Rated System". This system is rather a general one to that extent, but it is systematic and tries to assess quantitatively the quality and effectiveness of total productivity efforts in the organisation.

**Productivity Evaluation in Public Sector**

The public sector units have been giving considerable attention to integrating productivity with performance planning and control. The total productivity effort could be arranged into the following major factor-components, with their relative importance (as a case in a hypothetical public sector unit)

| | |
|---|---|
| 1. Productivity Targetting/Actions | 15 |
| 2. Productivity Standards/Norms | 20 |
| 3. Resource Utilisation | 20 |
| 4. Responsibility Accounting & Reporting/Organisation | 15 |
| 5. Sharing the Gains/Losses | 10 |
| 6. Research & Development | 5 |
| 7. Human Resource Development | 10 |
| 8. Social Responsibility | 5 |
| Total Productivity Eflorts | 100 |

Like the degree concept used in job-evaluation system each productivity factor is arranged in a rating scale having different standards of achievement as bench marks. Such standards are given point-values, to evolve a rating plan of the following type :

| S.No. | Organisational Factor | Weight-age | Degree-Points | | | | |
|---|---|---|---|---|---|---|---|
| | | | I | II | III | IV | V |
| 1. | Productivity Targetting/ Actions | 15 | 15 | 30 | 45 | 60 | 75 |
| 2. | Productivity Standards | 20 | 20 | 40 | 60 | 80 | 100 |
| 3. | Resource Utilisation | 20 | 20 | 40 | 60 | 80 | 100 |
| 4. | Responsibility Accounting | 15 | 15 | 30 | 45 | 60 | 75 |
| 5. | Sharing the Gains | 10 | 10 | 20 | 30 | 40 | 50 |
| 6. | R & D | 5 | 5 | 10 | 15 | 20 | 25 |
| 7. | Human Resource Develop-ment | 10 | 10 | 20 | 30 | 40 | 50 |
| 8. | Social Responsibility | 5 | 5 | 10 | 15 | 20 | 25 |
| | Total | 100 | 100 | 200 | 300 | 400 | 500 |

The definition of these standards/bench marks is an intricate and exhaustive task and should be suited to local requirements/conditions of the organisations/ functions under evaluation or comparison. Those managers undertaking internal evaluation of their organisations, should use these bench marks as guide lines and use their personal judgement and internal information to determine, the level of performance achieved in that organisational factor.

A typical application of evaluation system in an undertaking is given below. The first productivity Audit revealed that this plant had a haphazard growth, due to increasing market demand. This led to over employment and slackness in all operating systems. The employees were demotivated, absenteeism increased along with increased wastage of resources. The timely corrective actions evolved through productivity auditing have led to considerable improvement in productivity as evaluated over a three year period.

| Factor | Weight | 1st Year | 3rd Year |
|---|---|---|---|
| Productivity Target/Actions | 20 | 20 | 80 |
| Productivity Standards | 15 | 15 | 60 |
| Resource Utilisation | 25 | 60 | 100 |
| Responsibility Accounting | 10 | 10 | 30 |
| Sharing the gains | 10 | 10 | 30 |
| R & D | 10 | 30 | 40 |
| Human Resource Development | 10 | 20 | 40 |
| Total | 100 | 165 | 380 |

The public sector industry comprises of diversified industrial units ranging from those producing consumer goods like contraceptives to heavy machine building plants. While the physical outputs from these undertakings vary the productivity vigour in all the organisational activities remains common. If this vigour in the managerial groups of different undertakings is investigated, measured, compared and remedial actions taken, improved productivity and production performance will automatically be ensured. Such an evaluation of productivity is possible with this approach discussed earlier. Organisations like BPE, SCOPE, will be able to easily compare all PSUs against a common scale. Individual undertakings can utilise this approach to focus their attention more sharply on weaker areas of productivity. In addition inter and intra-unit comparison of divisions/departments, projects and plants is possible on rational basis.

One major limitation is that the system is only systematic and could be subjective to views/impressions of the person undertaking auditing. A defective evaluation may jeopardise the total exercise and development of the plan has to be undertaken with considerable caution, keeping in mind the purpose of the audit and also incorporating as much quantitative data as possible in the definition of standards or bench Marks. Inspite of these limitations, a system to provide a few rational guidelines for improvement is better than "no system" at all.

# FIRST ANNOUNCEMENT AND CALL FOR PAPERS

National Conference on Industrial Engineering, 1983
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*Theme* : **Industrial Engineering : Profession & Education—in India**

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Industrial Engineering (IE) has by now been established as a very important function for the growth and sustenance of any enterprise. In fact, this discipline has found an important niche in all fields of human endeavour. As such, the time has now come to take stock of how successful have been our attempts to increase productivity consciousness through Industrial Engineering practices. Further, it is also necessary to review the extent of their usefulness in the context of the general economic/industrial environment prevailing in India and other developing countries. It is with this background that the National Institute for Training in Industrial Engineering (NITIE) announces a conference with the theme "Industrial Engineering : Profession & Education—in India".

Original papers in any of the following areas are invited:

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Intending authors may kindly submit a title and an outline (in not more than 350 words) of their proposed paper in duplicate by July 31, 1983. Completed paper, typed in double spacing, alongwith diagrams traced in Indian ink should be submitted in triplicate by September 30, 1983. It may not be possible to publish the papers, received after this date, as part of the proceedings.

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# Transhipment Problems with Multiple Objectives

J. K. SHARMA

*In the general transhipment problems, the objective is to minimize the total transportation cost. The basic assumption underlying these formulations of the transshipment model is that management is concerned only with cost minimization. In fact, business firms quite frequently place higher priorities on non-economic goals than on cost minimization. The purpose of this paper is to present the formulation of the goal programming model for the analysis of transshipment problems, where multiple conflicting objectives must be considered.*

Mr. J.K. Sharma is a Assistant Professor, Institute of Management Technology, Post Box No. 137, Rajnagar, Ghaziabad-201001.



## The Goal Programming Approach

Goal programming is a mathematical programming technique through which decision makers can model and solve problems involving multiple conflicting objectives. The solution procedure is basically a modification and extension of the simplex method for linear programming. The limitations of the single objective approach of linear programming to the modelling of many real world decision making situations have resulted in an increasing interest in goal programming in recent years.

In goal programming a number of goals or aims are admitted and these goals do not have to be mutually compatible. Each goal is represented as if it were an equality constraint with the addition of two special variables which represent any under or over achievement of the goal target.

Let

$n$ = number of activities

$a_{ij}$ = per unit contribution of the j th activity towards the achievement of goal i

$b_i$ = goal target for the i th goal

The i th goal can be formulated as

$$\sum_{j=1}^{n} a_{ij} - x_j + u_i - v_i = b_i$$

where

$u_i$ = under achievement of the i th goal

$v_i$ = over achievement of the i th goal

$u_i, v_i \geqslant 0$

If we give the same weight to under and over achievement and equal weight to each goal the objective function is then formulated simply as :

$$\text{Minimize } Z = \sum_{i=1}^{m} (u_i + v_i)$$

With the objective function formulated as just described the programme simply minimizes the total discrepancy ,between achievement and goal targets but the manager must analyse each one of the m goals considered in the model in terms of whether over or under achievement of the goal is satisfactory. If over achievement is acceptable, $u_i$ can be eliminated from the objective function, and if under achievement is satisfactory, $v_i$ can be eliminated from the objective function. But if the exact achievement of the goal is desired, both $u_i$ and $v_i$ can be given different penalty weights and different weightings may be assigned to various goals. In this way the low order goals are considered only after the higher order goals are achieved as desired.

**The Goal Programming—Transshipment Model**

The general transshipment problem model can be mathematically expressed as :

$$\text{Minimize } Z = \sum_{i=1}^{m+n} \sum_{\substack{j=1 \\ i \neq j}}^{m+n} C_{ij} X_{ij}$$

subject to

$$\sum_{\substack{j=1 \\ j \neq i}}^{m+n} X_{ij} - X_{ji} = a_i;\ i = 1, 2, \ldots, m$$

$$\sum_{\substack{j=1 \\ j \neq 1}}^{m+n} X_{ij} - X_{ji} = b_i;\ i = m+1, m+2, \ldots, m+n$$

$$X_{ij} \geqslant O \text{ i, j} = 1, 2 \ldots\ldots m+n\ (i \neq j)$$

where i, j = 1, 2 ... m represent the m sources

i, j = m+1, m+2,...,m+n represent the n destinations

$C_{ij}$ = the unit cost of shipping from any i to any j ($i \neq j$)

$a_i$ = the supply at source i ($i = 1, 2, \ldots, m$)

$b_i$ = the demand at destination i ($i = m+1, m+2 \ldots m+n$)

$X_{ij}, X_{ji}$ = the quantity shipped from i to j; j to i ($i \neq j$)

In order to demonstrate model building of goal programming for the analysis of a transshipment problem it is assumed that the company in question supplies a single product to four warehouses at various locations from three origins (supply points). A summary of the transshipment problem is shown below :

| Sources | | Destinations: 1 (Plant 1) | 2 (Plant 2) | 3 (Plant 3) | 4 (Warehouse A) | 5 (Warehouse B) | 6 (Warehouse C) | 7 (Warehouse D) | Supply |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | — | $x_{12}$ | $x_{13}$ | $x_{14}$ | $x_{15}$ | $x_{16}$ | $x_{17}$ | $a_1$ |
| 2 Plant | 2 | $x_{21}$ | — | $x_{23}$ | $x_{24}$ | $x_{25}$ | $x_{26}$ | $x_{27}$ | $a_2$ |
| 3 | 3 | $x_{31}$ | $x_{32}$ | — | $x_{34}$ | $x_{35}$ | $x_{36}$ | $x_{37}$ | $a_3$ |
| 4 | A | $x_{41}$ | $x_{42}$ | $x_{43}$ | — | $x_{45}$ | $x_{46}$ | $x_{47}$ | |
| 5 Ware | B | $x_{51}$ | $x_{52}$ | $x_{53}$ | $x_{54}$ | — | $x_{56}$ | $x_{57}$ | |
| 6 House | C | $x_{61}$ | $x_{62}$ | $x_{63}$ | $x_{64}$ | $x_{65}$ | — | $x_{67}$ | |
| 7 | D | $x_{71}$ | $x_{72}$ | $x_{73}$ | $x_{74}$ | $x_{75}$ | $x_{76}$ | — | |
| | | Demand | | | $b_1$ | $b_2$ | $b_3$ | $b_4$ | |

The goal programming formulation for the transshipment problem is given as below :

(i) *Supply*. The supply is restricted to the maximum capacity of the plant, i.e.,

$$\sum_{j=2}^{7} X_{1j} + \sum_{i=2}^{7} X_{i1} + u_1 = a_1$$

$$X_{21} + \sum_{j=3}^{7} X_{2j} - X_{12} - \sum_{i=3}^{7} X_{i2} + u_2 = a_2$$

$$X_{31} + X_{32} + \sum_{j=4}^{7} X_{3j} - X_{13} - X_{23} - \sum_{i=4}^{7} X_{i3} + u_3 = a_3$$

The deviational variable $v_1$ are excluded since it is assumed that supply can not exceed the stated amounts for $i = 1,2,3$.

(2) *Demand*

$$\sum_{i=1}^{3} X_{i4} + \sum_{i=5}^{7} X_{i4} - \sum_{j=1}^{3} X_{4j} - \sum_{j=5}^{7} X_{4j} - v_1 = b_1$$

$$\sum_{i=1}^{4} X_{i5} + X_{65} + X_{67} - \sum_{j=1}^{4} X_{5j} - X_{56} - X_{57} - v_2 = b_2$$

$$\sum_{i=1}^{5} X_{i6} + X_{76} - \sum_{j=1}^{5} X_{6j} - X_{76} - v_3 = b_3$$

$$\sum_{i=1}^{6} X_{i7} - \sum_{j=1}^{6} X_{7j} - v_4 = b_4$$

The deviational variable $u_1$ is excluded since it is assumed that quantities demanded must be met for $i = 4, 5, 6, 7$.

(3) *Union Agreement Goal* : The union agreement specifies that atleast 25% of shipping out of any plant be direct to one or more of the warehouses. The goal constraints for this are :

$$\sum_{j=4}^{7} X_{1j} + u_5 - v_5 = \frac{25}{100} \times a_1$$

$$\sum_{j=4}^{7} X_{2j} + u_6 - v_6 = \frac{25}{100} \times a_2$$

$$\sum_{j=4}^{7} X_{3j} + u_7 - v_7 = \frac{25}{100} \times a_3$$

(4) *Road Hazard Goal* : The firm's goal is to discontinue shipping from plant 1 to warehouse 6, due to road hazard along that route. The goal constraint for this is

$$\sum X_{16} - v_8 = O$$

(5) *Minimum Satisfied Demand* : In order to avoid gross in-equalities of demand satisfaction among various warehouses, the management of the firm feels that amount transshipped through each plant should be 50% of its capacity. Thus the goal constraints are as follows :

$$\sum_{i=2}^{7} X_{i1} + u_9 - v_9 = \frac{50}{100} \times a_1$$

$$X_{12} + \sum_{i=3}^{7} X_{i2} + u_{10} - v_{10} = \frac{50}{100} \times a_2$$

$$X_{13} + X_{23} + \sum_{i=4}^{7} X_{i3} + u_{11} - v_{11} = \frac{50}{100} \times a_3$$

(6) *Transportation Cost* : Management of the firm wants to minimize the total transportation costs. Thus, the goal level for the constraints is set to zero and $v_{12}$ is minimized.

$$\sum_{i=1}^{7} \sum_{\substack{j=1 \\ i \neq j}}^{7} C_{ij} X_{ij} - v_{12} = O$$

**Goal and their Priorities**

The final specifications of the goals with their priorities ($P_1$ = highest priority) is given as follows :

$P_1$ = Minimize shipping from plant 1 to warehouse 6 to zero.

$P_2$ = Meet no less than 25% of the requirement of each warehouse.

$P_3$ = Minimize the quantities transshipped through each plant to warehouse to a 50% of total capacity.

$P_4$ = Minimize the total transportation costs for quantities transshipped.

The goal programming model for objective functions is given as follows :

$$\text{Minimize } Z = P_1 V_8 + P_2 (u_5+u_6+u_7) + P_3 (v_9 + v_{10} + v_{11}) + P_4 v_{12}$$

## Conclusion

The general goal programming model has been presented to demonstrate how GP may be applied to transshipment problems with an assumption that total supply equals total demand. Of course the transshipment problem with unequal demands and supply may also be formulized. Goal programming approach allows model experimentation with numerous variations of constraints and priority structure of goals. Solid multi-dimensional transportation problem could also be treated as a goal programming problem.

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# Optimising the Cost of Production

P.C. SETHIA

*This paper deals in brief about the what and how of process capability analysis and then highlights how it can optimise quality as well as cost of production by way of improved productivity.*

*The methodology suggested here actually provides the logic on the basis of which a production man in batch manufacturing industries, should select a machine out of the many available for manufacturing a particular quality characteristic such that a minimum of reject takes place.*

Mr. P.C. Sethia is Manager (Industrial Engineering), Hindustan Zinc Ltd., Udaipur.

## Introduction

The quality control techniques suggest that even nature is not able to produce two exactly identical pieces—so what of a Man-Machine system ? Measured quality of manufactured product is always subject to a certain amount of variation as a result of chance. Some stable "System of chance causes" is inherent in any particular scheme of Production and Inspection. Variation within this stable pattern is inevitable. The reasons for variation outside this stable pattern can be always discovered and corrected. And Statistical Control Charts ($\bar{x}$ and R chart for variable characteristics) by themselves suggest that whether a stable system of chance causes is present in a Production-Inspection System or some foreign system has crept into the system. Further—as long as the "Stable System of chance causes" is acting in a particular Production-Inspection System, then, the natural variability of such a system is often referred to as its "Process-Capability i.e., the capability of the system to give inherent quality variation. This amount of variability being 'natural' or 'inherent', because it arises from the fact that raw-materials vary, machines cannot exactly reproduce the identical movements on successive cycles of operation, and people cannot perform a repetitive task in precisely the same manner. The numerical measure of this inherent variation being 6 $\sigma'$ (six sigma prime) where, $\sigma'$ 9 (sigma prime) is the standard deviation of measured values of entire population which is supposed to be homogeneous at this juncture (produced under the stable system of chance causes).

**Determination**

What is needed to find out Process capability for a given quality characteristic from a particular Production-Inspection system is to

(1) take a lot of manufactured and inspected items from the system

(2) collect data about the variation of quality characteristics in the $\bar{x}$ and R chart data form

(3) compute $\bar{\bar{X}}$, $\bar{\bar{X}}'$, R, $\bar{R}$, $\sigma_{\bar{x}}$ and $\sigma'$

where

$\bar{\bar{X}}$ — the average value of quality characteristic for each sample of size say n (preferably n being 4 or 5)

$\bar{\bar{X}}'$ — the average of averages (Centre of the process)

R — range for each sample—being the difference of highest and lowest value of measured characteristics in the sample

$\bar{R}$ — average of the ranges of the samples

$\sigma_{\bar{X}}$ — standard deviation for the sample population $= \bar{R}/(d_2\sqrt{n})$ where $d_2$ being constants depends upon the value of n

$\sigma'$ — Standard deviation of the entire population $= \bar{R}/d_2$ or $\sqrt{n}\ \sigma_{\bar{X}}$

(4) Compute trial control limits for $\bar{\bar{X}}$ and R charts as $\sigma$

$UCL_{\bar{\bar{X}}} = \bar{\bar{X}}' + 3\sigma_{\bar{X}}$

$LCL_{\bar{\bar{X}}} = \bar{\bar{X}}' - 3\sigma_{\bar{X}}$

$DCL_R = D_4\bar{R}$

$LCL_R = D_3\bar{R}$

where $D_3$ and $D_4$ are again constants whose values depend upon sample size n.

(The values of these constants can be had from any statistics book or from the references).

(5) Plot $\bar{\bar{X}}$ and R chart and depict control limits on to it $\bar{\bar{X}}$ Chart : Say on graph, against each sample no. mark the values of $\bar{\bar{X}}$ for the respective sample. Plot $\bar{\bar{X}}'$ by a line and also control limits by lines.

R Chart : Against each sample plot, its range. Plot its control limits also.

(6) Verify whether all the plotted points in each case lie within the control limits and in case of $\bar{\bar{X}}$-chart, the plotted points are evenly distributed about the central lines. If so, then the whole Production-Inspection system is said to operate under the Stable system of chance causes. If not it would mean process is not operating under stable system of chance causes and thus needs correction.

(7) Once the stable system of chance causes is verified, then next is to compute $\sigma'$ and $\bar{\bar{X}}' + 3\sigma'$ and $\bar{\bar{X}}' - 3\sigma'$ values.

Plot all measured readings (inst. X against their respective no. and impose the $\pm\ 3\sigma'$ limits on to it. It will be found that 99.97% of the readings fall within these limits.

Thus entailing that within these limits of variability the system will be able to produce 99.97% of the products. This difference of $+3\sigma'$ and $-3\sigma'$ about the centre line $(\bar{\bar{X}}') = 6\sigma'$ referred to as process capability or spread of the process or system. This way process capability study reveals (1) centering of the process (the mean value of the quality characteristic the system is able to produce) and (2) the natural spread of the process. Further, if all the plottings are consolidated into a frequency distribution it will result into a normal distribution.

**Use of the Approach**

This approach first of all calls for knowing the process capabilities of each and every production inspection system for each and every possible combination of man machine and materials for all possible quality characteristics which can be accomplished by such systems. Once these are known, then these should be used in future production for making the optimal selection of a process (system) for producing a particular quality characteristic on a specified type of products by simply matching the process-capability for that quality characteristic of the product and the tolerances specified on to it (1 and 2) as shown in Figure 1.

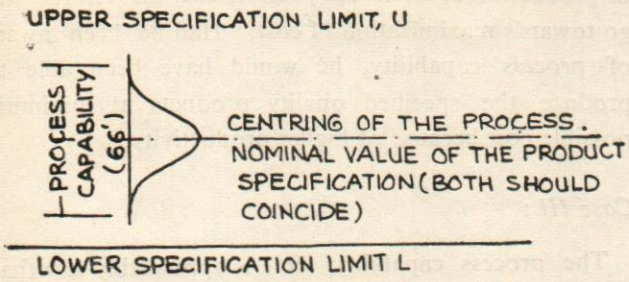


**Fig. 1: Matching of Process Capability and the Specifications of the Product Characteristic**

[All figures show the upper and lower specification limits specified on the characteristics on to which the spread of the process as well as its frequency distribution have been superimposed.]

### Optimising Quality & Cost of Production

In the absence of process-capability studies, on the production floor often the foreman tries to schedule a job on a process (system) which is time being free (not engaged) without giving any consideration to whether the process will be at all able to produce specified quality characteristics on the job within the specification limits or not. This ignorance on the part of production person can resuit into any one of the following consequences :

*Case I* :

The process capability ($6\sigma'$) is appreciably greater than the difference between the specification limits (U-L) as shown in Figure 2.

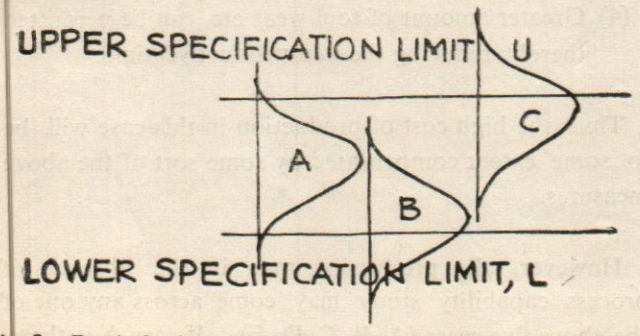


**Fig. 2: Particular instances in Production when Process Capability in Wider than Specification Limits**

From this Figure 2 it is obvious that even though the process is in statistical control but in neither of the above three possible cases (A, B and C) specifications will always be met. There will always be a certain percentage of reject and/or rework. Further if the three cases A, B and C are compared then again it will be seen that the percentage of reject and/or rework in case of A are quite less compared to case B or C. If at all production is to be carried out on this process efforts should be concentrated to see that matching of process capability is done with the specification limits by way of proper centering of the process, so that there is a minimum possible percentage of reject and/or rework. Ideally speaking, this situation should also be avoided as far as possible. Nevertheless, in case A the cost of quality of conformance will be least, compared to case B or C.

The production man, however, can never get the above said picture without the process capability study. As such in his sincere efforts to adhere to quality specification—he will often try to make frequent adjustments with machines and its tooling, will hire and fire the operators, will try to tighten inspection, will have 100% inspection, will blame the design persons who have given so tight tolerances, may also blame materials supplier and so on and so forth. Consequent upon his these actions—the quality of the product will go further down[1] and thus will make him get lost in the problem. In turn there will be reduced production from the process and the amount of reject and/or rework will further be increased thus affecting the productivity of the process adversely. Thus, precipitating a heavier cost than what it could have been.

This all suggests that a lot of cost saving in production is possible provided that the process capability of the process is known before actual production and then during production proper matching of this process spread is done with the specification limits.

*Case II* :

The process capability ($6\sigma'$) is approximately equal to the difference between the specification limits (U-L) as shown in Figure 3. From this it is evident that the process is in statistical control and further if the process is exactly centered then there will be hardly any reject or rework (probability theory suggests that if there is exact matching between the process-capability

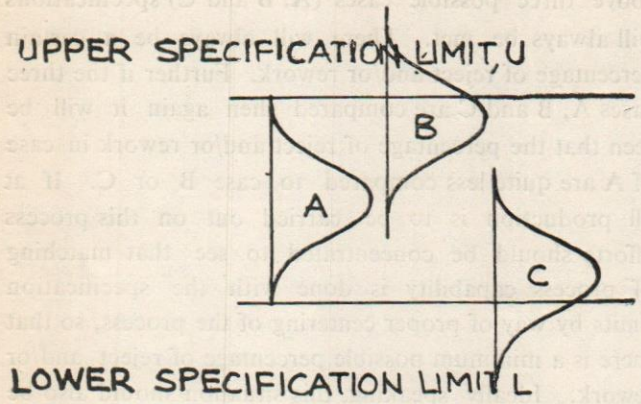


**Fig. 3: Particular instances in Production when the Process Capability is approximately equal to the Difference of Specification Limits**

and specification limits then there will be 0.27% reject and rework—of course it implies that the process is in statistical control) as in case A. Whereas in case B or C again there will be lot of reject and/or rework. Ideally speaking, it will always be economical to produce quality products if process-capability match exactly with the specification limits or more truly if the process-capability is slightly less than the specification limits (U-L) and there is proper centering of the process as suggested in Figure 1, because in such case there will be no reject or rework.

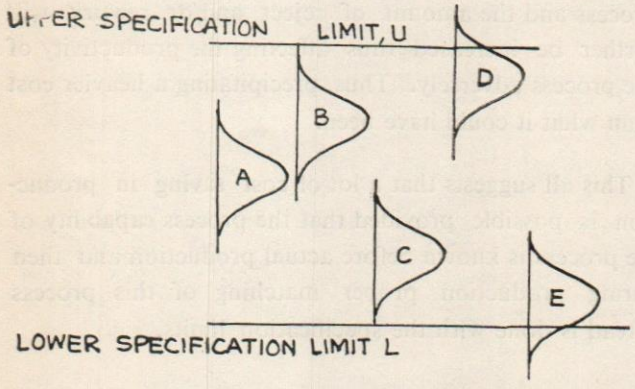


**Fig. 4: Particular instances in Production when the Process Capability is less than the Difference between Specification Limit**

However, the production person on the shop floor in the absence of the above knowledge, will never be able to know these intricacies and as such will take all these actions as listed previously which in turn will be quite wasteful in the sense that instead of improving quality of production at minimum possible cost his efforts will go towards maximization of cost. Had he been aware of process capability, he would have been able to produce the specified quality products at minimum possible cost because of higher productivity.

*Case III* :

The process capability ($6\sigma'$) is appreciably less than the difference between the specification limits (U-L) as shown in Figure 4. From this figure it is obvious that the process is highly precise and hence under the given condition it will not be economical to produce the product characteristic with wider specifications on this precise process. (This implies of course, that there is proper centering of the process also, as shown in case A). Ideally speaking, the production should be carried out on a process where the process-capability is slightly less than the difference between the specification limits. In this case the cost of production will be minimum. Nevertheless, if in the production this is the only alternative left for manufacturing, then proper centering of the process should be done and then the extra cost of production should be recovered by adopting the following cost saving measures :

(1) Adopt reduced inspection—say adopting sampling inspection to cent per cent inspection, to relax the condition of inspection

(2) Increasing time interval between sampling-inspection

(3) Relaxed amount of supervision for quality control

(4) Greater amount of tool wear etc. can be permitted thereby reducing the non-productive time.

Thus, the high cost of production in this case will be to some extent compensated by some sort of the above measures.

However, the production man in the absence of process capability study may come across any one of the above five cases (A, B, C, D, E). If case A is there, then here he is making a costly production, because he is not aware of the above facts so that he can recover the extra cost as cited above. If case B or C is there, in that case not only he is employing costly process but

also making production which may be objectional from interchangeability point of view, in which case he may have to change over to selective assembly system meaning thereby additional cost on sorting type of inspection. And if case D or E is there, then again, not only he is employing a costly process (highly precise compared to specification limits) but at the same time producing certain amount of reject and/or rework also and thus lowering productivity. These ways are precipitating additional cost over already high cost of production.

**Conclusion**

The foregoing discussion suggests that a Production man in the absence of "Process Capability Studies", is always liable to manufacture products of specified quality at considerably higher cost, On the contrary, if the Process Capabilities at the initial stage are undertaken and then if the results are implemented as suggested above then the extra cost incurred on process capabilities can always be paid back by one or two production runs and afterwards there can be enormous savings by way of increased productivity of systems meeting the quality requirements also.

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# The Theory-Practice Gap in Assembly Line Balancing

DR. SADANANDA SAHU

*This paper highlights the major developments in assembly line balancing from the development of the first analytical technique in 1954 to the present day models. The theoretical survey indicated that much of research effort is directed towards heuristic, deterministic and single-model cases. The survey of assembly line balancing practices indicated that manual and trial-and-error methods are in common use. Hence there is evidence of considerable gap between theory and practice. Conjectures are made as to the possible reason for the gap. Finally, current trends and speculations as to the future are discussed.*

Dr. Sadananda Sahu is a Assistant Professor, Indian Institute of Technology, Kharagpur—721302

## Introduction

Henri Ford is credited with the development of the first real example of assembly line in automobile industry in 1913.[1] His original work has led to the widespread use of assembly lines in mass production systems. In assembly lines, the production (assembly) of the product is normally divided into a number of small operations, each of which can be performed repetitively by the same operator. Each unit of product spends the same amount of time (theoretically) at each station. This time, called the cycle time, becomes the basic interval within which the line generates one complete unit of product.

Efficient working of the assembly calls for assigning the operations to the stations such that the technological considerations, often known as precedence relationships, are satisfied and the total idle time of each operator is minimized. In the literature, this problem is referred to as the "assembly line balancing problem".

## Line Balancing Problem

Several variations of the line balancing problem are found in the literature. Attention, however, is focussed on the two fundamental approaches as follows :

(a) Given a required cycle time, allocate operations to stations so as to minimize the sum of idle times over all the stations and distribute the idle times evenly among the stations.

(b) Given the required number of stations, assign operations to stations so as to minimize and evenly distribute the sum of idle times over all stations.

**Theoretical Developments**

Bryton[2] developed the first analytical technique for the line balancing problem in 1954. But Salveson[3] produced the first published study on the problem. Since then, over the years a large number of solution methods for solving the line balancing problem have beed proposed, many of which have been reviewed by Kilbridge and Wester[4], Ignall[5], Cauley[6], Mastor[7], Buxey et al[8], Panwalkar[9] and Dar-El[10].

The line balancing methods can be classified on the basis of :

(i) the number of models (or versions) of the product assembled on the line—single-model, mixed-model or multi-model (batched assembly),

(ii) the nature of the operation times—deterministic or stochastic, and

(iii) the type of solution approach—mathematical, heuristic or empirical.

An attempt is made in this section, in a summary review of the theoretical developments, to ascertain time trends, if any, in (a) total research effort, and (b) type of research effort.

Figures 1 through 3 attempt to provide the necessary insight.

In viewing Figure 1 which plots the number of approaches versus the year in which they appeared, a sizable effort begins to appear in the late fifties (stimulated by the classic works of Bryton[11], Salveson[12]) and continues through the sixties and seventies. In this figure, multi and mixed-model research is separated from those related to single-model. Effort in multi and mixed-model line balancing started around 1962 and continues, although they represent only 20% of the total effort. 1970's and late 1960's show an increase in this area of effort. These problems, though difficult, are more realistic.

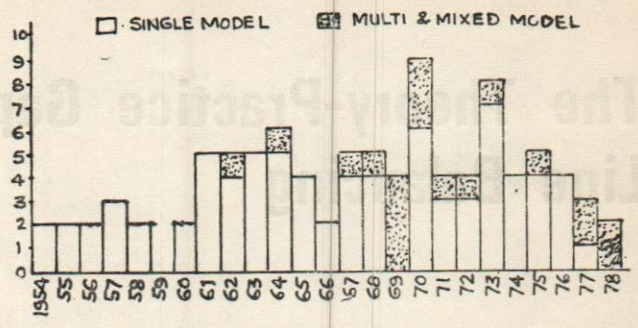


**Fig. 1: Number of Techniques versus Year**

Figure 2 shows, by year, the percentage of effort in deterministic versus stochastic approaches. The deterministic approaches claim about 85% of total research effort to date. The early work on stochastic line balancing started around 1965 when Moodie and Young[13] proposed an efficient heuristic approach. Over the years, relatively more, though not adequate, effort has been spent on stochastic line balancing. In 1973, four stochastic line balancing and smoothing techniques were reported by Reeve and Thomas[14]. In order to overcome the difficulties encountered in solving stochastic line balancing problems, a compromise formula has been suggested by Sphicas and Silverman[15], who propose deterministic equivalents to stochastic line balancing for certain types of operation time distributions. This transformation is quite useful in the sense that good balances for stochastic problems can be obtained by employing efficient and relatively less complicated deterministic techniques.

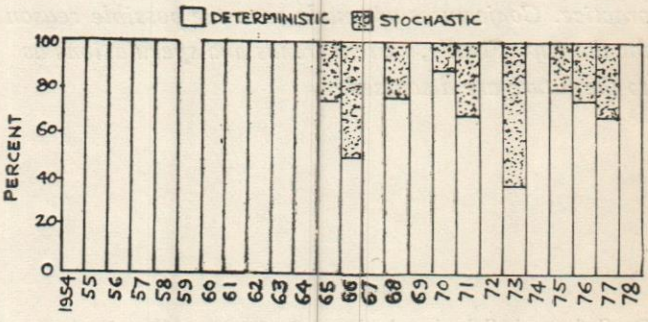


**Fig. 2: Deterministic versus Stochastic Approaches by Year**

Figure 3 shows three types of approaches by year of occurences. Total effort over the years can be broken down approximately as follows :

Mathematical approaches 35%

| | |
|---|---|
| Heuristic approaches | 50% |
| Empirical approaches | 15% |

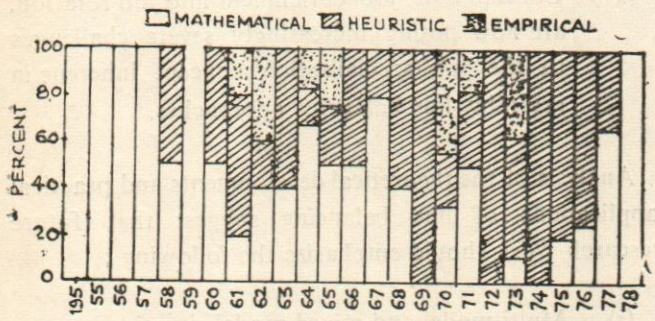


**Fig. 3: Type of Approach by Year**

Heuristic approaches constituting half of the total effort had their beginning in late fifties and continue to grow because of their ability in providing compromise between solution quality and computational effort. Empirical approaches developed since early sixties, offer in certain situations, superior solutions.

### Industrial Applications

To what extent are the formalized line balancing methods, that have appeared in the literature, applied to actual assembly situations ? What are the current practices ? Attempts have been made to answer these questions for the American industry by Lehman[16] and Chase[17] and for the British industry by Wild[18]. Although no consolidated effort of this type has been made for Indian industries, some useful inferences can be made from a number of projects carried out in various Indian industries ( Banerjee[19], Bhattacharya[20], Das[21], Jain[22], Mukherjee[23], Panda[24], Sahu[25], Sangal)[26].

Lehman, while summarizing the findings of the National Survey of Assembly Operations[27], reports on the extent of usage of the various methods as follows :

| | |
|---|---|
| Manual Methods (using precedence diagram) | 40% |
| Trial and Error Methods | 41% |
| Computer Methods | 15% |
| Other Methods | 4% |

As regards computer methods, three fourths of the companies have written their own programs.

The Survey of paced assembly lines conducted by Chase[28] also aims at finding the extent to which formalized line balancing methods are being used by American firms engaged in progressive assembly. This study reveals that only 5% of the 85 respondents use formalized published techniques, and 39 respondents are familiar with the techniques.

### The Gap

A close look at the above two sections indicates that there is considerable amount of gap between theory and practice. This can be explained in terms of the Venn diagram shown in Figure 4.

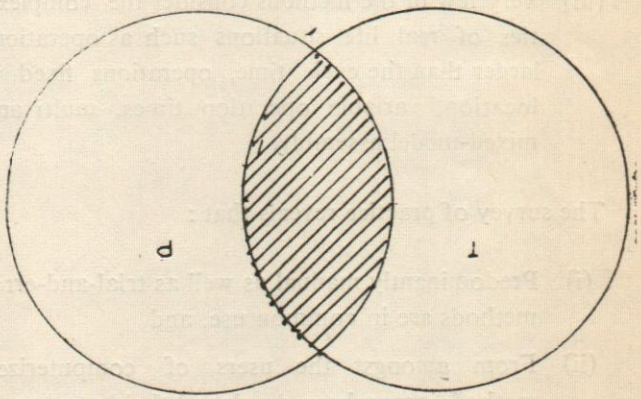


**Fig. 4: Venn Diagram**

The set represents the theoretical developments in assembly line balancing methodology, while the set P represents the real world of line balancing problems. The intersection $T \cap P$ (cross-hatched area) represents the methods used in practice, which are computationally feasible and which actually originated from theory. Thus, the gap between theory and practice can be measured by :

$$\text{GAP} = \frac{1-(T \cap P)/P}{(T \cap P)/P}$$

so that if $(T \cap P)/P = 1$, GAP = O,

whereas if $(T \cap P)/P = 0$, GAP $= \infty$

Hence, it is desirable to have a feel of the magnitude of $(T \cap P)/P$. This can be obtained by the survey of theory and practice of line balancing.

**Conclusions**

Given the information in the above three sections, it becomes necessary to compare them in order to have a better understanding of the gap between theory ond practice of assembly line balancing.

A review of the theory of line balancing indicates that :

(i) single-model assembly line balancing has been predominantly studied,

(ii) maximum effort has been devoted to heuristic methods compared to other types, and

(iii) very few of the methods consider the complexities of real life situations such as operations larger than the cycle time, operations fixed in location, variable operation times, multi and mixed-model assembly.

The survey of practice reveals that :

(i) Predominantly manual as well as trial-and-error methods are in common use, and

(ii) From amongst the users of computerized methods, many have developed their own computer programs.

Comparison of the above two lists shows that there is considerable amount of gap between theory and practice of assembly line balancing. Possible reasons for non-use of the formalised techniques are as follows :

(i) Many of the users are not familiar with the techniques.

(ii) The techniques are inflexible and in many cases represent idealized situations.

(iii) These techniques, in certain situations take more time to balance the lines than subjective judgment and experience.

(iv) Much of the research work is rather abstract; the authors do not appear to have considered the need to understand the effect of various factors on the performance of the line. These factors include : operators' work-time distributions, buffer storage between stations, number of operators at each station, number of stations on the line, non-steady operating conditions.

(v) Concepts of job enrichment and job rotation, are now posing increasingly severe challenges to the job specialization concept inherent in assembly line balancing approaches.

Analysis of the theoretical developments and practical applications of line balancing suggest that future research work should emphasize the following :

(i) Multi-model and mixed-model situations,

(ii) Inclusion of effects of various factors like variability in performance times, and paralleling,

(iii) Consideration of various relevant costs in line design,

(iv) Development of more flexible approaches such as the interactive approach of Moodie [28], and

(v) Consideration of behavioural aspects.

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**Kurukshetra University**
**Kurukshetra—132119**

Managerial decision making is becoming an increasingly complex job. The rapidly changing dynamic environment in which the manager has to perform, the uncertainties involved, the risk involved due to magnitude of the impact of decisions and the quickness with which the decisions have to be arrived at, have all commulated to the point where the manager finds himself ill-equipped to make effective decisions on the sole basis of judgement and experience. As the management profession has developed, marketing researchers, corporate planners, operations researchers, statisticians, computer specialists and other staff specialists have been called upon to contribute to the solution of increasingly complex problems. This trend in turn has led to the need for finding better ways to formulate and explicit models of executive decision-making process. Thus, the dependence of executive decision making process on intution is giving way to 'Quantitative models'.

With access to the computer ability of storing large mass of data and logical manipulation at very high speed these 'quantitative models' are becoming a reality of the management decision-making process.

Under the present dynamic environment in which the manager has to operate, it has become necessary for the manager and analyst to come closer to the extent that it is becoming more and more desirable for the manager to be 'analyst' as well. More important, is the association of the manager with process of analysis' rgiht from the formulation stage to the implementation and evaluation stage. This underscores the need for teaching Quantitative techniques and skills to the young graduates aiming for careers in management area as well as to the practitioners who have been in the field for long. This is precisely the reason that courses of quantitative techniques have become an integral part of Management syllabi.

Therefore these techniques find place in, as part of syllabus, of every course that deals with management or related areas viz. Economics, Public Administration etc. In many of these courses the quantitative techniques in one form or the other have two to three semester progammes. The book fulfills the long felt need of this group of students who so far had to depend on various references and (mostly foreign books with illustrations based on the country of origin).

The book is divided into three parts viz. Part-I Statistics for Managerial Decision Making; Part-II Operation Research for Managerial Decision Making and Part-III as supplementary readings on Mathematical concepts that are used or required at various stages in the earlier two parts.

This is a book which brings for the first time, most of the relevant quantitative techniques, in one place. With illuminating, simple treatments of topics without over emphasis on mathematical rigour. Every chapter has solved examples and exercises which add to understanding and extend the horizon of comprehension through displaying diverse kind of application of these tools in managerial functions. The book should be sufficient for a two semester course and if mathematical concepts are to be included, a three semester course. Depending upon individual requirements specific chapters can be ignored.

Because this book basically deals with decision-making techniques, the chapter No. 10—"Decision Making under uncertainty" could have been made more elaborate through introduction of solved examples clarifying step by step process of treatment of the topic in its various facets.

Since, the topics have been discussed keeping mathematical rigour to bare minimum, the book will also prove to be useful to application oriented practitioners in various fields. A good buy at the price.

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**Alternatives to the Multinational Enterprise**

**Mark Casson**
**The Macmillan Press Ltd.;**
**London, 1979**
**Price : £ 10.00**
**PP xiii+116**

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**Reviewed by : P. Chattopadhyay**
**P 240 Lake Road**
**Calcutta-700029**

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The advent of multinational enterprises in the third world economics has been essentially based on two types of propelling forces. One, the exploration of means for international diffusion of proprietary technology and managerial skills and thereby maximization of profits in conditions in which political dominance has become, subservient to commercial dominance particularly, due to the liquidation of empires, occupied territories and colonies. Two, the desperate need experienced by these poor third world countries to bridge the technological gap, particularly for expediting industrialization, amelioration of the living conditions of people, provision of more employment and augmentation of production for domestic and export sales.

This book by Mark Casson addresses itself to an exploration of the possibility of host governments to seek ways of importing technology without surrendering their power.

The book is divided into six chapters. Chapter one is concerned with a statement of the issues. The second chapter deals with the concept of efficiency and its application to proprietary information. Chapter three highlights the rationale of the multinationals enterprise. A theory of foreign direct investment, technology transfer, trade and capital movements are presented in chapter four. The second, third and fourth chapters comprise the author's discussion on theoretical issues. Chapter five underlines a policy for foreign direct investment while the last chapter deals with the future contractual basis for technology transfer. The fifth and sixth chapters together comprise an analysis of policy. While reviewing the basic issues in multinational enterprise, discussing host country relations and summarizing empirical evidence on the subject in the first chapter, the basic concepts in the theory of resource allocation are dealt with in chapter two and a discussion of the origination of the rationale of the multinational firm in industrial economics, various institutions for administering the allocation of resources and factors that govern the optimum size of firm are highlighted in the third chapter. The purpose of chapter four is to integrate the theory of the firm with the orthodox theory of trade and to explain the factors that govern the participation of multinational firms in international trade and investment. The costs and benefits of foreign direct investment are underscored in chapter five, where as the last chapter assesses the potential scope for alternatives to foreign direct investment and appraise the relative merits of licensing, subcontracting and other forms of contractual relationship.

Interesting sidelights are provided in the book. For instance, the author mentions that since production lags and the use of durable equipment are both reflected in the capital-intensity the greater will be the difficulty of organizing an efficient external market for the intermediate product. This suggests that when multistage production is associated with increasing returns to scale or high capital intensity there will be strong incentive to internalize. Internalization of an intermediate product market generates

vertical integration. When factor prices differ between locations and barriers to trade are relatively low there is normally an incentive to base different stages of production at different locations, so as to match factor intensity at each stage to factor abundance. When the locations are in different countries vertical integration creates an MNE. He is logical in his observation that the degree to which internalization fragments the market depends mainly on the nature of the product. However, it is possible for several firms to be involved in exploiting the similar, closely substitutable items of proprietary information. The balance between the costs and benefits of internalization determines not only the type of market which is internalized but also the optimal size and structure of the firm.

The author notes that the final discrepancy as between expected performance and actual performance arises mainly because the foreign direct investor does not bear the full cost of his mistakes, encouraging the firm to underinvest in information about the host government in the first place. He believes that it should be possible to subsidize the diffusion of relevant information to the firm; to tax its mistakes by way of imposing fines for particular types of anti-social behaviour; and to regulate the firm by requiring its actions to be vested by a government body. He, therefore, pleads for reform of the patent law to give additional products for giving non-integrated competitors access to the market when they require it and to introduce statutory formulae for the determination of internal prices in cases where no comparable external price exists. He also suggests that it should be possible to amount the laws of bankruptcy and limited liability as also the relevant parts of labour law for reducing the incentive to vertical integration.

Thus, in the context of the increasingly critical attitude of host countries towards foreign direct investment, he underlines the need for revitalizing the concept of international market for proprietary technology, where transfers of technology at present internal to firms are externalized by contracts between nationals of different countries. Host countries, in his view, can promote market alternatives to the multinational enterprises by offering legal safeguards to complement the patent system through maintaining the confidentiality of marketing and managerial expertise transferred to them. Licensing of technology can be encouraged by offering the licensor the option of buying back production and marketing experience from the licenses at a fixed price. The author laments that the international agencies like the UNCTAD have not so far taken any positive steps for promoting the alternatives to multinational enterprises, while the negative proposals for regulating and restricting the behaviour of multinational enterprises have already proved to be of limited efficacy. He considers that while such proposals may indeed attract wide political support in the developing world, they in fact represent a wasted opportunity for countries dependent on foreign direct investment.

A good lot of material, empirical and analytical, has been presented in this short volume in support of the contentions of the author. The discussions of both theory and practice and the presentation of policy issues have come in a clearer light while profuse documentation has made his observations authentic. Indeed the book opens up a new chapter in the debate on multinational corporation and the widespread exploitative behaviour that they have shown so that their creative role could be better appreciated while their negative approaches could be held in check. That there are several ways of retention of control over investment and employment decisions, while international cooperation for technological uplift is sought, has been amply demonstrated by the author, albeit in a capsule form. The discussion of current issues in multinational enterprises in a theoretical frame has made the observations widely acceptable on both sides.

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**Trade Union Recognition**

**B. N. Datar**
**Published by : Lala Lajpat Rai College of Commerce and Economics**

**Price : not mentioned**
**pp : 37**

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**Reviewed by : Ms. Mani K. Madala, Senior Consultant, National Productivity Council Lodi Road, New Delhi-110003**

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Based on talk delivered by Datar, as a part of Lala Lajpat Rai Memorial Lectures, this booklet at the beginning presents a bird's eye view of the Indian Trade Union

movement. Following this the recognition of the trade unions is discussed under five broad heads : Recognition by Government, Recognition by Employers, Recognition by Workers, Recognition by Rival Unions and Recognition by the Society with many examples drawn both nationally and internationally.

India is a vast country in which a variety of complex situations keep arising in different regions and the situations keep changing with time. What is applicable in Kerala may not be applicable in Bihar and so on and so forth. The stipulations for recognition of trade unions by the Act, Datar advocates should not be so stringent that the trade union organisers should feel helpless and the movement itself should get a set back. Mr. Datar advocates flexibility. If any stipulations are set out, enough time should be allowed for them to sink in the minds of all concerned. While talking about how the law with regard to the recognition of trade unions be framed Mr. Datar throws up a pertinent point—"law will not recognise charisma and charisma in some circumstances can muster adequate strength to beat the law." Should this be allowed to happen ? Take the case of Dutta Samant.

The booklet is definitely worth a perusal. Avoidable printing errors disallow smooth reading.

*Productivity*
*1983, XXIV, 2, 209-217*

# Corporate Planning:
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S. N. VIG
National Productivity Council, New Delhi

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