Global Journal of Flexible Systems Management

giftjournal

Guidelines for Authors

Aim
The journal is intended to share concepts, researches and practical experiences to enable the organizations to become more flexible (adaptive, responsive, and agile) at the level of strategy, structure, systems, people, and culture. Flexibility relates to providing more options, quicker change mechanisms, and enhanced freedom-of-choice so as to respond to the changing situation with minimum time and efforts.

It is aimed to make the contributions in this direction to both the world of work and the world of knowledge so as to continuously evolve and enrich the flexible systems management paradigm at a generic level as well as specifically testing and innovating the use of SAP-LAP (Situation-Agent -Process-Learning-Action-Performance) framework in varied managerial situations to cope with the challenges of the new business models and frameworks.

Scope
The Journal will include the papers relating to: conceptual frameworks, empirical studies, case experiences, insights, strategies, organizational frameworks, applications and systems, methodologies and models, tools and techniques, innovations, comparative practices, scenarios, and reviews.

The papers may be covering one or many of the following areas: Dimensions of enterprise flexibility, Connotations of flexibility, and Emerging managerial issues/approaches generating and demanding flexibility (details can be seen on the website - www.giftsociety.org).

Coverage
The journal will be organized into various sections to include following types of contributions: Research papers, Short notes/correspondence, Applications and case studies, Book reviews, Book summaries, Interviews and round tables, Information about relevant conferences and seminars, Educational and learning experiments, and any other relevant information related with the theme of the Journal.

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Four copies of manuscript should be submitted to the Editor-in-Chief at this address: Prof. Sushil, Department of Management Studies, Indian Institute of Technology, Hauz Khas, New Delhi - 110 016, Ph: 91-11-6591167, 91-11-6857787, Fax: 91-11-6591167, 91-11-6862620.

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Each paper is reviewed by the editor and if it is judged relevant for publication, it is then sent to referees for double blind peer review. The papers are reviewed for relevance, focus on flexibility, innovation, practical considerations, quality of evidence, contribution, methodology, readability, and organization. Based on the recommendations of the referees, the editor then decides whether the paper should be accepted as it is, to be revised or rejected. The reviewing time will normally be 10-12 weeks.

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Title: The title should be brief and typed on a separate sheet.

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The second page should contain the title and an abstract of 100-150 words. It should also include up to eight keywords about the paper. The authors may attach the category sheet to define the relevant categories to which the paper belongs (available on the website - www.giftsociety.org). The second page should not include the authors name. The paper should begin from the third page.

Headings: should be short clearly defined, and numbered.

Footnotes: should be used only when absolutely necessary and must be identified in the text by consecutive numbers placed as superscript.

Text: The main text should be more readable and mathematical models, if any, should be provided in Appendix. The idea proposed should preferably be supported by real life case examples from business situations.

Tables and Figures: All tables and figures should be kept to a minimum and numbered consecutively using Arabic numerals. Each table should have a brief title written on the top of the table, and each figure should have a brief caption written on the bottom of the figure.

Photos and Illustrations: must be supplied as good quality black and white original with captions. Their position should be shown in the text by typing on a separate line the words “*take in Plate a*”

References: to other publications must be in standard style. That is shown within the text as the author’s name followed by a comma and year of publication, all in round brackets, e.g. (Volberda, 1997). At the end of the paper a reference list in alphabetical order must be given as follows:


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of contributions from specific interest areas, it is planned to bring out special issues of *GIFT* from Volume 3. The first special issue is planned on the theme; “Organizational Strategy Formulation and Flexibility”, which will be guest edited by Prof. Jatinder N.D. Gupta. A call for papers for this special issue can be seen at the end of the current issue of the journal.

Thus, the flexible structure of GIFT in the form of these schools in contemporary areas of relevance along with the mechanisms of synthesis will bring ‘diversity with focus’ in the sharing and learning process to make this movement more meaningful and contemporary.

Sushil
*Editor-in-Chief*
GIFT Schools to Bring Diversity with Focus

While discussing the genesis and launch of *Global Journal of Flexible Systems Management* in its first issue, it was brought out that ‘Flexible Systems Management’ is a movement towards a new synthesis of knowledge in the disciplines of systems and management, where the bottom line is ‘flexibility’. In order to aid this process of synthesis from multiple directions, GIFT schools in the contemporary areas of interest are being developed. As in most of the evolving managerial approaches ‘flexibility’ is a common point, these schools in various thrust areas will be enriching the ‘Flexible Systems Management’ paradigm from multiple perspectives.

The professional society GIFT has a flexible organizational structure, in which new schools can be created based on new interest areas and the schools dealing with obsolete interest areas can be phased out. It provides an evolutionary and organic structure so as to adapt with the evolution of knowledge. To begin with, the following eight schools have been planned:

- GIFT School of Global Management
- GIFT School of Technology and Innovation Management
- GIFT School of Information Technology and Knowledge Management
- GIFT School of E-Commerce and E-Governance
- GIFT School of Learning Organization and Strategic Transformation
- GIFT School of Quality, Productivity and Wastivity Management
- GIFT School of Environment Management and Sustainable Development
- GIFT School of Human Values and Management Ethos

Each school has sufficient autonomy to organize its activities to enrich the specific area of interest, and at the same time its synthesizes with the larger framework of ‘Flexible Systems Management’. In order to aid the process of synthesis, three major routes are built into the system, viz. cross-membership in schools, annual global conference GLOGIFT, and Flexible Systems Management.

Each member of GIFT can opt for an association with any of the two GIFT schools in operation at any point in time. This association can be changed every year as per the shifting interests of members. In this manner, each school may have members with interest in all other schools. This type of cross-membership will aid a great deal in cross-fertilizing the ideas and ultimately facilitating the synthesis of knowledge generated in various quarters.

The synthesis in further aided by a formal route of an annual global conference GLOGIFT, where the interest of various schools are represented. Though every year lead may be taken by some schools, the conference is an opportunity to share cross-learning of all the schools. For example, for GLOGIFT 2002, the lead is coming from the schools of Technology and Innovation Management and Global Management, giving the theme to the conference as: “Perspective on International Technology and Know How Transfer: Towards a Flexible Enterprise”. The issues of technology and know how transfer highlight the interest of these schools, where the concern for flexible enterprise helps in synthesizing it with other schools and ultimately to ‘Flexible Systems Management.’

Another major vehicle of synthesis is *Global Journal of Flexible Systems Management*, where researches and experiences from various perspectives and directions focusing on the issue of ‘flexibility’ are published at one place. *Global Journal of Flexible Systems Management* is evolving as a general management journal with a specific focus on ‘flexibility’. Since flexibility is a multi-dimensional concept, coalescing of these diverse developments will aid the evolution and enrichment of the flexible management paradigm. In view of the relevance
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Multiplicity of Cognitive Frameworks for Ethical Decision Making: Variability across Gender and Age Groups

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Abstract
A moral judgment is a considered opinion of what ought to be done (i.e., a decision about the morally right thing to do) when confronted with an ethical dilemma. Ethical ideologies or frameworks have been studied to identify the underlying reasoning of an individual in making decisions in a situation of ethical dilemma. Western philosophers and thinkers have identified a variety of frameworks that have been explored in the context of business. The present work explores some of the ethical ideologies/frameworks identified in the Indian philosophical systems along with western frameworks, and tests their use by the Indian managers. Three hundred and nineteen managers formed the sample for the study. Two ethical ideologies (Moksh and Karma) rooted in Indian ethical philosophies were juxtaposed with other more universal ones. Further, difference in the use of these frameworks was tested for the two genders and two age groups. Results indicate that Indian managers use both, the Indian as well as the universal (western) philosophies. There were some gender and age-group related differences in the use of the frameworks. Implications of the findings are discussed. The results indicate flexibility in the use of these multiple frameworks.

Keywords: ethics, ethical frameworks, gender, justice, karma, moksh

Introduction
The Oxford Dictionary defines 'ethics' as the “science of morals or morality” and operationally it may be treated as an “....inquiry into the nature and background of morality, where the term morality is taken to mean moral judgments, standards and rules of conduct” (Taylor, 1975). Thus, the subject matter of ethics is morals or morality, which are the individual or group standards of right and wrong or good and bad. Ethics, then, involves an examination of these morals used by individuals and groups and their applicability in real life situations. Hence, it is the individual’s or the group’s logic, norms or principles used in decision-making, which is at the heart of ethical behaviour.

Over time, the individual develops an ethical decision history. Through a repeated process of decision-making, ethical philosophies and decision ideologies become relatively stable. The content of one’s ethical system, the network of ethical norms and principles one holds, constitute a person’s ethical philosophy, which is referred to as ethical framework in the present work. Social scientists have contended for years that these normative structures influence the decisions made by individuals (Hogan 1973, Fritzche and Becker 1984, Premeaux and Mondy 1993, Stead, Worrell and Stead 1990).

Flexibility in ethical decision frameworks implies a use of multiple cognitive frameworks and variability in their use as per the situations as well as actor. In an earlier study (Bhal, 2000), flexibility in the use of frameworks in different situations found support. In this paper, we focus on actor related flexibility and variability.

Philosophical Roots of Ethical Frameworks
For the purpose of understanding individual ethical philosophy and behaviour, it is important to know about the prevailing theories in the field of ethics. At the outset, the ethical theories may be divided into two fundamental types, teleological and deontological. These two approaches entail different conclusions about what ought to be done.

Teleological theories emphasize the importance of consequences of the actions or practices. According to these theorists, the consequences of an action or practice determine its moral worth. The most widely studied teleological theory is Utilitarianism. According to utilitarianism, an action or practice is right if it leads to the greatest possible balance of good consequences or to the least possible balance of bad consequences for all the people involved (Bayles, 1968).

Deontologists (derived from the Greek word for “duty”), on the other hand, emphasize that actions are not justified only by their consequences and the concept of duty is independent of the concept of good. Besides good outcome, there are other factors as well like fairness of a distribution process, keeping a promise etc., which determine the rightness of an action. Deontological “duties” are from this perspective,
an undeniable feature of business ethics. One of the most popular deontological theories is ‘Categorical imperative’ given by Immanuel Kant (1724-1804) an eighteenth century philosopher. He emphasized on the performance of one’s duty for the sake of duty and not for any other reason and insisted that all persons should act not only in accordance with duty but also for the sake of duty (Sullivan, 1989). The other popular deontological theories are related to the notion of justice and right. The theory of justice requires the decision-maker to be guided by the concepts of equity, fairness, and impartiality (Rawls, 1971) and a theory of right asserts that human beings have certain fundamental rights or entitlements that should be respected in all decisions (White, 1984). Thus, whereas utilitarians focus on ends, deontologists are more concerned with the means.

Besides teleological and deontological bases, one obvious source of morality might be taken to lie in religion. God, is the best authority on deciding what is right and what is not. Thus for a Christian the ethical rulebook is the ‘Bible;’ for a Muslim (following Islam) it is the ‘Quran;’ for Jews it is the ‘Torah’ (the first five books of the Christian’s old testament interpreted by Talmud) and for Hindus the various scripts from ‘Upanishads to Bhagvad Gita.’

Indian Ethical Philosophy

Although Indian ethics does not exist as a separate subject, but the ethical aspect of Indian philosophy is thousands of centuries old and is referred to in historical as well as contemporary literature. Bhagvad Gita, an ancient scripture elucidating the ethical principles in governance is seen as a source of ethical philosophy by modern day thinkers and practitioners (Chakravarty, 1987). Two principles propounded in Gita that may be considered relevant in the context of business are the philosophy of Karma (Duty) and Moksh (Salvation).

The Karma Theory

Preaching of Bhagvad Gita advocates that one has a choice in one’s action, but never in results. The results are determined the moment the action is performed. One cannot avoid the fruit of action. The results of action are governed by laws, which are not under our control. Therefore, individuals should only concentrate on their actions without worrying about the results (Swami Dayanand, 1999). Thus, Karma gives a metaphysical orientation to the concept of duty by saying that there is another superior force that controls the outcomes of an action.

The Doctrine of Moksh (Salvation)

All the Indian systems agree in believing that an action done by an individual leaves behind it some sort of potency, which has the power to ordain for him joy or sorrow in the future accordingly (depending upon whether it is good or bad). When the fruits of the action are such that they cannot be enjoyed in the present life or human life, the individual has to take another birth as a man or any other being in order to suffer them. It was believed that the unseen potency of the action generally required some time before it could be fit for giving the doer the merited punishment or enjoyment, which results in cycles of birth and rebirth. The ultimate aim of this life then is to free oneself from this cycle of birth and rebirth and attain salvation or Moksh.

Thus, in this ideology, every action is to be seen in a futuristic perspective. The long-term impact of an action has to be kept in mind without getting too swayed by the present. As might be expected, all Indian systems agree upon the general principles of ethical conduct that must be followed for the attainment of salvation or freedom from this cycle of birth and rebirth. That all passions are to be controlled, no injury to life in any form should be done, and that all desire for pleasures should be checked, are principles which are almost universally acknowledged. (Dasgupta 1957, Sharma 1965).

There are management teachers and trainers who have used these prescriptions to bring about organizational change. They have focused on these values as normative goals and their efforts have largely been towards transforming managers. However, there is no study in the Indian context that identifies the actual use of these frameworks by Indian managers. Thus, there is a possibility of the use of multiple frameworks rooted in different philosophical traditions. Though, the frameworks rooted in Indian ethical philosophy have not been operationalised and studied in the context of business ethics, there are other frameworks, mentioned in the earlier sections, that have been. A brief review of the literature on the use of ethical frameworks in business is as follows.

Ethical Frameworks in Business: Previous Literature

Arthur (1984) has provided an extensive list of frameworks of moral reasoning which include: Hedonism - extreme selfishness, Utilitarianism - the greatest good for greatest number, Pragmatism - whatever minimizes conflict, Salvation (a) - good works to earn redemption, Salvation (b) - isolation, mediation and devotion, Golden Rule - based on faith, charity and reciprocity, Divine Right - maintenance of the "pecking-order", Egalitarianism - push down the rich, push up the poor, and Paternalism - nature is sacred.

While suggesting a contingency model of ethical decision-making Ferrell and Gresham (1985) talked about ethical frameworks as individual variable factor. They followed the classification of ethical framework based upon the basic teleological and deontological philosophies, where teleological included Utilitarian philosophy and deontological philosophies included Rights and Justice principle.
Some of the other frameworks studied more directly in the context of business include the

- **Doctrine of the Means** - seeking the means or moderate course of action between the extreme behaviors,
- **Intuition Ethics** - being guided by simply what people feel or understand to be the right course of action,
- **Conventionalist Ethics** - it is assumed that business is like a game and therefore has its own set of rules, supporting the statement that it’s all fair in love, war and business (Steiner and Steiner, 1988),
- **Professional Ethics** - taking only those actions, which would be viewed as proper by a panel of professionals or colleagues, and
- **TV Test** - acting in such a way that one would be comfortable explaining his/her action on TV to the general public (Lacznia and Murphy 1991).

In an exploratory study, McDonald and Pak (1996) studied the use of self-interest, utilitarianism, categorical imperative, duty, justice, neutralization, religious conviction and light of the day frameworks.

It is evident that a set of frameworks has been used by researchers in the Western countries. There are theorists that prescribe the use of Indian philosophy but there is little empirical work that studies the actual use of these philosophies by Indian managers.

Thus, our first objective is to assess the cognitive frameworks of Indian managers for decision-making in situations of ethical dilemma and our proposition is as follows:

**Proposition:** Indian managers would show a use of ethical frameworks based on Indian ethical philosophies along with the other Western frameworks.

### Determinants of Ethical Frameworks

Understanding how individuals make decisions in situations of ethical dilemma, has been a concern of the researchers primarily in the area of psychology. The researchers have focused on the individual, the situation and the interaction of the two. Major focus of the individual approach is to identify characteristics of the moral individual. Studies emphasizing individual factors influencing ethical decision-making have shown a number of variables to be significant determinants of ethical or unethical behaviour. Researchers have identified age and gender as two variables which may affect ethical decision-making, hence gender and age were taken as important variables in the study. They were also used as a test of the differentiating power of the measure of ethical frameworks emerging in the study.

#### Gender and Ethics

Whether males and females are different in their perception of ethical dilemma and social issues has been a matter of much debate in the literature on gender issues. Gilligan (1982) suggested that male and female have distinctively different moral orientations and argued that whereas women think of moral questions as problem of care involving empathy and compassion, men appear to conceptualize them as problems of right, justice and fairness. Lyons (1983) expands on this theme suggesting that the focus of men’s and women’s sense of what is or is not moral is not the only difference. She hypothesizes that the fundamental processes by which men and women make moral choices are different, in that men are more immersed in an ongoing ethical consciousness not limited to discrete events and situations.

Gender related differences in the use of ethical frameworks were also reported by Harris (1989) in his study of four ethical maxims. The model responses of male showed a decisive preference for egoist (self interest) based decision approach. Females, in contrast, professed the use of utilitarian approach. The findings were supported by a replication study in which Galbraith and Stephenson (1993) used the same ethical maxims as Harris.

However, men and women have also been found not to differ in the use of ethical frameworks, e.g. Schminkle (1997) studied gender differences among seventy-five managers in ethical decision-making. He used Brady’s (1990) classification of ethical framework i.e. formalist and utilitarianism. Survey of Ethical Theoretic Aptitudes (SETA) (Brady, 1990) along with three vignettes (each one rated as neutral, utilitarian and formalist by trained raters) was used in this study. Results of the study showed that men and women did not differ on the ethical models to which they personally subscribed. There is a strong body of literature suggesting that there is no difference between men and women in their ethical behaviour (Fritzsche 1988, Hegarty and Sims 1978, Singhpakdi and Vittell 1990); no difference in their moral reasoning (Derry 1989, Lifton 1985, Walker 1984); no difference in their ethical perception (Davis and Welton 1991, Kidwell Steven and Bethke 1987); no difference in their ethical attitudes and values (Shukla and Costa 1994); no difference in the ethical beliefs and ethical judgments (McNichols and Zimmerer 1985, Stanga and Turpen 1991, Tsalikis and Oritz-Buonafina 1990).

In the Indian context, the social roles are such that women are expected to perform the religious rituals and use religious guidelines in their day-to-day life.
Thus, the study aimed to test whether Indian male and female managers differ in their use of ethical frameworks identified in the Indian context. The Indian women, though have come out to work, but they are still seen as primarily responsible for carrying on the religious traditions and care for the family (Jolly-Wadhwa 2000, Mathur and Mathur 2001), our first hypothesis, then states.

H1: Women are likely to show a greater use of ethical frameworks based in Indian philosophy as compared to men.

Age and Ethics

A number of past studies have compared the ethical value measures of students and practitioners to analyze the effect of age and experience on ethical behaviour. There are some studies that report no age related differences. For Glover, et al (1997) age was not a predictor of ethical decision-making. Callan (1992), too, in a study of 226 state employees found that age did not significantly influence the attitude of respondents towards ethics.

However, majority of these studies (Arlow and Ulrich 1980, Bellizzi and Hite 1989, Kreitner and Reif 1980, Singhapakdi, 1990) show business professionals to be significantly less tolerant of questionable business practices than students. Barnett and Karson’s (1989) study of 513 executives analyzed decision involving ethics, relationship and results. Career stage was viewed as a surrogate for age in this study. Early career stage respondents acted significantly less ethically than later career stage respondents. Ruegger and Ernest (1992) found that students falling in the range of 40-plus year age group were most ethical, followed in order by the 31-40 group, the 22-30 group and those 21 years of age and under. Serwienk (1992) in a sample of small insurance agencies found that older workers had stricter interpretation of ethical standards in two of four indices used in the study. Premeaux and Mondy (1993) found that segments of the group who were five years or less from retirement were much more likely to act in accordance with a “rule” or “right” philosophy.

Age is a potential determining factor for commenting upon the ethical standards of an individual and needs to be explored for the Indian managers too. Thus, the study also aimed to test and compare the use of frameworks for young and old managers. In the Indian context, older generation is seen as more religious with mythic cosmic orientation. The other view, particularly relevant in the Indian context could be the changing value systems of the young and the old. Young and old managers have shown to have different orientations and values systems (Bhal, 1997). Hence, our second hypothesis is as follows:

H2: Older managers are more likely to use frameworks based in the Indian ethical philosophies as compared to younger managers.

Methodology

Research Site

The study was carried out in 10 organizations-five from the public sector and five from the private sector organisations.

Participants

Altogether 316 executives from 10 different organizations constituted the sample for the study. Care was taken to include participants from different divisions of the organizations like production, accounts, sales, personnel, etc. Care was also taken to include the respondents from all the three levels i.e. lower, middle and higher managerial levels. Because of less number of women working in the managerial posts, only a small number of women executives could be included in the sample. Women respondents constitute around 8% of the sample, which is close to the actual constitution of the population. Table 1 lists age -group (Young and Old) and gender -wise split of the sample. Mean age of the Young respondents was 33.24 years with in sd of 6.38, whereas the mean age of the old respondents was 51.81 years with an sd of 3.43. Mean age of the male respondents was 40.90 years with an sd of 10.53, and mean age of the female respondents was 34.24 years with an sd of 8.84.

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<td>291</td>
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<td>316</td>
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Table 1

Age and Gender- wise Split of the Sample

Note: Young upto 45 years; Old 46 years and above

Instruments Used

Based on literature six frameworks were used in the study, to begin with. Of these, three were from traditional Western literature and models. Definitions of these frameworks are based on Velasquez (1998) and Hosmer (1987). The items were based on McDonald & Pak (1996) and Sharma and Bhal (In press).

The definitions of the Indian frameworks of Moksh and Karma are based on the discussion above. Their operational definitions are given below.

Utilitarianism

When the decision is taken under this framework, the emphasis is on balancing the costs and benefits, or good and bad in an effort to maximize utility. Utilitarianism asserts that the decision-maker should always act so as to produce the greatest ratio of good over bad for every one.
The focus of the decision-maker in this framework is on the consequences of his or her decision and the impact of these consequences on those concerned with the decision.

**Categorical Imperative**

This framework is based on the principle that an action is either morally right or wrong regardless of the consequences. This framework comprises of two formulations, which are simplistically referred to as the universal and the means-end rules. The universal rule is concerned with the question: would the decision-maker be willing to have others act in this way to him or her? The means-end rule is concerned with the question: are the individuals concerned being treated as ‘end’ in themselves, i.e. respected and in possession of rights, or are they being treated as ‘means’ and utilized purely for the sole achievement of a specific objective?

**Justice**

This framework is concerned with ‘fairness’ of the decision, and whether there has been a just distribution of benefits and burdens among all those concerned with the decision, despite their age, sex, religion, interests, income, personal characteristics, social and occupational positions. It is based on the pre-existing notions of freedom, equality and concern for disadvantaged, although it has been suggested that most adult individuals do possess an intuitive sense of fairness based on natural justice.

**Religious Conviction**

Under the ethical framework of religious conviction, the decision-maker will refer to their religious convictions and the decision is based on the directions of one’s faith.

**Moksh**

This framework is based on the belief that present life is a block in the cycle of birth and rebirth. The individual wants to obtain moksh (liberation which is eternal happiness) from the cycle of birth and rebirth. The present life is an outcome of the actions in one’s previous life and actions in the present life will decide your next life, i.e. activities in this life will determine the fate of our next life. Hence, every action is judged in terms of its impact on next life. Therefore, all activities, which lead to liberation from this cycle of birth and rebirth, or improving our next life, should be indulged in.

**Karma**

In this framework, the decision-maker considers every action as his duty—without any attachment to the fruits of action. He believes that his jurisdiction is restricted to performing or not performing an action/duty or performing that in a different way, the results of the action do not fall in his/her jurisdiction. Karma emphasizes on action that is detached from the results that it may yield.

Respondents were presented with two situations involving an ethical dilemma and they were asked to make a decision. This was followed by a set of items on ethical frameworks. Respondents were asked to rate 21 items (on a 5-point scale) as their reasons for making the decision (see Appendix I). These 21 items covered the six frameworks-Utilitarianism (3 items), Categorical Imperative (3 items), Justice (3 items), Religious Belief (3 items), Moksh (5 items) and Karma (4 items).

**Results and Discussion**

**Conceptualization of the Frameworks**

To check the match between the proposed frameworks and the managers' cognitive conceptualization of the frameworks, factor analysis was conducted. Results of the factor analysis are given in Appendix II A.

Factors with eigen-values more than or equal to one were retained. Also, only, those factors were included where more than two items could be retained. An item was retained in a factor when it had a loading of .5 or more and cross-loading of .40 or less. On the basis of these criteria, factor analysis yielded three neat factors (Appendix II A).

The first factor explaining the maximum variance consisted of 5 items. All these items were initially conceptualized as the items constituting the Moksh framework. This is a framework based in Indian ethical philosophy and may be linked to religious beliefs of Indian managers.

The second factor also consisted of 5 items. Of these, two items were originally from Justice dimension and three were from Karma. Thus, this second dimension as perceived by the respondents did not match the theoretically conceptualized dimensions.

The third factor consisted of three items, all of which were originally conceptualized as constituting the framework of Religious Belief.

The nature of factors reveals that two of the originally conceptualized frameworks emerged as it is and both these had a philosophical or transcendental element, not rooted in here and now. These two frameworks of Moksh and Religious Belief had an element of faith, which the Indian managers clearly identified. There seems to be some faith in the philosophical or religious frameworks for ethics. The second dimension had elements of Karma (duty) and Justice. Justice is a universal framework rooted in logic and here and now experiences but Karma is conceptualized as consisting of two
components—duty and detachment from the results. Though, as per our definition (and subsequent framing up of the items), it had a transcendental element but it seems it was not perceived to be so by the managers as they clubbed these items with the concept of justice. Many people often interpret karma as duty and it is possible that managers perceived it to be so. This factor was termed as Duty and Fairness.

In essence, then our results indicate use of the philosophy of Moksh in particular, religious philosophy (Religious Belief) in general and a practical framework-Fairness of Action. This provides support for the use of multiple frameworks for ethical decision-making. For all subsequent analyses, these three frameworks are considered as they also show high reliability (Cronbach’s coefficient alpha) coefficients.

Use of Ethical Frameworks-Variability Across Age-Groups and Gender

Our next objective was to assess whether the use of these frameworks varies across gender to test for flexibility related to actors. To assess these differences t-test was conducted. Results of the t-test for male and female responses are given in Appendix II B.

The results indicate differences on two of the three ethical frameworks, viz. Moksh and Religious Belief. Men use both these frameworks more often than women. Our second hypothesis thus is not supported in the right direction. Though, men and women do differ on the use of frameworks, the differences are just the reverse of the hypothesised relationship. Traditionally, women have been associated more with religion and a mythic orientation to life in India. Most of the rituals related to religion (like fasting etc.) have been associated with women but our results indicate that women use these frameworks less often as compared to men. Self-selection theories as stated by Dobbins and Platz (1986) assert that those who choose business career have traits different from those typical of their gender. This proposition could account for observed differences in ethical attitude or behaviour of women in the general population compared to those in the work environment and there is no difference in the behaviour of men and women at their work place. Also, differences between the sexes due to early socialization may get overridden in the work environment by the perceived costs and rewards associated with occupational goals; thus, while women may enter business career with values different from men, they may respond similarly to the same training and occupational environment and become more like men in their actions and perceptions (Derry, 1989). Also, it is possible that the differences in gender related behaviour may vary from situation to situation, thus, there may be situations where women have more religious orientation (like home and family) but these differences do not exist in workplaces. Thus situational variations may be possible in gender related differences (Barnett and Karson 1989, Tansey et al 1994). The underlying causes for these variations may be explored in subsequent studies providing deeper insights into gender related differences in ethics.

Differences between the young and old managers too were tested as the second test for flexibility related to actors using t-test. Results are given in Appendix II C.

Results indicate older managers use Moksh more frequently as an ethical ideology as compared to younger managers. Even though, there is no significant difference in the use of the other two frameworks, the trends indicate that older managers use Religious Belief and Moksh more as compared to the younger managers. Whereas younger managers use more Duty and Justice as compared to older managers. Thus, our third hypothesis finds support in this study. The literature suggests that age or career stage is a factor in determining values, as younger managers tend to assign less importance to trust and honor, and more importance to money and advancement than older executives (Johnson, Neelankavil & Jadhav, 1986). The view is mixed as ethical position changes with age, but no single factor can be identified as causing this change. College freshmen and juniors, for example, were found to be more justice oriented (fairness and equality) than MBA’s who tended to be more utilitarian (maximize benefit / minimize costs) in their approach to ethical dilemmas (Borkowski & Ugras, 1992). The authors concluded that this difference might be due to idealism on the part of the former group, and experience from the employment for the latter. It is possible that as one matures there is less emphasis on selfish interest and an increase in concern for others. It is not certain however, whether it is age or the accumulating work experience associated with age, which causes individuals to modify their ethical positions as they move from different stages of life.

Our results clearly indicate a variability in the use of frameworks amply supporting the flexibility thesis in the use of ethical frameworks, which has significant implications for the design and implementation of softer systems within the organizations.

Implications

The study primarily addresses the issues with a view to contribute to theoretical development, however it has practical implications too. To begin with, the kind of issues that would have significant moral implications would be substantially determined by the frameworks under use. As a variety of frameworks are being used, it is likely that different situations would involve different criteria for ethical evaluation. Hence, first of all, if the organisation attempts to institutionalize any system of imbibing organisational values, the system will have
to be flexible to incorporate the variations in the ethical ideologies or framework. This, however, should not be taken to mean a compromise on values or a flexible use of values themselves but a flexible implementation of the values in the light of the variety of frameworks being used as the moral intensity of different issues is going to vary substantially.

Work in the field of normative ethics has focused largely on utilitarian, justice and other frameworks. However, little effort has been made to use religious and other prescriptions for studying the ethical decision-making. Our results indicate that not only do the managers use a combination of western and Indian ideologies, these ideologies also vary across gender and age group. This places demands on the organisation to design systems that respond to these varying demands. The formation of cliques, and political entities are likely to center around these ethical ideologies.

References


Appendix I

Section A

Vignette 1
You are in the board of selection committee for the post of manager works. Instead of selecting a more experienced long-term employee, you favored your first cousin who also appeared for the interview and is well qualified for the post.

4) I would Strongly Agree.....Agree........Neutral.......Disagree.......... Strongly Disagree, with the decision.

Vignette 2
A corporate learned that his company intended to announce a stock split and increase the dividend. On the basis of this information, he bought additional shares and sold them at a gain following the announcement.

5) I would Strongly Agree.....Agree.......Neutral.......Disagree........ Strongly Disagree, with the decision.

Section B

When making a decision on each of the case just presented, what factors did you generally take into consideration? Review the following statements and select one of the five responses given below for each statement. Write the corresponding number of the selected response against each statement in the given space.

<table>
<thead>
<tr>
<th>Statement</th>
<th>Very often</th>
<th>Often</th>
<th>Sometimes</th>
<th>Rarely</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. It should not have bad affect on my next life (janm).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2. It is waste of energy worrying about the effect that an action might have; one should just get on to what one has to do.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>3. It is important that justice is seen to be done.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>4. It should help in improving my next life (janam).</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>5. Results of the duties that we perform do not fall in our jurisdiction.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>6. The decision should produce the greatest net value to all the parties.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>7. Every action is judged in terms of its impact on next life.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>8. Only thing that is in our hand is to keep performing our duties without worrying about the results.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>9. It should be the most equitable decision.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>10. What is the right thing to do in my religious beliefs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. People must be treated fairly at all times.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Consequences of the decision should affect the majority in a positive way.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>13. It is in line with the advice from a religious or philosophical source.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>14. Whatever is happening with me now is the result of my previous life.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>15. Our job is to do our duty to the best of our capability without thinking about the result.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>16. It should secure the benefit of the larger number.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>17. My religious faith must permit such an action.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>18. Its not fair to treat people as a means to an end.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>19. How would I feel if someone did that to me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>20. I would not do to others what I don’t want them to do to me.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>21. I consider my next life too while making a decision.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>21</td>
</tr>
</tbody>
</table>
### A: Factors, Item Loadings and Other Characteristics of the Frameworks

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.66</td>
<td>.10</td>
<td>.10</td>
</tr>
<tr>
<td>4</td>
<td>.82</td>
<td>-.09</td>
<td>.17</td>
</tr>
<tr>
<td>7</td>
<td>.83</td>
<td>-.06</td>
<td>-.05</td>
</tr>
<tr>
<td>14</td>
<td>.72</td>
<td>-.07</td>
<td>.34</td>
</tr>
<tr>
<td>21</td>
<td>.74</td>
<td>-.05</td>
<td>.34</td>
</tr>
<tr>
<td>3</td>
<td>-.03</td>
<td>.55</td>
<td>-.08</td>
</tr>
<tr>
<td>5</td>
<td>-.11</td>
<td>.76</td>
<td>.00</td>
</tr>
<tr>
<td>8</td>
<td>.07</td>
<td>.63</td>
<td>-.09</td>
</tr>
<tr>
<td>11</td>
<td>-.11</td>
<td>.55</td>
<td>.09</td>
</tr>
<tr>
<td>15</td>
<td>-.07</td>
<td>.66</td>
<td>.19</td>
</tr>
<tr>
<td>10</td>
<td>.33</td>
<td>.18</td>
<td>.76</td>
</tr>
<tr>
<td>13</td>
<td>.37</td>
<td>.05</td>
<td>.68</td>
</tr>
<tr>
<td>17</td>
<td>.18</td>
<td>-.18</td>
<td>.77</td>
</tr>
<tr>
<td><strong>Eigen value</strong></td>
<td>4.323*</td>
<td>3.529</td>
<td>1.625</td>
</tr>
<tr>
<td><strong>% Variance</strong></td>
<td>20.587</td>
<td>16.803</td>
<td>7.737</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>11.2636</td>
<td>21.0858</td>
<td>8.4684</td>
</tr>
<tr>
<td><strong>sd</strong></td>
<td>5.6727</td>
<td>3.0150</td>
<td>3.2604</td>
</tr>
<tr>
<td><strong>Reliability</strong></td>
<td>.85</td>
<td>.70</td>
<td>.75</td>
</tr>
</tbody>
</table>

### B: t-test: Ethical Frameworks Used by Male and Female Managers

<table>
<thead>
<tr>
<th>Ethical framework</th>
<th>Gender</th>
<th>Mean</th>
<th>sd</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moksh</td>
<td>Male</td>
<td>2.32</td>
<td>1.13</td>
<td>2.836**</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1.61</td>
<td>1.04</td>
<td></td>
</tr>
<tr>
<td>Duty and Fairness</td>
<td>Male</td>
<td>4.22</td>
<td>.60</td>
<td>-3.82</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>4.26</td>
<td>.59</td>
<td></td>
</tr>
<tr>
<td>Religious Belief</td>
<td>Male</td>
<td>2.86</td>
<td>.60</td>
<td>1.07</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>2.40</td>
<td>1.17</td>
<td></td>
</tr>
</tbody>
</table>

Note: Numbers in parentheses indicate the sample size. *=p<.05; **=p<.01

### C: t-test: Ethical Frameworks Used by Young and Old Managers

<table>
<thead>
<tr>
<th>Ethical framework</th>
<th>Age group</th>
<th>Mean</th>
<th>sd</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Young</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moksh</td>
<td>Young</td>
<td>2.13</td>
<td>1.06</td>
<td>-2.177*</td>
</tr>
<tr>
<td></td>
<td>Old</td>
<td>2.44</td>
<td>1.21</td>
<td></td>
</tr>
<tr>
<td>Duty and Fairness</td>
<td>Young</td>
<td>4.23</td>
<td>.57</td>
<td>.534</td>
</tr>
<tr>
<td></td>
<td>Old</td>
<td>4.19</td>
<td>.65</td>
<td></td>
</tr>
<tr>
<td>Religious Belief</td>
<td>Young</td>
<td>2.74</td>
<td>1.09</td>
<td>-1.479</td>
</tr>
<tr>
<td></td>
<td>Old</td>
<td>2.94</td>
<td>1.07</td>
<td></td>
</tr>
</tbody>
</table>

Note: Numbers in parentheses are the sample size. *=p<.05.
Flexibility Mapping: Practitioner's Perspective

1. What types of flexibilities you see in the practical situation of "Ethical decision-making" on the following points:
   - Flexibility in terms of "options"
   - Flexibility in terms of "change mechanisms"
   - Flexibility in terms of "freedom of choice" to participating actors.

2. Identify and describe the types of flexibilities that are relevant for your own decision-making context? On which dimensions, flexibility should be enhanced?

3. Try to map your own decision-making on following continua. (Please tick mark in the appropriate box(es)).

<table>
<thead>
<tr>
<th>Cognitive Framework</th>
<th>Indian philosophy</th>
<th>Indian Ethical Framework</th>
<th>Duty &amp; Fairness (Practical)</th>
<th>Moksha (Religious)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. Develop a SAP-LAP (Situation Actor Process-Learning Action Performance) model of "Ethical Decision Making".

Reflecting Applicability in Real Life

1. What kind of variability do you see in the cognitive frameworks for ethical decision-making in your organization as per gender and age?

2. Do your findings corroborate with the results presented in this paper?
Flexibility and Related Issues in Evaluation and Selection of Technological Systems

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Abstract

At any point of time the performance evaluation of a manufacturing system plays a crucial role for economic appraisals and system reorganization. In this paper, the notion of an integrated manufacturing performance measure for evaluation and selection of a manufacturing system has been proposed with flexibility and related issues as one of the main focus. This paper also demonstrates the use of the derived integrated manufacturing performance measure through different manufacturing situations. In the first case, the impact of addition of a new facility on a manufacturing system was investigated. In the second situation, current and past performance of a manufacturing system was compared. Finally, in the third case, evaluation of system performance has carried out when there are certain variations in the product design.

Keywords: flexibility, integrated manufacturing performance measure, productivity, quality, unified framework

Introduction

The much-sought-after flexibility of a manufacturing system is its ability to respond to changes either in the environment or in the system itself. Such a flexibility is required for the present day industry owing to the environmental changes like varying customer needs, development of advanced technologies and rise in production costs. Incorporation of the required level of flexibility in a manufacturing system depends upon the type of uncertainty to cope with the unpredictable changes in the environment.

A flexibility framework is a structure representing a sequence of steps or actions to be followed for reaching the desired objective. Flexibility framework captures the impact of system features including various kinds of flexibilities on system performance measures like productivity and quality (Son and Park, 1987). Identifications of gaps in the literature on flexibility frameworks (Gerwin 1993, Rao and Mohanty 1991, Slack 1987, Taymaz 1989, Zelenovic 1982) motivated for development of a unified framework in terms of various performance measures such as flexibility, productivity and quality. This leads to arrive at a new performance index i.e. revised integrated manufacturing performance (RIMP) measure, which quantifies both tangible and intangible benefits and costs. This new acronym is used just for differentiation of the proposed manufacturing measure from the earlier index. RIMP measure primarily differs from the existing integrated manufacturing performance (IMP) measure mainly in handling more number of partial flexibilities. To meet the current needs of the modern industry, some additional issues related with flexibility and quality are incorporated in the current study, which are not focused in the past studies (Son and Park, 1987).

In the literature, various authors have proposed different frameworks for different objectives. The major contributions of these authors are: (i) a hybridized perspective, which can integrate both hierarchical and functional aspects for FMS evolution (Rao and Mohanty, 1991), (ii) extraction of overall production flexibility at the system level (Taymaz, 1989), (iii) enumerating the types of uncertainties faced by manufacturing managers to identify specific flexibility dimensions (Gerwin, 1993), (iv) better work conditions, motivation, work satisfaction, making decisions on their own work (Zelenovic, 1982), (v) conceptualizing and analyzing the flexibility needs of manufacturing organizations (Slack, 1987), and (vi) to quantify and combine various critical performance measures for evaluation of a manufacturing system as a whole (Son and Park, 1987). In this study, a unified framework for evaluation and selection of manufacturing systems has been proposed with flexibility as one of the main focus.

Performance Evaluation of Manufacturing Systems

Performance of an enterprise is often measured as a ratio of output to input. The outputs constitute the products of the enterprise and the inputs are the resources used by the enterprise. Neely et al. (1994) defined performance measurement as the process of quantifying the efficiency and effectiveness of a manufacturing system. In the life cycle of any manufacturing system, decision-making is involved at various stages of planning, design, and operation (Viswanadham and Narahari, 1994). During the design and planning stages, performance modelling can help in deciding the number and type of machines, number of material handling devices, number of buffers, number of fixtures, best possible layout, and part type selection (Stecke, 1985).
Performance modelling and evaluation of manufacturing systems helps decision makers at higher levels to conduct an economic feasibility analysis for expansion/diversification of the system. This could help in installing a new manufacturing system with a substantial reduction in the number of machines, floor space, inventory level, throughput and lead time and also high quality products, with a greater flexibility to respond to the market needs (Kakati and Dhar, 1991). Barad and Sipper (1988) investigate the relative impact of versatility as a selected physical characteristic of the resources, versus some operating strategies, on flexible manufacturing system performance. Also, in their work, simulation experiments are designed and analyzed to enable estimation of interaction effects between flexibility, environmental factors, and changes. Individual and combined effects of flexibility and reliability on a multi-component, multi-product system are analyzed under the framework of producibility (Nagrur, 1992). Gelders et al. (1994) expressed the need for identification of manufacturing objectives, performance measurement systems, and improvement programmes with respect to time. It is seen from the literature for contributions of various researchers that how the flexibility is linked to various performance measures, such as, productivity (Son and Park 1987, Tayyari and Kroll 1990, Troxler and Blank 1989), cost (Gelders et al. 1994, Stam and Kuula 1991, Tayyari and Kroll 1990, Wabalickis 1987), reliability (Datta et al. 1992, Nagrur 1992), and time (Datta et al. 1992, Templemeier et al. 1989, Troxler and Blank 1989).

Organization of the Paper

This paper is composed of six sections. It presents the necessity for a unified framework based on survey of literature. then the proposed unified framework is explained. The next section describes the procedure for deriving the RIMP measure. Then it highlights performance evaluation and selection of manufacturing systems through RIMP measure. In the last section it gives the conclusions and possible extensions of the study.

Motivation Behind the Proposed Unified Framework

The reasons for proposing a unified framework in the present study are:

i. to forecast uncertainties of manufacturing, because there is not much emphasis in this regard in the past,

ii. to incorporate organizational flexibility at par with other flexibilities, because this flexibility component has not been treated properly,

iii. to attempt a micro level analysis considering the flexibility options to deal with various manufacturing uncertainties, because not much emphasis in this regard is given in the literature, and

iv. to derive RIMP measure for performance evaluation and selection of manufacturing systems (such as conventional, FMS or future automated factory) owing to lack of a proper flexibility measure to suit all types of manufacturing systems in the literature.

In the light of the above, a unified framework that offers guidelines for evaluation and selection of manufacturing systems is proposed with flexibility and related issues as the main focus. This framework is illustrated with three case studies in the subsequent sections of this paper.

![Figure 1: Proposed Unified Framework for Performance Evaluation and Selection of Manufacturing Systems](image)

All the three measures - total productivity, total quality, and total flexibility - are used to compute the RIMP measure which can be used as an integrated performance measure for evaluation and selection of manufacturing systems.

Proposed Unified Framework for Performance Evaluation and Selection of Manufacturing Systems

The basic features of the unified framework begin with the forecasts of different manufacturing uncertainties as shown in Figure 1. At any point of time, the uncertainties in manufacturing can be mapped to different flexibilities through various environments (see Table 1) from which the system flexibility can be assessed. From here onwards the system flexibility is treated as total flexibility of the system. The impact of total flexibility on productivity and quality measures can be investigated further. Ultimately all the three measures – total productivity, total quality, and total flexibility – are used to compute the RIMP measure which can be used as an integrated performance measure for evaluation and selection of manufacturing systems. In the proposed framework, the major flexibilities defined so far are categorized into four levels, which include basic, system, organizational and aggregate (Stecke and Raman, 1995). The reason for addition of organizational...
flexibility in this framework is due to the fact that the flexibility is not only a technical issue but also a part of a managerial system, which may have to involve all factors, needed to effectively manage an organization (Rao and Mohanty, 1991).

In the four levels identified above, all the levels are interconnected as shown in the Figure 1. The range of second level flexibilities can be fixed up based on the knowledge of the incoming basic flexibilities. Similarly, the organizational flexibility is the resultant of system flexibilities. The overall impact of basic, system, and organizational flexibilities influence the final level, i.e. production flexibility of the manufacturing system.

The flexibility measure of each type is computed to arrive at the resultant total flexibility measure. Each flexibility type under each level is connected with the performance measures namely total productivity and total quality to contribute towards the total system performance measure. The partial flexibility measures are computed in terms of cost factors, which may help the decision maker to take an appropriate and timely decision. The procedure for arriving at RIMP is presented subsequently after deriving various total measures. In Figure 1, the significance of the dotted boundary line is to draw attention of the system designer to the production system so that appropriate production planning and control functions may be exercised. In the proposed framework, the linkage between uncertainties, factors causing uncertainties and the flexibilities is further discussed below.

Uncertainties versus Flexibilities

Modern industry suffers from technological lacunae resulting in various manufacturing uncertainties in the form of fluctuations in product demand, product characteristics, length of product life cycles, machine down time, raw material standards, and product delivery times (Gerwin, 1987). To cope with these uncertainties, the relationships among flexibility, environment and factor of uncertainty have been developed. While mapping of flexibilities to various factors of uncertainty, familiar flexibility definitions from the literature have been taken into consideration (details are presented in Appendix I). A schematic representation in this regard, which illustrates the relationships among flexibility, environment and factors of uncertainty has been shown in Table 1. These relationships may help the designer in tackling the manufacturing uncertainties and subsequently to decide a suitable type of flexibility to meet that environment. Uncertainties under five environments (Rao and Mohanty, 1991) are linked through the factors of influence as shown in Figure 2. The procedure for computation of RIMP measure based on partial measures of productivity, quality and flexibility is presented in the next section.

Table 1: Influencing Factors on Environments and Flexibilities

<table>
<thead>
<tr>
<th>Flexibility type</th>
<th>Environment type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine</td>
<td>a</td>
</tr>
<tr>
<td>Routing</td>
<td>a</td>
</tr>
<tr>
<td>Process</td>
<td>a</td>
</tr>
<tr>
<td>Action</td>
<td>b,d,e,f,g</td>
</tr>
<tr>
<td>Operation</td>
<td>a,c</td>
</tr>
<tr>
<td>Volume</td>
<td>d,e,f,g,L:m,n,o,p</td>
</tr>
<tr>
<td>Expansion</td>
<td>a,d,e,f,g,h</td>
</tr>
<tr>
<td>Product</td>
<td>a</td>
</tr>
<tr>
<td>Market</td>
<td>a,b,d,e,f,g,i,j,k,l</td>
</tr>
<tr>
<td>Production</td>
<td>a,d,e,f,g,m,n,o,p</td>
</tr>
<tr>
<td>Design</td>
<td>a,b</td>
</tr>
<tr>
<td>Quality</td>
<td>a,d,e,g,j,l,k,m,p,q,r</td>
</tr>
</tbody>
</table>

Legend: a, b, ..., r represent the influencing factors as shown in Figure 2.
Development of the Revised Integrated Manufacturing Performance Measure

Total Productivity Measure

Total productivity (Son and Park, 1987) for a given period is the integrated measure of partial measures like labour productivity, capital productivity, material productivity and overhead productivity.

Let

\[ O_T = \text{System output (usually expressed in physical volume, such as pieces, tons and other measurable units).} \]

\[ C_L = \text{Labour cost} \]

\[ C_C = \text{The service cost of using invested capital} \]

\[ C_R = \text{Raw material cost} \]

\[ C_{OH} = \text{Overhead cost} \]

Now TP is given by

\[ TP = O_T / (C_L + C_C + C_R + C_{OH}) \]  ... (1)

Total Quality Measure

Total quality measure (Son and Park, 1987) for a given period is the integrated measure of partial measures like prevention and failure costs. But based on the literature and the opinion of the experts in the field it is decided to include the appraisal quality in the definition of the total quality measure (TQ).

Let

\[ C_P = \text{Prevention cost} \]

\[ C_F = \text{Failure cost} \]

\[ C_A = \text{Appraisal cost} \]

Now TQ is given by

\[ TQ = O_T / (C_P + C_F + C_A) \]  ... (2)

Total Flexibility Measure

In the proposed framework, the major flexibilities defined so far are categorized into four levels, which include basic, system, organizational and aggregate.

Let

\[ C_{IC} = \text{Inventory costs of finished products and raw materials} \]

\[ C_{OB} = \text{Cost of obsolete products} \]

\[ C_I = \text{Infra-structural cost incurred to produce break-even volume} \]

\[ C_{CU} = \text{Cost of additional tooling for capacity utilization} \]

\[ C_{SU} = \text{Cost of setup} \]

\[ C_{SA} = \text{Additional cost of infrastructure for expansion} \]

\[ C_W = \text{Parts waiting cost} \]

\[ C_S = \text{Cost of additional setup} \]

\[ C_R = \text{Additional cost incurred due to rerouting} \]

\[ C_{IE} = \text{Idle cost of equipment} \]

\[ C_{MH} = \text{Additional material handling cost} \]

\[ C_{PR} = \text{Cost incurred due to frequent changes in production programs} \]

\[ C_{IN} = \text{Investment cost for information processing} \]

\[ C_{CF} = \text{Cost of controlling} \]

\[ C_{TPC} = \text{Total production cost} \]

The various partial measures of flexibilities can be given by

\[
\begin{align*}
\text{a) Demand flexibility (FD)} & = O_T / C_{IC} \\
\text{b) Market flexibility (FM)} & = O_T / C_{OB} \\
\text{c) Volume flexibility (FV)} & = O_T / C_I \\
\text{d) Capacity flexibility (FC)} & = O_T / C_{CU} \\
\text{e) Product flexibility (FP)} & = O_T / C_{SU} \\
\text{f) Expansion flexibility (FEX)} & = O_T / C_A \\
\text{g) Process flexibility (FS)} & = O_T / C_W \\
\text{h) Machine flexibility (FM)} & = O_T / C_S \\
\text{i) Routine flexibility (FR)} & = O_T / C_{IE} \\
\text{j) Equipment flexibility (FE)} & = O_T / C_{IE} \\
\text{k) Material handling flexibility (FMH)} & = O_T / C_{MH} \\
\text{l) Program flexibility (FPR)} & = O_T / C_{PR} \\
\text{m) Information and Data handling flexibility (FID)} & = O_T / C_{IN} \\
\text{n) Control flexibility (FC)} & = O_T / C_{CF} \\
\text{o) Production flexibility (FPD)} & = O_T / C_{TPC} \\
\end{align*}
\]

The revised integrated manufacturing performance (RIMP) measure in terms of TP, TQ and TF is given by

\[
\frac{1}{RIMP} = \frac{1}{TP} + \frac{1}{TQ} + \frac{1}{TF} \]  ... (4)

or

\[ RIMP = \left(\frac{TP \times TQ \times TF}{(TP \times TQ) + (TQ \times TF) + (TF \times TP)}\right) \]  ... (5)

The physical significance of this measure with suitable illustrations is given in the next section. Different case studies representing various manufacturing situations such as precision machine tool (both conventional and CNC) units and automobile engine cylinder liner unit have been considered for demonstration of the proposed unified framework. The results are presented in the following section.

Performance Evaluation Through RIMP Measure

The Impact of Addition of a New Facility in a Manufacturing System (Case Study 1)

The case unit considered here is a manufacturing unit producing cylinder liners for various types of automobile
engines that have domestic and international market. The product, cylinder liner has some variations in its dimensions (such as total length, thickness, collar diameter, collar width, inner and outer diameters) depending upon its application. However, the product undergoes nine different operations such as parting, outside diameter turning, collar width, fine boring, chamfering operations on various conventional centre lathes, centreless grinding (for finishing purpose), and honing (for rough and fine boring operations). Completion of the operations on a centre lathe requires 28 minutes tooling time, whereas centreless grinding and honing machines required only 6 minute tooling time. RIMP measure for such conventional system has been computed and presented in Table 2. At this stage it was felt that the operations listed earlier which were done on various centre lathes if done on a single CNC lathe, would result in both tangible and intangible benefits. The results from the RIMP computations in this regard are shown in Table 2. For demonstration of reduction in operation times on CNC lathe, the data available from a well established industrial unit has been considered. From the CNC programming of the machine it was observed that approximately 5 minutes of tooling time is required for performing first 5 operations, i.e. parting to chamfering (as specified in the existing system). Thus the total operation time for manufacturing a cylindrical liner has been reduced to 11 minutes provided that unaltered tooling times on centreless grinding and honing machines.

Table 2 : Shop floor Performance Measures of Existing System versus Modified System

<table>
<thead>
<tr>
<th>Partial measure</th>
<th>Total measure</th>
<th>Existing system (conventional)</th>
<th>Modified system (after introduction of CNC lathe)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Productivity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labour</td>
<td>Total productivity (TP)</td>
<td>01.48</td>
<td>01.20</td>
</tr>
<tr>
<td>Capital</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhead</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevention</td>
<td>Total quality (TQ)</td>
<td>11.47</td>
<td>21.20</td>
</tr>
<tr>
<td>Failure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment</td>
<td>Total flexibility (TF)</td>
<td>04.51</td>
<td>11.17</td>
</tr>
<tr>
<td>Process Demand</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TP</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TQ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TF</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revised integrated manufacturing performance (RIMP) measure</td>
<td>01.02</td>
<td>01.03</td>
<td></td>
</tr>
</tbody>
</table>

Interpretation of Results

Based on the results (refer to Table 2), the system designer may not be satisfied with the lowered productivity measure of 1.203 against 1.489 for the existing system. The reason for such a decrease is due to the huge capital investment in installation of CNC lathe. However, installation of such an advanced facility increases RIMP measure as a result of increase in total quality and total flexibility from 11.47 to 21.00 and 4.51 to 11.17 respectively. Also, the reason for the marginal increase in RIMP measure is due to the high unit cost of the CNC lathe, which is introduced in the system. But interestingly here the additional capital cost is compensated to some extent through the increase in TQ and TF. Further it has been inferred from the case application that the capital investment and unit cost of production are comparatively higher than those of the conventional system.

Comparison of the Current and Past Performance of a Manufacturing System (Case Study 2)

Different case studies representing various manufacturing situations such as precision machine tool (both conventional and CNC) units and automobile engine cylinder liner unit have been considered for demonstration of the proposed unified framework. The selected organization is one of the sophisticated machine tool manufacturing units in India producing different kinds of machine tools such as surface grinder, thread rolling machine, cutter and tool grinder, milling machines etc. For demonstration of the derived RIMP measure, only thread rolling machine has been considered. However, while computing RIMP measure, selective partial measures of flexibility are considered (as the selected manufacturing system is a conventional one). The results in this regard are presented in Table 3.
Interpretation of Results

It is clear from Table 3 that the total performance measures such as productivity, and flexibility are decreased significantly though there is an increase in market demand. The inherent reasons behind the decrease in total performance measures and the corresponding RIMP measure are listed in Table 4. Form the results (Table 4), it is self explanatory that the decrease in RIMP measure from 0.23 to 0.18 may be due to decrease in any one of the three total performances or any combination of TP, TQ, or TF. From this, it has investigated further the inherent factors associated behind these changes and the appropriate actions that are necessary to respond to the changes.

<table>
<thead>
<tr>
<th>Total measure</th>
<th>Reason for decrease</th>
<th>Remedy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total productivity (TP)</td>
<td>More overheads due to 1. frequent traveling time of personnel and material 2. high maintenance costs of old machines</td>
<td>Overheads can be minimized by replacing the existing system with advanced technology</td>
</tr>
<tr>
<td></td>
<td>Under utilization of the system due to 1. frequent breakdowns of machines (since 50% of machines are more than 15 years old) 2. increase in employee absenteeism 3. more man-hours are lost because of power failure</td>
<td></td>
</tr>
<tr>
<td>Total quality (TQ)</td>
<td>Competition from private sectors 1. fluctuations in incoming raw material 2. day to day changes in customer expectations towards end product 3. no prompt delivery of the final product at customer door step 4. increase in tool inspection/and appraisal cost 5. increase in rework cost due to close product tolerance</td>
<td>In this case total quality measure has marginally increased.</td>
</tr>
<tr>
<td>Total flexibility (TF)</td>
<td>1. high set-up costs 2. no routing flexibility 3. increase in idle cost of equipment 4. part waiting costs due to unplanned changes in the product design 5. poor communication and data handling 6. no organizational restructuring flexibility</td>
<td>Grouping of facilities based on part features for rerouting etc. Phased introduction of advanced facilities</td>
</tr>
<tr>
<td>RIMP</td>
<td>Due to changes in TP, TQ and TF</td>
<td>Phased introduction of advanced technology</td>
</tr>
</tbody>
</table>

Evaluation of System Performance under Variations in Product Design (Case Study 3)

The organization selected is a precision machine tool manufacturing company producing sophisticated and advanced machines like CNC machining centres and CNC lathes for the local as well as global market. In the existing layout, there are two NC machines, two CNC machines and the other is conventional. The system is capable of manufacturing six models of first type and three models of second type by utilizing the existing resources. In this case illustration, the RIMP measure has been computed for the two product models (CNC machining centre and CNC lathe) separately. Afterwards, for certain design changes in the first product (CNC machining centre), the RIMP measure has been computed. The results are given in Table 5.

Table 5: Shop floor Performance Measures of the System before and after Changes in the Product Design

<table>
<thead>
<tr>
<th>Partial measure</th>
<th>Total measure</th>
<th>Before change</th>
<th>After change</th>
</tr>
</thead>
<tbody>
<tr>
<td>ProductivityLabour Capital Material Overhead</td>
<td>Total Productivity (TP)</td>
<td>00.61</td>
<td>00.57</td>
</tr>
<tr>
<td>Quality Prevention Failure Appraisal</td>
<td>Total Quality (TQ)</td>
<td>12.01</td>
<td>11.25</td>
</tr>
<tr>
<td>Flexibility Process Demand Product Machine Material-Handling</td>
<td>Total Flexibility (TF)</td>
<td>01.11</td>
<td>00.95</td>
</tr>
<tr>
<td>TP TQ TF</td>
<td>Revised Integrated Manufacturing Performance Measure (RIMP)</td>
<td>00.38</td>
<td>00.34</td>
</tr>
</tbody>
</table>

Table 6: Product Features before and after Changes in the Product Design

<table>
<thead>
<tr>
<th>Product feature</th>
<th>Before change</th>
<th>After change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of sub-assemblies</td>
<td>147</td>
<td>151</td>
</tr>
<tr>
<td>Work table size (millimeters)</td>
<td>630 x 630</td>
<td>800 x 800</td>
</tr>
<tr>
<td>Power (kW)</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Work table traverse (millimeters)</td>
<td>800 x 800 x 630</td>
<td>1000 x 800 x 630</td>
</tr>
</tbody>
</table>

Interpretation of Results

Table 6 shows that there is a change in the existing model design in terms of worktable traverse and worktable size.
This leads to changes in the system performance measures namely productivity, flexibility and quality. The changes in terms of additional input costs push these measures to the lower side. The value of TF decreases from 1.11 to 0.95 due to additional tooling cost (machine flexibility), rerouting cost (routing flexibility) and material handling cost (material handling flexibility). Though the difference in the two measures is 0.11, it accounts for an additional cost of 9.83 millions of rupees to fulfill the above flexibilities (machine, routing and material handling). In the beginning, it may not be encouraging to invest such a huge capital by any practitioner. But in future it is worthwhile to meet the varying product demands.

Conclusions

Based on the review of literature on flexibility frameworks some efforts have been made on developing a unified framework for integrating the system flexibility measure with other significant performance measures like productivity and quality to arrive at a new performance measure, i.e. revised integrated manufacturing performance (RIMP) measure. This may serve the needs of modern industry in terms of providing guidelines to evaluate and select an appropriate manufacturing system. The robustness of the RIMP measure is tested through different case studies and is depicted in Table 7. From Table 7 it is very clear that the proposed integrated manufacturing measure can be used as a decision tool for a wide variety of manufacturing situations for instance,

(i) it can be used as a decision tool for introducing a new manufacturing facility (as illustrated in case study 1).

(ii) it can be used for evaluation of manufacturing performance with time, i.e. whether to continue the production in the existing conditions or not (as illustrated in case study 2).

(iii) it can be used to compare the system performance when there are certain variations in the product design (as illustrated in case study 3).

Extensions of the Study

The present work can be extended to develop and study a unified framework on a variety of production systems. Gaining of evidence is likely to provide valuable insights into the structure and combination of flexibilities in different kinds of manufacturing systems. For instance, the case study 1 dealt with a conventional type manufacturing system in which one new CNC lathe was introduced. It was observed that this acquisition leads to an increase in the RIMP measure of 1.3 per cent only. This small increase, however, had remarkable intangible benefits. There is improvement in quality and flexibility to the tune of 84.82 per cent and 147.3 per cent respectively. Thus it can be extended to other manufacturing situations to visualize the intangible benefits such as quality and flexibility by evaluating the system performance through RIMP measure.

The study can further be extended in the following ways:
The effect of TP, TQ and

Table 7: Performance Evaluation of the Selected Cases Through Unified Framework - At a Glance

<table>
<thead>
<tr>
<th>Case Study</th>
<th>Objective</th>
<th>Total measure</th>
<th>RIMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>To investigate the impact of addition of a new facility on a manufacturing system</td>
<td>In the selected case, TP measure is decreased due to acquisition of a CNC lathe</td>
<td>Only there is a marginal increase in RIMP measure i.e. from 1.02 to 1.03, especially due to machine acquisition and subsequent increase in TP and TF</td>
</tr>
<tr>
<td>2.</td>
<td>To compare the current and past performance of a manufacturing system</td>
<td>1. TP is decreased in the current system due to a tremendous increase in production overheads 2. Fluctuations in product demand pushes the TF to lower side in the current system 3. On the other hand in the same current system, TQ is increased due to implementation of ISO 9000 systems</td>
<td>RIMP is pushed down from 0.23 to 0.18. This is due to lower values of TP and TF in the current year (refer to Table 4).</td>
</tr>
<tr>
<td>3.</td>
<td>To evaluate the system performance when there are certain variations in the product design.</td>
<td>All the three measures are decreased especially due to additional costs to meet the new product design requirements</td>
<td>The decrease in RIMP i.e. from 0.38 to 0.34 is indicates that the existing system is not flexible enough for meeting the uncertainty in product design</td>
</tr>
</tbody>
</table>
TF when combined with other performance measures of the production system can be investigated.

(i) Micro-level analysis of ill-structured costs such as quality and flexibility for justification of automation projects can be carried out.

(ii) Investigations on RIMP measure with financial justification.

(iii) Development of a decision support system for flexibility in manufacturing for evaluation and selection of manufacturing systems.

References


### Appendix - I: Select Definitions of Various Flexibilities used While Mapping to Various Uncertain Environments

<table>
<thead>
<tr>
<th>Flexibility Type</th>
<th>Definition adopted</th>
<th>Other sources supporting the selected definition of flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Action</strong></td>
<td>The capacity for taking action to meet new circumstances. It facilitates response to change by taking appropriate action (Buzacott, 1982)</td>
<td></td>
</tr>
<tr>
<td><strong>Expansion</strong></td>
<td>The system’s ability of being built and expanded incrementally (Stecke and Raman, 1995)</td>
<td>Browne et al. (1984), Kusiak (1986), Lim (1986), Slack (1987), Zelenovic (1982)</td>
</tr>
<tr>
<td><strong>Market</strong></td>
<td>The ability of a system to efficiently adapt to changing market conditions (Stecke and Raman, 1995)</td>
<td>Stecke and Parker (1997)</td>
</tr>
<tr>
<td><strong>Production</strong></td>
<td>It is defined as the universe of part types that an flexible manufacturing system can produce. It is attained by increasing the level of technology and the versatility of the machine tools (Browne et al., 1984)</td>
<td>Sarker et al. (1994), Stecke and Raman (1995), Taymaz (1989), Gupta and Goyal (1989)</td>
</tr>
<tr>
<td><strong>Design</strong></td>
<td>The ability to redesign a manufacturing process including its expansion and development measures for the flexibility based on the factors range, time, and cost (Rao and Mohanty, 1991)</td>
<td>Bernardo and Mohamed (1992), Taymaz (1989)</td>
</tr>
<tr>
<td><strong>Quality</strong></td>
<td>The ability of the system to change the quality requirements of various products that are manufactured on the system (Rao and Mohanty, 1991).</td>
<td></td>
</tr>
</tbody>
</table>
Flexibility Mapping: Practitioner's Perspective

1. What types of flexibilities you see in the practical situation of “Evaluation and Selection of Technological Systems” on the following points:
   - Flexibility in terms of “options”
   - Flexibility in terms of “change mechanisms”
   - Flexibility in terms of “freedom of choice” to participating actors.

2. Identify and describe the types of flexibilities that are relevant for evaluation and selection of technological systems in your context. On which dimensions, flexibility should be enhanced?

3. Try to map your own organizational technological system on following on continua. (Please tick mark in the appropriate box(es)).

Type of Flexibility

- External or basic Flexibility
- Total Productivity
- System Flexibility
- Internal or organizational Flexibility
- Total Quality
- Aggregate Flexibility

4. Develop a SAP-LAP (Situation Actor Process-Learning Action Performance) model of “Evaluation and Selection of Technological Systems” relevant to your organization.

Reflecting Applicability in Real Life

1. Implement the revised Integrated Manufacturing Performance (RIMP) measure in your organization as proposed in this paper.

2. Carry out analysis to see the impact of adding a new facility and a design change, as proposed in this paper, in the context of your organization and make suitable recommendations for technology upgradation.
Manufacturing Strategy Perspective on Flexibility:  
A Case of Select Indian Companies  
G. S. Dangayach and S. G. Deshmukh  
Department of Mechanical Engineering  
Indian Institute of Technology, New Delhi - 110 016, India  

Abstract  
Manufacturing managers in a broad array of industries may concur that achieving low cost and high quality is no longer enough to guarantee success. In today's fierce competitive scenario, companies are increasingly concentrating on flexibility as a way to achieve new forms of competitive advantage. This flexibility will enable them to respond to customer orders quickly, provide a broad product range, and introduce new products quickly. Flexibility has been recognized as an important competitive priority in manufacturing strategy literature. This research presents a manufacturing strategy perspective on flexibility from Indian industry point of view. The objective of the survey was to assess the status of flexibility in Indian manufacturing companies. In general, flexibility seems to be one of the important priorities for Indian companies. The issue of flexibility is mapped using a manufacturing strategy framework. Two dimensions of flexibility (structural and infrastructure flexibility) are identified and a sectoral comparison is made.

Keywords: advanced manufacturing technology, competitive priorities, empirical research, flexibility, manufacturing strategy

Background
The issue of manufacturing flexibility is assuming significant importance in production management. The need for flexibility is growing due to the changing nature of competition (Buzacott 1982, Gerwin 1987, Slack 1987). Upton (1994) defines flexibility as “the ability to change or react with little penalty in time, effort, cost or performance”. Flexibility has long been recognized as a manufacturing capability that has the potential to impact the competitive position and the business performance of an organization (Cox 1989, DeMeyer et al. 1989, Gupta and Goyal 1989). It is identified as an important competitive priority in manufacturing strategy literature (Skinner 1969, Hill 1987, Gerwin 1993). The manufacturing strategy is a plan that describes the way to produce and distribute the product. It is defined by APICS dictionary as “a collective pattern of decisions that acts upon the formulation and deployment of manufacturing resources. To be most effective, the manufacturing strategy should act in support of the overall strategic directions of the business and provide for competitive advantages” (Cox and Blackstone 1998).

Hill (1987) categorized manufacturing strategy issues into two types, i.e. structural and infrastructural. Structural issues set the process and technology choice for productive operations, whereas infrastructural issues provide it long-term competitive edge by continuously improving upon human resources policies, quality systems, organization culture and information technology. Infrastructural issues are developed through persistent day-to-day use and with commitment of top management and team work at all levels. Effective integration of infrastructural issues with structural issues helps a company achieve manufacturing excellence.

In line with Hill’s framework we have classified manufacturing flexibility into two broad types i.e. structural flexibility and Infrastructure flexibility. Structural flexibility (such as related to capacity, facility and technology) deals with issues that set the process and technology for operations. 

**Capacity:** Production capacity of a company.

**Facility:** The system, which facilitates the production.

**Technology:** The type of technology used (whether connected or standalone).

Infrastructural flexibility (such as related to human resources policies, quality policies, organizational culture, environmental issues etc.) provide the necessary support to the operations function. These are discussed below in brief.

**Human resources policies:** These include skill levels of staff, nature and extent of training, why committed to work? How much they are paid? How they are approached? And how they are motivated? For example, In cement industry, due to dusty and foggy environment, human resources policies are more important. To reduce labour turnover and keep their motivation high, effective labour welfare policies are a must.

**Quality policies:** These deal with how defective products and services are prevented? How quality systems are implemented? What is the system for monitoring, measuring, and improving upon quality.

**Organizational culture:** Organisational culture includes team work, central versus distributed control, degree of autonomy, degree of decentralization etc. which are very important in
Flexibility is “the ability to change or react with little penalty in time, effort, cost or performance”.

Impact of product variety on performance in process industries. Lau (1999) studied 382 US computer and electronics companies and related flexibility and infrastructural issues in manufacturing strategy. Beach et al. (2000) conducted a survey of UK manufacturing companies and examined flexibility in manufacturing operations. Vokurka and Leary-Kelly (2000) reviewed literature and presented a comprehensive contingency-based framework for flexibility. Dangayach and Deshmukh (2001) studied 25 process companies from India to identify various manufacturing strategy issues. In their study of automobile companies Dangayach and Deshmukh (1999) discussed various aspects of manufacturing strategy observed in Indian companies. Various researchers examined flexibility aspects (Sethi and Sethi 1990, Dixon 1992, D’Souza and Williams 2000, Beach et al. 2000) in their studies of manufacturing companies. Most of the studies were based on developed economies such as USA and UK. Very few studies have been made on flexibility aspects in developing countries. This research is an attempt to fill this gap. In this study, we report findings of a multi-sector survey of Indian manufacturing companies. The survey aimed to examine manufacturing flexibility perspective on flexibility.

Framework of Manufacturing Flexibility

Figure 1 shows a conceptual framework of manufacturing flexibility, which is developed, based on the literature (Dixon 1992, Gupta 1993, Lau 1999). In this research, an attempt is made to test this framework.

Imperatives

Manufacturing flexibility is influenced by various imperatives such as globalized market, competitive pressures, demanding customers, and shortened technology life cycle. These are explained in brief.

- **Globalized market**: This is because of the liberalization of economies, WTO agreements, and advancements in information technology.
- **Competitive pressures**: These pressures are felt since there are no trade boundaries.
- **Demanding customers**: The customer is also globalized and being exposed to a variety of products/services, demands value for money through quality.
- **Shortened technology life**: Today the life cycle of any technology is very volatile. Information technology, materials and biotechnology have made the life spans very small. Due to this, a company needs to keep continuous watch on technology front.

Flexible Response of Organization

We hypothesize that an organization responds to the above pressures by employing flexibility as a competitive weapon. Six attributes of manufacturing flexibility (design changes, volume changes, product mix adjustment, large product
features, capacity adjustment, and large product variety) are identified and given in Appendix-I. Based on the manufacturing strategy literature, we have categorized manufacturing flexibility into structural flexibility (SF) and infrastructure flexibility (IF). We hypothesize that a company deploys various tools and techniques to incorporate flexible response. Issues of structural flexibility may be addressed by use of Advanced Manufacturing Technology (AMT). Similarly, Integrated Information Systems (IIS), Advanced Management Systems (AMS), and Autonomy enable a company to address the issue of infrastructure flexibility. Detailed attributes of AMT, IIS, AMS, and Autonomy are given in Appendix I. Thus the organizational response to manufacturing flexibility can be actuated by employing AMT, IIS, AMS, and Autonomy.

**Advanced Manufacturing Technology (SF):** Deploying advanced manufacturing technology like CAD, CAM, FMS etc.

**Integrated Information Systems (IF):** Integration of various functions through information systems (MRP, ERP etc.).

**Advanced Management Systems (IF):** Simplification of processes with advanced management systems such as TQM, BPR, WI etc.

**Autonomy (IF):** Giving workers more responsibility for planning and inspection.

We have measured structural and infrastructure flexibility through attributes of AMT, IIS, autonomy and AMS.

**Manufacturing strategy is a collective pattern of decisions that acts upon the formulation and deployment of manufacturing resources. To be most effective, the manufacturing strategy should act in support of the overall strategic directions of the business and provide for competitive advantages.**

To examine the flexibility perspective in Indian manufacturing companies, a survey was conducted in four major manufacturing sectors, i.e. automobile, electronics, machinery, and process. A structured questionnaire was developed and administered. The questionnaire is given in Appendix II. In the next section, analyses of survey findings are given.

**Methodology Used and Analysis**

The survey methodology is used for study and focus of study is cross-sectional. The objective of study is to become more familiar through survey and information is collected at one point in time. The methodology was based on a questionnaire survey with mono-respondent approach. One hundred and twenty filled responses have been received (34.8% response rate)(Table 1). This response rate is higher than as suggested by Flynn et al. (1990) (between 10 to 30%). The detailed research methodology is given in Appendix II.

The discussion of the results is divided into five sections. The first section describes attributes of manufacturing flexibility. The following sections are devoted to the, structural flexibility (advanced manufacturing technology), and infrastructure flexibility (integrated information systems, advanced management systems, and autonomy), effect of company size on flexibility, and correlation coefficients.

**Table 1 : Statistics of the Respondent Companies and Sector-wise Distribution**

<table>
<thead>
<tr>
<th>Number of employees</th>
<th>Respondent companies (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 100</td>
<td>24 (20)</td>
</tr>
<tr>
<td>2. 100-500</td>
<td>22 (18.4)</td>
</tr>
<tr>
<td>3. 500-1000</td>
<td>20 (16.6)</td>
</tr>
<tr>
<td>4. 1000-3000</td>
<td>39 (32.5)</td>
</tr>
<tr>
<td>5. 3000-5000</td>
<td>6 (5)</td>
</tr>
<tr>
<td>6. &gt; 5000</td>
<td>9 (7.5)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>120 (100)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual sales (million US $)</th>
<th>Respondent companies (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 0.25-1.25</td>
<td>24 (20)</td>
</tr>
<tr>
<td>2. 1.25-2.5</td>
<td>10 (8.4)</td>
</tr>
<tr>
<td>3. 2.5-12.5</td>
<td>24 (20)</td>
</tr>
<tr>
<td>4. 12.5-25</td>
<td>12 (10)</td>
</tr>
<tr>
<td>5. &gt; 25</td>
<td>50 (41.6)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>120 (100)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exports (% of total sales)</th>
<th>Respondent companies (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Nil</td>
<td>35 (29.2)</td>
</tr>
<tr>
<td>2. ( 10 %)</td>
<td>65 (54.1)</td>
</tr>
<tr>
<td>3. 10-20 %</td>
<td>15 (12.5)</td>
</tr>
<tr>
<td>4. 20-30 %</td>
<td>2 (1.7)</td>
</tr>
<tr>
<td>5. &gt; 30 %</td>
<td>3 (2.5)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>120 (100)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry sector</th>
<th>Respondent companies (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Automobile</td>
<td>31 (26)</td>
</tr>
<tr>
<td>2. Electronics</td>
<td>31 (26)</td>
</tr>
<tr>
<td>3. Machinery</td>
<td>24 (20)</td>
</tr>
<tr>
<td>4. Process</td>
<td>34 (28)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>120(100)</strong></td>
</tr>
</tbody>
</table>
Attributes of Manufacturing Flexibility

Respondents were asked to indicate degree of importance given (on five point Likert scale) to various attributes of flexibility (MF1-MF6). These attributes were identified based on the literature (Gupta and Buzacott 1989, Gupta and Somers 1992, Gupta 1993, Stecke and Raman 1995). Table 2 presents the sector-wise mean and standard deviation values. It is observed that in general Indian manufacturing company feels to “adjust capacity quickly” (MF2), as the most important attribute (mean score 3.60), which provides flexibility. Design changes (MF1) is the least important attribute (mean score 3.00) for Indian manufacturing companies. Rapid volume changes (MF3) is the most important attributes of flexibility for automobile sector, whereas “adjust capacity quickly” (MF2) is the most important attribute for electronics, machinery, and process companies. Similarly “making rapid design changes” (MF1) is the least important flexibility attribute for electronics, machinery, and process sector.

Structural Flexibility (SF)

Advanced Manufacturing Technology

Based on the literature (Mechling et al. 1995, Clark 1996) 12 relevant advanced manufacturing technologies (AMT) are identified for Indian companies which provide structural flexibility. Details of these activities are given in Appendix-I. Respondents were asked to indicate degree of investment in these AMTs in their companies on five point Likert scale (where 1-No investment and 5-Heavy investment). Overall and sector wise mean and standard deviation score is given in Table 3 (a). It observed from Table 3 (a) that the most preferred AMT for automobile sector companies is CNC and that of electronics and machinery sector is CAD, whereas process companies are investing highly in automated material handling systems (AMHS) due to their continuous flow type production process.

Table 3 (a) : Structural Flexibility (SF):
Advanced Manufacturing Technology (AMT)

<table>
<thead>
<tr>
<th>AMT</th>
<th>Overall (N = 120) Mean SD</th>
<th>Automobile (N = 31) Mean SD</th>
<th>Electronics (N = 31) Mean SD</th>
<th>Machinery (N = 24) Mean SD</th>
<th>Process (N = 120) Mean SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAD</td>
<td>3.18 1.31</td>
<td>3.58 1.08</td>
<td>3.51 1.17</td>
<td>3.50 1.21</td>
<td>2.32 1.51</td>
</tr>
<tr>
<td>CAE</td>
<td>2.52 1.30</td>
<td>2.77 1.30</td>
<td>2.67 1.32</td>
<td>2.37 1.31</td>
<td>2.26 1.28</td>
</tr>
<tr>
<td>CAP</td>
<td>2.51 1.38</td>
<td>2.61 1.47</td>
<td>2.70 1.32</td>
<td>2.41 1.38</td>
<td>2.35 1.39</td>
</tr>
<tr>
<td>CNC</td>
<td>2.90 1.62</td>
<td>3.64 1.35</td>
<td>2.93 1.69</td>
<td>2.62 2.41</td>
<td>2.16 1.67</td>
</tr>
<tr>
<td>DMC</td>
<td>2.18 1.32</td>
<td>2.61 1.47</td>
<td>2.19 1.32</td>
<td>2.00 1.28</td>
<td>1.88 1.14</td>
</tr>
<tr>
<td>RO</td>
<td>1.61 1.01</td>
<td>1.58 0.80</td>
<td>1.87 1.20</td>
<td>1.54 1.02</td>
<td>1.52 1.02</td>
</tr>
<tr>
<td>CM</td>
<td>2.00 1.20</td>
<td>2.48 1.26</td>
<td>1.85 1.15</td>
<td>2.04 1.16</td>
<td>1.67 1.12</td>
</tr>
<tr>
<td>FMS</td>
<td>2.30 1.29</td>
<td>2.83 1.29</td>
<td>2.06 2.28</td>
<td>2.45 1.21</td>
<td>1.97 1.21</td>
</tr>
<tr>
<td>AMHS</td>
<td>2.27 1.32</td>
<td>2.38 1.30</td>
<td>2.09 1.87</td>
<td>2.94 2.64</td>
<td>1.55 1.55</td>
</tr>
<tr>
<td>AGV</td>
<td>1.65 1.09</td>
<td>1.67 1.13</td>
<td>1.54 1.09</td>
<td>1.41 0.82</td>
<td>1.94 1.20</td>
</tr>
<tr>
<td>BC</td>
<td>2.00 1.29</td>
<td>2.22 1.38</td>
<td>2.03 1.40</td>
<td>1.66 1.00</td>
<td>2.02 1.31</td>
</tr>
<tr>
<td>AS/RS</td>
<td>1.89 1.27</td>
<td>1.96 2.12</td>
<td>1.38 1.54</td>
<td>1.02 1.85</td>
<td>1.32 1.32</td>
</tr>
<tr>
<td>Grand mean</td>
<td>2.25 1.28</td>
<td>2.52 1.26</td>
<td>2.29 1.29</td>
<td>2.11 1.16</td>
<td>2.07 1.29</td>
</tr>
</tbody>
</table>

SD - Standard deviation (on five point Likert scale; 1-No investment, 5-Heavy investment)

Values in bold represents the structural flexibility attribute with the highest mean score.

Infrastructure Flexibility (IF)

Integrated Information Systems (IIS)

Integrated Information Systems (IIS) encompasses systems such as Material Requirement Planning (MRP), Manufacturing Resource planning (MRPII), Enterprise Resource Planning (ERP), and Activity Based Costing (ABC). Respondents were asked to indicate degree of investment in these activities in their companies on a five point Likert scale (where 1- No investment and 5 - Heavy investment). Overall and sector wise mean and standard deviation score is given in Table 3(b). It is observed from Table 3(b) that mean score is highest for MRP, which reflects that Indian manufacturing companies (from all four sectors) are investing in MRP to achieve infrastructure flexibility.

Advanced Management Systems (IF2)

Eleven advanced management systems (AMS) are identified for Indian companies, which help in simplification of processes. Details of these activities are given in Appendix I 1. Respondents were asked to indicate degree of investment in these activities in their companies on five point Likert scale.
Table 3 (b) : Infrastructure Flexibility (IF1): Integrated Information Systems (IIS)

<table>
<thead>
<tr>
<th>IS</th>
<th>Overall Mean SD</th>
<th>Automobile Mean SD</th>
<th>Electronics Mean SD</th>
<th>Machinery Mean SD</th>
<th>Process Mean SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRP</td>
<td>3.18 1.28</td>
<td>3.58 1.25</td>
<td>3.09 1.37</td>
<td>2.79 1.25</td>
<td>3.20 1.17</td>
</tr>
<tr>
<td>MRPII</td>
<td>2.80 1.41</td>
<td>3.25 1.36</td>
<td>2.51 1.45</td>
<td>2.50 1.31</td>
<td>2.88 1.40</td>
</tr>
<tr>
<td>ERP</td>
<td>2.76 1.58</td>
<td>2.93 1.45</td>
<td>2.74 1.73</td>
<td>2.70 1.57</td>
<td>2.73 1.58</td>
</tr>
<tr>
<td>ABC</td>
<td>2.60 1.39</td>
<td>2.64 1.33</td>
<td>2.41 1.50</td>
<td>2.50 1.17</td>
<td>2.82 1.50</td>
</tr>
<tr>
<td>Grand mean</td>
<td>2.83 1.41</td>
<td>3.10 1.35</td>
<td>2.68 1.51</td>
<td>2.62 1.32</td>
<td>2.90 1.41</td>
</tr>
</tbody>
</table>

SD - Standard deviation (on five point Likert scale; 1-No investment, 5-Heavy investment) Values in bold represents the infrastructure flexibility attribute with the highest mean score.

The new competition is in terms of reduced cost; improved quality, products with higher performance, a wider range of products and better service, all delivered simultaneously.

Table 3 (c) : Infrastructure Flexibility (IF2): Advanced Management Systems (AMS)

<table>
<thead>
<tr>
<th>IS</th>
<th>Overall Mean SD</th>
<th>Automobile Mean SD</th>
<th>Electronics Mean SD</th>
<th>Machinery Mean SD</th>
<th>Process Mean SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>OA</td>
<td>3.16 1.19</td>
<td>3.06 1.15</td>
<td>3.25 1.20</td>
<td>3.08 1.01</td>
<td>3.29 1.36</td>
</tr>
<tr>
<td>CR</td>
<td>3.69 1.03</td>
<td>3.80 1.01</td>
<td>3.90 0.94</td>
<td>3.12 1.15</td>
<td>3.76 0.95</td>
</tr>
<tr>
<td>TQM</td>
<td>3.70 1.08</td>
<td>4.16 0.77</td>
<td>3.93 0.85</td>
<td>3.16 1.23</td>
<td>3.47 1.23</td>
</tr>
<tr>
<td>RC</td>
<td>2.48 1.25</td>
<td>2.35 1.11</td>
<td>2.61 1.38</td>
<td>2.50 1.10</td>
<td>2.47 1.39</td>
</tr>
<tr>
<td>BPR</td>
<td>2.95 1.26</td>
<td>3.25 1.18</td>
<td>2.96 1.27</td>
<td>3.08 1.31</td>
<td>2.58 1.25</td>
</tr>
<tr>
<td>SPC</td>
<td>3.25 1.16</td>
<td>3.41 1.20</td>
<td>3.41 1.05</td>
<td>2.91 1.24</td>
<td>3.17 1.16</td>
</tr>
<tr>
<td>JBT</td>
<td>2.89 1.32</td>
<td>3.67 1.07</td>
<td>2.87 1.33</td>
<td>2.41 1.24</td>
<td>2.50 1.26</td>
</tr>
<tr>
<td>WI</td>
<td>3.62 1.00</td>
<td>3.70 1.03</td>
<td>3.77 1.02</td>
<td>3.37 1.09</td>
<td>3.55 0.89</td>
</tr>
<tr>
<td>BM</td>
<td>3.21 1.17</td>
<td>3.58 1.11</td>
<td>3.00 1.23</td>
<td>3.12 1.11</td>
<td>3.14 1.18</td>
</tr>
<tr>
<td>EE</td>
<td>3.36 1.08</td>
<td>3.54 0.99</td>
<td>3.51 1.09</td>
<td>2.95 0.99</td>
<td>3.32 1.17</td>
</tr>
<tr>
<td>MT</td>
<td>3.81 0.98</td>
<td>3.77 0.99</td>
<td>3.83 0.96</td>
<td>3.83 1.00</td>
<td>3.91 0.99</td>
</tr>
<tr>
<td>Grand mean</td>
<td>3.28 1.13</td>
<td>3.48 1.05</td>
<td>3.36 1.12</td>
<td>3.04 1.13</td>
<td>3.19 1.16</td>
</tr>
</tbody>
</table>

SD - Standard deviation (on five point Likert scale; 1-No investment, 5-Heavy investment) Values in bold represents the infrastructure flexibility attribute with the highest mean score.

Table 3 (d) : Infrastructure Flexibility (IF3): Autonomy

<table>
<thead>
<tr>
<th>IS</th>
<th>Overall Mean SD</th>
<th>Automobile Mean SD</th>
<th>Electronics Mean SD</th>
<th>Machinery Mean SD</th>
<th>Process Mean SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>2.74 1.16</td>
<td>2.87 1.11</td>
<td>2.80 1.10</td>
<td>2.79 1.21</td>
<td>2.47 1.02</td>
</tr>
<tr>
<td>A2</td>
<td>3.60 0.95</td>
<td>3.83 0.89</td>
<td>3.61 0.88</td>
<td>3.54 0.97</td>
<td>3.41 1.04</td>
</tr>
<tr>
<td>A3</td>
<td>3.50 1.22</td>
<td>3.12 1.20</td>
<td>3.67 1.24</td>
<td>3.58 1.13</td>
<td>3.67 1.22</td>
</tr>
<tr>
<td>A4</td>
<td>3.28 1.42</td>
<td>3.38 1.33</td>
<td>3.29 1.55</td>
<td>3.04 1.39</td>
<td>3.38 1.45</td>
</tr>
<tr>
<td>Grand mean</td>
<td>3.28 1.18</td>
<td>3.30 1.13</td>
<td>3.36 1.24</td>
<td>3.23 1.17</td>
<td>3.23 1.18</td>
</tr>
</tbody>
</table>

SD - Standard deviation (on five point Likert scale; 1-Totally disagree, 5-Totally agree) Values in bold represents the infrastructure flexibility attribute with the highest mean score.

The respondents were asked to indicate their degree of agreement for four attributes of autonomy (A1-A4) on a five point Likert scale. Table 3(d) gives the overall and sector wise mean and standard error scores. It is observed from Table 3(d), that in general Indian manufacturing companies are giving more inspection responsibility to workers (A2; mean score 3.60) to achieve infrastructure flexibility. Electronics, machinery and process sector companies are giving more decision-making power (A3; mean score 3.67, 3.58, 3.67 respectively) to its employees, however automobile companies are following the trend of general manufacturing company, i.e. giving more responsibility to their workers for inspection.

Table 4: Criteria to Classify Companies

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Small (N)</th>
<th>Medium (N)</th>
<th>Large (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees</td>
<td>≤ 500 (46)</td>
<td>500 - 3000 (59)</td>
<td>&gt; 3000 (15)</td>
</tr>
<tr>
<td>Annual sales (million US $)</td>
<td>≤ 2.5 (34)</td>
<td>2.5 - 25 (36)</td>
<td>&gt; 25 (50)</td>
</tr>
</tbody>
</table>

N - Number of companies

Effect of Company Size on Flexibility

To study the effect of size of the companies on flexibility, we have classified the respondent 120 companies into three clusters (small, medium and large) based on two criteria. First classification is based on number of employees, and other is on annual sales. Number of employees ranges from 100 to above 5000 and annual sales varies from US $ 0.25 million to above US $ 25 million. The companies are labeled as small, medium and large based on criteria given is Table 4.
in mean is statistically significant. This reflects that manufacturing flexibility matters in small, medium and large size of companies based on number of employees and annual sales.

Table 5: Mean scores of Three Clusters on Various Flexibility Dimensions

<table>
<thead>
<tr>
<th>Flexibility dimension</th>
<th>Small Criter. 1</th>
<th>Criter. 2</th>
<th>Medium Criter. 1</th>
<th>Criter. 2</th>
<th>Large Criter. 1</th>
<th>Criter. 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMT (12-items)</td>
<td>1.68</td>
<td>1.83</td>
<td>2.49</td>
<td>2.26</td>
<td>2.61</td>
<td>2.52</td>
</tr>
<tr>
<td>IIS (4-items)</td>
<td>2.51</td>
<td>2.57</td>
<td>2.98</td>
<td>2.70</td>
<td>3.21</td>
<td>3.11</td>
</tr>
<tr>
<td>AMS (11-items)</td>
<td>3.15</td>
<td>3.13</td>
<td>3.34</td>
<td>3.17</td>
<td>3.42</td>
<td>3.47</td>
</tr>
<tr>
<td>Autonomy (4-items)</td>
<td>3.28</td>
<td>3.28</td>
<td>3.31</td>
<td>3.27</td>
<td>3.20</td>
<td>3.35</td>
</tr>
<tr>
<td>MF (6-items)</td>
<td>3.13</td>
<td>3.17</td>
<td>3.44</td>
<td>3.37</td>
<td>3.32</td>
<td>3.35</td>
</tr>
</tbody>
</table>

Criterion 1: based on number of employees, Criterion 2: based on annual sales

Correlation Coefficients

Figure 2 shows the correlation coefficients between manufacturing flexibility (MF) and dimensions of structural flexibility (AMT) and infrastructure flexibility (IIS, autonomy, AMS). Two tailed Pearson correlation coefficient is calculated with SPSS for Windows (version 7.5). Our results show that correlation coefficient between MF and IIS is the least, i.e. 0.254, however it is highest between MF and AMS (0.410). Correlation coefficients are significant at level 0.01. These results validate our findings that Indian companies are paying more attention to AMS as compared to IIS and AMT.

Concluding Remarks

Research Findings

- Economic reforms and global competition have given Indian manufacturing companies an opportunity to look at the strategic role of manufacturing. This has motivated Indian companies to give high priority to quality management.
- Because of competitive imperatives, Indian companies need to respond to global pressures. Flexibility provides a useful mechanism to respond to such pressures.
- Various dimensions of flexibility are identified. It is classified into structural flexibility and infrastructure flexibility.
- It seems that Indian companies are giving more importance to attributes of manufacturing flexibility as it is observed (from Tables 2 to 3(d)) that grand mean of manufacturing flexibility (MF1 to MF6) is the highest, i.e. 3.30.
- Infrastructure flexibility attributes (AMS, Autonomy, and IIS) are more preferred by Indian manufacturers as compared to structural flexibility (AMT).
- Indian companies are investing more in advanced management systems (AMS: grand mean=3.28) and Autonomy (grand mean=3.28) to achieve infrastructure flexibility as compared to integrated information systems (IIS: grand mean=2.83).
- Advanced manufacturing technology (AMT: grand mean=2.25) has attracted least emphasis by Indian companies.
- Indian companies are investing only in CAD and CNC to achieve structural flexibility. It is the structural flexibility, which provides basis for competitive edge to a company in present intense global competition.
- Decisions to achieve flexibility could be addressed by investing in various improvement activities such as AMS, IIS, AMT, and autonomy.
- It is worthwhile to recollect Skinner’s (1969) insistence on the importance of human factors and “production systems”. The findings in this study re-affirm the importance of “infrastructure”- the software (AMS), in a sense, that a company employs to select and control the performance of its hardware (AMT). These systems should be designed to encourage the continual adaptation and improvement of a company’s skill base.
- Indian manufacturing companies seem to be following “people-intensive” capabilities based approach to achieve flexibility. It is reflected with the more emphasis given to infrastructure flexibility attributes such as advanced management systems, integrated information systems, and autonomy.
- Large companies (in annual sales and number of employees) invest more in infrastructure flexibility than small and medium size companies. We observed statistically significant difference in mean scores among large, medium, and small companies (Table 5).

Implications of the Study

Managerial Implications

For practitioners, this study provides several important implications:

- By building on the work of previous studies conducted in the industrialized countries, this study helps to provide a better understanding on flexibility in a dynamic and changing business environment, and points out manufacturing strategy perspective on flexibility for Indian manufacturers.
- The results underscore the importance of attributes of flexibility (i.e. manufacturing flexibility, structural flexibility (advanced manufacturing technology), and infrastructure flexibility (integrated information systems, and advanced management systems)) for practitioners. To
achieve flexibility in a company, managers should invest in hard (advanced manufacturing technology) and soft (integrated information systems, and advanced management systems) techniques.

- Manufacturers can no longer be comfortable competing on the basis of one or two functional area competencies. The globalized environment requires that manufacturers have multiple competencies such as quality, delivery, flexibility, and cost.

**Implications for Researchers**

The study also provides some implications for researchers.

- The questionnaire developed can be improved further to examine linkages of flexibility with other competitive priorities.
- Other dimensions of flexibility need to be explored further.
- Sector specific dimensions of flexibility can be explored further.

**Limitations and Scope for Future Work**

The four major manufacturing sector companies (automobile, electronics, machinery, and process) have been included in our study. Companies from all parts of the country (East: 6, West: 20, North: 78, and South: 16) responded to our questionnaire. However, this study has some limitations, which future researchers could consider. First, mono-respondent approach is adopted due to high cost associated with multi-respondent approach. Second, flexibility aspects are studied in a developing country like India. Future researchers may direct their study to compare flexibility of Indian companies with that of other developing countries. Third, other sectors can be included in the study and/or the present sectors can be further classified (for example, further classification of automobile into vehicle manufacturers and component manufacturers).

**Acknowledgement**

A part of the research reported here was presented at the International Conference: GLOGIFT-2000 and published in the conference proceedings “New Business Paradigm: Global, Virtual and Flexible”. A discussion with Professor Kathryn E Stecke has helped in refining our ideas and format of this paper. We are grateful to her for constructive comments and suggestions.

Authors would like to thank also, the anonymous referees for their valuable comments, which has improved the contents and format of the paper.

**References**


### Appendix I

#### Explanation of Various Attributes of Flexibility

<table>
<thead>
<tr>
<th>Flexibility Dimension</th>
<th>Notation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing flexibility (MF)</td>
<td>MF1</td>
<td>Make rapid design changes</td>
</tr>
<tr>
<td></td>
<td>MF2</td>
<td>Adjust capacity quickly</td>
</tr>
<tr>
<td></td>
<td>MF3</td>
<td>Make rapid volume changes</td>
</tr>
<tr>
<td></td>
<td>MF4</td>
<td>Offer a large degree of product features</td>
</tr>
<tr>
<td></td>
<td>MF5</td>
<td>Offer a large degree of product variety</td>
</tr>
<tr>
<td></td>
<td>MF6</td>
<td>Adjust product-mix</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Structural flexibility (SF) (AMT)</th>
<th>Notation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FMS</td>
<td></td>
<td>Computer aided design: computer supported design and drafting system</td>
</tr>
<tr>
<td>AMHS</td>
<td></td>
<td>Computer aided engineering: computer assisted engineering methods</td>
</tr>
<tr>
<td>AGV</td>
<td></td>
<td>Computer control: numerically controlled machine tools</td>
</tr>
<tr>
<td>BC</td>
<td></td>
<td>Direct numerical control: numerical control machine with centralized computer</td>
</tr>
<tr>
<td>AS/RS</td>
<td></td>
<td>Robotics: use of Robots for pick and place or other material handling work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cellular manufacturing: organizing the shop floor such that an operator has the resources to produce an entire product</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flexible manufacturing systems: computer integrated systems which have the flexibility to rapidly change product type and mix</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Automated material handling systems: automatic material handling devices such as conveyors, gantry robots etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Automated guided vehicles: driver less vehicles run on special painted paths</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bar coding: bar identification system</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Automated storage and retrieval system (AS/RS): mechanized stock management system</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructure flexibility (IF1) (IIS)</th>
<th>Notation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRP</td>
<td></td>
<td>Material requirement planning: computer assisted material planning system</td>
</tr>
<tr>
<td>MRPII</td>
<td></td>
<td>Manufacturing resource planning: computer based system for planning and allocation of work among employees</td>
</tr>
<tr>
<td>ERP</td>
<td></td>
<td>Enterprise resource planning: integrated information management system</td>
</tr>
<tr>
<td>ABC</td>
<td></td>
<td>Activity based costing: philosophy of cost reduction through activity based cost accounting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructure flexibility (IF2) (AMS)</th>
<th>Notation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>OA</td>
<td></td>
<td>Office automation: computerization of office systems</td>
</tr>
<tr>
<td>CR</td>
<td></td>
<td>Customer relations: improve customer satisfaction, customer-supplier relationship</td>
</tr>
<tr>
<td>TQM</td>
<td></td>
<td>Total quality management: approach to improving the competitiveness of an Organization through kaizen, total participation and continuous improvement</td>
</tr>
<tr>
<td>RC</td>
<td></td>
<td>Recycling: reusing waste materials</td>
</tr>
<tr>
<td>BPR</td>
<td></td>
<td>Business process reengineering: fundamental rethinking and radical redesign of business processes to achieve improvements</td>
</tr>
<tr>
<td>SPC</td>
<td></td>
<td>Statistical process control: the use of statistical methods to control quality</td>
</tr>
<tr>
<td>JIT</td>
<td></td>
<td>Just-in-time: produce and deliver finished goods just-in-time to be sold</td>
</tr>
<tr>
<td>BM</td>
<td></td>
<td>Benchmarking: comparing a company’s performance against the best practice</td>
</tr>
<tr>
<td>WI</td>
<td></td>
<td>Workforce involvement: giving worker more planning responsibility</td>
</tr>
<tr>
<td>EE</td>
<td></td>
<td>Employee empowerment: philosophy of handing responsibility and decision making to employees lower down in Organization</td>
</tr>
<tr>
<td>MT</td>
<td></td>
<td>Management training: training and skill development programs for managers</td>
</tr>
</tbody>
</table>

Source: MF (Upton 1995), SF (Mechling et al. 1995), IF1 and IF2 (Dangayach & Deshmukh 1999), IF3 (Mortia & Flynn 1997)
A database of 345 manufacturing companies has been created based on companies from all over the country. The manufacturing industry is made up of many different sectors; the overall-manufacturing climate influences each of which. In Indian perspective major manufacturing sectors are automobile, electronics, machinery manufacturing and process industries (Statistical Outline of India 1999-2000). We have included all these four sectors in our study. Selection criteria is based on two parameters i.e. number of employees (≥ 100) and annual sales (≥ 0.25 million US $).

Automobile sector includes companies producing light and heavy-duty vehicles and automotive components. Electronics industry includes companies manufacturing telephones, electronic circuits, control panels, computer peripherals, insulators and domestic electronic appliances. Machinery manufacturing companies produces power presses, weighing machines, computer numerical control machines, pumps, air conditioners, compressors, agricultural machines and material handling equipment. Companies in process sector produces paints, drugs and medicines, tyres, steel, cement, petroleum products, textile fabrics, fertilizers and chemicals.

To assess content validity a “dry run” was made and few questionnaires were administered to few leading practitioners, consultants and academicians. Based on their feedback the present form has been evolved and final version of the questionnaire was sent to the CEOs of 345 companies. Inter-item analysis is used to check the scales for internal consistency or reliability. Cronbach’s coefficient alpha is calculated for each scale, as recommended for empirical research in operation management (Flynn et al. 1990, and given in appendix. Cronbach’s alpha values for each scale is more than 0.5, which is considered adequate for exploratory work (Nunally 1978).

1. Attributes of manufacturing flexibility (on 5 point Likert scale, 1– Least important, 5-Most important) (Cronbach’s alpha = 0.8722)
2. Investment in improvement activities (on 5 point Likert scale, 1– No investment, 5-Heavy investment) (Cronbach’s alpha = 0.9079)
3. Autonomy (on 5 point Likert scale, 1–No emphasis, 5-Full emphasis) (Cronbach’s alpha = 0.7953)

The Respondents

After reminders, phone calls, e-mail and re-reminders, 120 filled responses have been received, which gives 34.8% response rate. Area wise distribution of respondent companies is observed as under

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of respondents (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern India (NI)</td>
<td>78 (65)</td>
</tr>
<tr>
<td>Western India (WI)</td>
<td>20 (17)</td>
</tr>
<tr>
<td>Southern India (SI)</td>
<td>16 (13)</td>
</tr>
<tr>
<td>Eastern India (EI)</td>
<td>6 (5)</td>
</tr>
<tr>
<td>Total</td>
<td>120 (100)</td>
</tr>
</tbody>
</table>

Out of 120 respondents 58 (48%) were CEO/General Manager/President/Vice President/Executive Director with 20-30 years experience. With 10-20 years experience, 37 (31%) respondents were of Divisional Manager/Production Manager/Head-Operations/Works Manager/Director-Technical level. Twenty-five (21%) respondents were Assistant Manager/Deputy Manager/Production Engineer/Quality Engineer with 5-10 years experience.
Flexibility Mapping: Practitioner’s Perspective

1. What types of flexibilities you see in the practical situation of “Manufacturing Strategy Formulation” on the following points:
   - Flexibility in terms of “options”
   - Flexibility in terms of “change mechanisms”
   - Flexibility in terms of “freedom of choice” to participating actors.

2. Identify and describe the types of manufacturing flexibilities that are relevant for your own organizational context. On which dimensions, manufacturing flexibility should be enhanced?

3. Try to map your own organizational technological system on following on continua. (Please tick mark in the appropriate box(es)).

<table>
<thead>
<tr>
<th>Manufacturing Flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional</td>
</tr>
<tr>
<td>Information Systems</td>
</tr>
<tr>
<td>Functional</td>
</tr>
<tr>
<td>Management Systems</td>
</tr>
<tr>
<td>Traditional</td>
</tr>
<tr>
<td>Advanced</td>
</tr>
<tr>
<td>Workers</td>
</tr>
<tr>
<td>Command and Control</td>
</tr>
<tr>
<td>Autonomy</td>
</tr>
</tbody>
</table>

4. Develop a SAP-LAP (Situation Actor Process-Learning Action Performance) model of “Manufacturing Strategy Formulation” relevant to your organization.

Reflecting Applicability in Real Life

1. Estimate different types of flexibilities for your organization as given in this paper.

2. Keeping the manufacturing flexibility perspective, develop the manufacturing strategy for your organization.
International Supply Chain Management: Learning and Evolving Networks

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Abstract  
Multinational corporations are redesigning their organizational structure from a hierarchic multi-domestic structure into a global network. Using the contingency theory framework, we identify the reasons for this change, optimal structures and the potential cost/benefits to be expected. In addition, we also indicate how supply chains learn and adapt to the dynamic global environment. These findings can help practitioners gain a better understanding of international supply chains and provide a theoretical model for academicians to conduct future studies.

Keywords: contingency theory, international operations, material and information flows

Introduction  
In the last two decades, competition has changed dramatically with the opening up of trade barriers regionally and globally. Local companies in both developing and developed countries are being now exposed to increased competition from a new set of competitors that can exploit the comparative advantage of several countries simultaneously. Adding to the local companies’ problems is the growing volatility of the business environment due to the larger number of international players, rapid changes in technology and shorter product life cycles.

Firms have begun to implement two strategies in order to remain competitive: (i) by seeking supplies and productions on a global scale, and (ii) reducing value-added operations in-house via outsourcing and strategic alliances. By sourcing internationally multinationals can take advantage of the unique conditions existing in the countries, such as low wages, raw material availability, and proximity to markets (Grunwald and Flamm, 1985). In addition, this distributed system now gives firms the flexibility to react to the increased volatility in technology and marketplace. It requires transformation of the organization and proper management of supply chains to be successful (Hobbs et al, 1998).

Initially, American firms took their ideas from the US and transplanted them to overseas locations, whereas Japanese firms invested in operations overseas to tap the local cost, material availability and quality advantages. The European firms set-up multi-domestic operations and let them develop their own products, services and supply system. Today, most large American, Japanese and European Multinational Corporations (MNCs) are now moving toward the twin strategy of global disaggregation and supply chain management. In this research, we develop a model to identify why such strategies are necessary today and the expected benefits to accrue by making such a transition.

In the following sections, we will (i) examine the literature relevant to our research, (ii) define our model, and (iii) highlight the implications of this model for managers and nations.

Literature Review  
In this research, we will examine the literature on (i) locating plants globally, (ii) supply chain management, (iii) flexibility, and (iv) contingency theory in order to ground our proposed model.

Managers have had extensive literature to rely upon in locating facilities internationally. For example, Bass, et al (1977) outline the economic, social and political considerations for locating plant sites. A number of quantitative models are also available (Haug 1985, Hodder and Jucker 1986) to help managers in putting up plants globally. Next, the applicable literature on international supply chains is examined.
The literature on international supply chain management is extensive and includes defining the concept, providing descriptive/survey studies of its practices, modelling flows via quantitative/simulation models and providing theoretical models for the control of supply chains.

Logistics is defined by Davies (1987) and Gary and Davies (1991) as composed of materials management, physical distribution management, credit rating, insurance and delivery promises. According to Houlihan (1987), the concept of international logistics can be expanded into international supply chain management by including purchasing, product distribution and sales. A topology by Wood (1990) provides a classification of the various types of distribution channels and the use of intermediaries.

Descriptive/survey studies have also examined the approaches MNC’s have taken in redesigning their supply chains (Berry and Naim 1996, Ernst and Guerrieri 1998), impact of JIT systems on supply chains (Cook and Rogowski 1996, Humphreys, et al 1998, Simpson et al. 1998) and the role of logistics partnerships (Kopczak, 1997). Quantitative models of international supply chain have been suggested (Molonli and Benton, 1997), such as using Theory of Constraints (Perez, 1997) and strategic production-distribution models (Vidal and Goetschalckx, 1997). Levy (1995) finds a significant impact of demand variability and production disruptions which result in substantial unexpected costs related to expedited shipping, high inventories, and lower demand fulfillment using a simulation study.

Theoretical models have also been proposed (Cohen and Malik, 1997). For example, Thorelli (1986) applies organizational network theories to determine the optimum level of control in supply chain management. In addition, Delk (2000) proposes a financial model for international supply chain.

Configured plants form a network or chain that needs to be effectively coordinated (Pope and Prasad 1998, Motwani et al 2000, Popp 2000) to achieve needed flexibility (De Meyer et al. 1989, Fernie 1994, Kogut 1985a, Kogut and Kulatilaka 1994). Multinationals view these flexible networks as a means to derive a strategic advantage (Schary and Skjott-Larsen, 1998). A number of researchers have attempted to define the benefits of such systems (Allen and Pantzalis 1996, Gupta and Somers 1996, Upton 1997). However, none of these researchers examine the organizational dimension to support such flexible structures.

Contingency theory has been extensively used to describe organizational structures under varying environmental conditions. This theory assumes that there is not one “best” structure for all conditions, but rather the optimum form varies according to the underlying condition (Burns and Stalker 1961, Lawrence and Lorsch 1969). The organizational structures are viewed to exist on a continuum from a mechanistic (hierarch) structure on one end to an organic/flat form at the other extreme. In between the two forms, is a range of structures adopting a variety of characteristics of the two extremes. The mechanistic form is prescribed where the environment is stable. A hierarchic structure is quite efficient when the processes can be standardized and mechanized. However, such a structure becomes inefficient when the environment changes and the standards and mechanisms become no longer relevant. In such situations, less formal, organic structure would be more effective.

Much of the literature in international operations is fragmented and is not able to provide an integrative approach to a manager who is trying to apply the dual strategies of global disaggregation and supply chain management. In this paper, a model is developed that specifies the type of international operation and the corresponding logistics structure based on the dynamic international conditions using the contingency theory.

Effectiveness of Global Supply Chains
In this section, we develop an integrative model for the effective application of supply chain management for the international operations. First, we explain the types of international structures, and then detail how the changing environment affects them.

Firms have begun to implement two strategies in order to remain competitive: (i) by seeking supplies and productions on a global scale and (ii) reducing value-added operations in-house via outsourcing and strategic alliances.

International Operations Structures
The structure of international operations can be viewed on a continuum of multi-domestic, hybrid to global networks (Figure 1). On one extreme is a multi-domestic structure, whereas on the other end is a distributed global network. Most multinationals do not setup up operations at the extreme ends, but rather exist somewhere along the continuum. Some firms are organized more closely towards a multi-domestic structure, while others are closer to the organic global network form. The type of structure which is most applicable is a function of the environment a business operates within.

<table>
<thead>
<tr>
<th>Structure</th>
<th>Multi-domestic</th>
<th>Hybrid</th>
<th>Global network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>Hierarchic</td>
<td>Stable</td>
<td>Dynamic</td>
</tr>
<tr>
<td>Flows (Information and Material)</td>
<td>Formal structured pattern</td>
<td>Evolving</td>
<td>Distributed learning systems</td>
</tr>
</tbody>
</table>

Figure 1. Continuum of International Operations: Structure, Environment and Flows
If the environment is rather stable and closed, a multi-domestic structure would be the most efficient form. Multi-domestic operations are designed to source, produce and satisfy demand in only one country. This type of structure tends to be more hierarchic in nature, with the various operations functioning somewhat independently of each other and solely reporting to the headquarters (See Figure 2). As the environment becomes more open and correspondingly more dynamic, a hybrid structure would be more effective. A hybrid structure would possibly entail transactions of products, markets and information across two or three countries. For example, with the lowering of trade barriers greater interaction between the subsidiaries is becoming the norm. Such hybrid structures (Figure 3) allow for example an operation in Mexico to supply finished items to the Spanish and British markets, given the possible low labor cost comparative advantage. Finally, as trade barriers fall and the business environment becomes more open and dynamic, a network structure would be the most adaptable for such conditions. On this side of the continuum is a network structure, where the entire value chain is distributed globally. This type of a network (Figure 4) takes advantages of the different comparative advantages among nations. By sourcing and producing on a worldwide basis and matching them with the value chain activities of a multinational’s operations provides a very effective and flexible system. For instance,

In this research, we will examine the literature on (i) locating plants globally, (ii) supply chain management, (iii) flexibility, and (iv) contingency theory in order to ground our proposed model.

An example of such types of structures would be the way Goodyear built factories in the 1960s and 1970s to accommodate the specific demands for various countries. Hence, a plant in Brazil would only produce to satisfy the local demand. No material or data flow occurs between the similar sister plants in other countries.

Between these two extremes of hierarchic and organic designs lie a number of hybrid forms that combine aspects of both to varying degrees (Morgan, 1989). If the trade barriers have fallen somewhat and the environment is more dynamic, design could be somewhat mechanistic, but with management teams, project teams and task forces extending over a number of subsidiaries. This type of a structure would be useful to solve problems that cannot be settled through the formal mechanism. In addition, this type of interaction would allow for new patterns of materials and information flows.
An example for a hybrid structure would be Newell-Rubbermaid office products, where an injection molding plant in Madison, Wisconsin supplies to markets in the U.S., Canada, Mexico and elsewhere. In this type of a structure, there are dedicated plants no duplication of operations.

**Global Network Design**

In a global environment that is truly dynamic with insignificant trade barriers, an organic network organizational design would be recommended. This requires an informal structure with flexible roles, implicit means of control, decentralized decision-making, organic communication channels, and few standard rules and procedures. This results in subsidiaries that do not have narrowly defined roles. Instead, they have the flexibility to source items from a variety of suppliers locally or internationally. Because information has to flow quickly between the different nodes, they have to be interdependent and use informal channels of communication. The supply chain network has to make on-the-spot decisions constantly. It has therefore to trust and communication. The supply chain network has to make on-the-spot decisions constantly. It has therefore to trust and value those employees (Woodward 1965, Lawrence and Lorsch 1969, Dean and Susman 1989), units, suppliers or strategic allies that make quick decisions, even if it means taking a risk. This requires a growth-promoting climate, which encourages collective responsibility for decisions throughout the entire supply chain.

**Table 1. Critical Factors and Outcomes of International Operations Structures**

<table>
<thead>
<tr>
<th>Issues</th>
<th>Multi-domestic</th>
<th>Global Supply Chain</th>
<th>Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical Factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tariffs and trade barriers</td>
<td>High</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Transportation costs</td>
<td>High</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Coordination/Communication costs</td>
<td>High</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>Operations outcomes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sourcing</td>
<td>Local</td>
<td>Global</td>
<td></td>
</tr>
<tr>
<td>Production</td>
<td>Local</td>
<td>Distributed based on local core competencies</td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td>Low</td>
<td>High</td>
<td></td>
</tr>
<tr>
<td>Rationalization</td>
<td>None</td>
<td>Complete</td>
<td></td>
</tr>
<tr>
<td>Economic outcomes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economies of Scale</td>
<td>Local production</td>
<td>Global</td>
<td></td>
</tr>
<tr>
<td>Price/cost</td>
<td>Standard/stable</td>
<td>Varies to dynamic environment</td>
<td></td>
</tr>
<tr>
<td>Optimization</td>
<td>Global</td>
<td>Possible sub-optimization</td>
<td></td>
</tr>
<tr>
<td>Markets</td>
<td>Local</td>
<td>Global</td>
<td></td>
</tr>
<tr>
<td>Learning</td>
<td>Learning curve in production and sourcing</td>
<td>Network learning</td>
<td></td>
</tr>
<tr>
<td>Partners</td>
<td>100% owned</td>
<td>JV, Strategic alliances</td>
<td></td>
</tr>
<tr>
<td>Cross-cultural interaction</td>
<td>Limited to subsidiary - headquarters activities</td>
<td>Distributed throughout the organization</td>
<td></td>
</tr>
</tbody>
</table>

An example of this structure can be found with the PC suppliers in the U.S. Often material and information flows traverse several countries between strategic partners and suppliers, taking advantage of the unique comparative benefits of the various nations. For example, the power unit could be produced in China, the chips come from Japan and the motherboards are sourced from Singapore. These items are then assembled in Mexico taking advantage of the low labour costs and proximity to the U.S. The final packaging, configuration and tests are completed in the U.S.

**Discussion and Conclusion**

The contingency model provides a framework to determine the optimal structure based on the international environment. In Table 1, is a list of the critical factors and the outcomes (operational and economic) for the multi-domestic hierarchical and global network forms. These issues will be next looked into relative to the international environment today.

The rapidly changing markets and technology environment require the organization structure to be transformed. The global economy is changing dramatically. With the increased standard of living in newly industrialized and developing countries, multinationals have more markets to tap into. Simultaneously, the lowering of trade barriers on account of the World Trade Organization (WTO) requirements and the development of regional trading blocks such as the North American Free Trade Agreement (NAFTA) has removed many of the protections provided to multi-domestic operations. In addition, the accelerating flow of foreign direct investment and other financial instruments allow production to be established quickly in far-flung corners of the world that can gain from the different comparative advantage of nations. Product characteristics are also becoming more homogenous with the product life cycles shortening. Finally, the cost of coordination/communication has fallen dramatically due to the new information technology. The availability of email, Internet, extranet, fax machines, video conferencing and airplanes is making the management of operations around the world easier to coordinate. Supply chain software allows firms to optimize production and logistics for the entire company spanning dozens of countries, not just a factory. In addition, the Internet is now being used to coordinate entire supply chains with strategic partners over the five continents.

Given these changes, it is apparent that production and materials management will become more networks oriented. For firms to be successful in this kind of a structure would require more cross-cultural training, a method to encourage learning throughout the network, development of partnership relations. As a result of these efforts, firms would be flexible enough to provide mass customization of products, at lower cost in shorter time.

**References**


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Flexibility Mapping: Practitioner's Perspective

1. What types of flexibilities you see in the practical situation of “Supply Chain Management” on the following points:
   - Flexibility in terms of “options”
   - Flexibility in terms of “change mechanisms”
   - Flexibility in terms of “freedom of choice” to participating actors.

2. Identify and describe the types of flexibilities that are relevant for your own organizational context. On which dimensions, flexibility should be enhanced?

3. Try to map your own organizational technological system on following on continua of Supply Chain Management. (Please tick mark in the appropriate box(es)).

<table>
<thead>
<tr>
<th>Structure</th>
<th>Global network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multi-domestic Hierarchic</td>
<td></td>
</tr>
<tr>
<td>Stable</td>
<td>Dynamic</td>
</tr>
<tr>
<td>Formal structured pattern</td>
<td>Distributed learning system</td>
</tr>
</tbody>
</table>

4. Develop a SAP-LAP (Situation Actor Process-Learning Action Performance) model of “Supply Chain Management” relevant to your organization.

Reflecting Applicability in Real Life

1. How can you evolve an international Supply Chain Management network in your own context?
2. How can you adapt the model of Supply Chain Management proposed in this paper in your organizational context?
Flexible Framework for Strategic Information Systems Planning: A Case Study from Banking Sector

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Abstract

This paper presents a flexible approach to Strategic Information Systems Planning (SISP) for banking sector in India. SISP has become an increasingly important issue for both researchers and practitioners. Various frameworks are proposed in the past, which are predominantly based on strategic behavior of U.S. business culture. The dynamics of market space is engineering Because of globalization, merger, speed of product change, innovation etc. This necessitates the need of a more flexible approach in IS planning. Therefore, an attempt is made to propose a flexible framework with specific focus to Indian banking sector. The framework is then validated by implementing it in the case of State Bank of India.

Keywords: Indian banks, SAP- LAP methodology, strategic information systems planning

Introduction

Strategic Information Systems Planning

Information System (IS) planning has evolved over the last twenty-five years. In the late 1970s, primary objectives were to improve communications between computer users and MIS (Management Information Systems) department, increase top management support for computing and identifying new and payback computer applications (McLean and Sodan, 1977). In the late 1980s, two new objectives emerged. They are identification of strategic IS applications - those that give the organization a competitive advantage and development of organization-wide information architecture (Moskowitz, 1986). Strategic Information System Planning (SISP) has become an increasingly important issue for both researchers and practitioners (Earl 1993, Sass and Keefe 1988). In supply of key issues over the past ten years, SISP has consistently remained among the top ten issues (Caudle et.al. 1991, Pulvia and Pulvia 1992, Teo et.al. 1997).

Lederer and Sethi (1992a) have given two simultaneously performed approaches to SISP. On the one hand, SISP helps organization use IS in innovative ways to build barriers against new entrants, change the basis of competition, generate new products, built-in switching cost (Porter, 1985). As such SISP promotes innovation and creativity. On the other hand, SISP is a process of identifying a portfolio of computer based applications to assist an organization in executing its current business plans and thus realizing its existing business goals. The distinction between the two approaches results in the former being referred to as attempting to impact organizational strategies and the latter as attempting to align MIS objectives with organizational goals (Lederer and Sethi, 1992).

Brief Review of SISP Models/Frameworks

Various frameworks are developed by the researchers to help the practitioners to identify IS strategy. An evolutionary model suggested by Nolan (1979) is a well-known six-stage model with the help of which an organization is able to see where it stands and where it is heading in terms of computerization. IS strategies can be formulated depending on the type of stage the organization is in with respect to IT. The model omits to encompass human and technological dimension (Robson, 1997). Critical Success Factor (CSF) analysis suggested by Rockart (1979) and Business System Process (BSP), an IBM or proprietary technique, are the techniques suggested for information requirements of the organizations. CSFs are the key activities for any organization in which performance must be satisfactory if the business is to survive and flourish. Its weakness is that it needs very skilled and prescriptive interviews to do the abstracting of CSF from senior managers. It is usually impossible to build a true picture of organization information requirements using only CSFs (Robson, 1997). CSF is more useful in designing support systems for isolated senior executives than in resolving company wide issues of integrated information systems (Sullivan 1985). A further difficulty associated with CSF analysis is that the resultant decision may ignore any resource constraints surrounding their management. BSP is a lengthy process that offers a structured approach to planning via a number of defined stages that lead from the identification of business processes to a definition of required data structures. It involves top-down planning followed by
bottom-up implementation. From the top-down, organization’s business mission, objectives and functions are recognized. It analyzes the processes for organization’s data needs. From the bottom-up, data currently needed to perform the processes are identified. The final BSP output describes an overall information system architecture comprised of databases and applications as well as the installation schedule of individual systems. Rather than identifying isolated applications projects, BSP takes a co-ordinated inter system view. It is a business-oriented approach. Despite these advantages; BSP has limitations. It was designed for centralized environments. This is not surprising, considering that it was developed and promoted by IBM during a period when firm’s principal products were main frame computers. Nothing in the original methodology helps an organization if its computing resources has become organizationally or physically decentralized (Sullivan, 1985).

Sullivan (1985) has nicely explained suitability of different approaches with the help of a two-dimensional matrix indicating the combination of extent of system infusion (impact) and system diffusion (deployment), as shown in Figure 1.

Stage of growth method applies in what we call a traditional environment, in which both infusion and diffusion are low. This is conventional data processing center. BSP works in backbone environment, in which computing has become strategic to company, but it is still centralized in the manner of its deployment. CSF is suited to the environment in which technology is more distributed than it is crucial, i.e., high diffusion but low infusion. This is federation. Today, the system diffusion and infusion both are high, i.e. complex environment where no methodology best suits. Here firms develop eclectic approach to meet their specific needs. Therefore, few more frameworks are suggested in the literature to guide formulate IS strategy.

In India, one bank might be mature user of IT while another might be just introducing IT because of vast geographical spread and varying nature of customer’s requirements.

<table>
<thead>
<tr>
<th>FEEDERATION (Critical success Factor)</th>
<th>COMPLEX (Eclectic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRADITIONAL (Stage of Growth)</td>
<td>Backbone (BSP)</td>
</tr>
</tbody>
</table>

Figure 1: Suitability of Various IS Planning Approaches

Table 1: A Framework of Frameworks

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Awareness</th>
<th>Opportunity</th>
<th>Positioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Vision</td>
<td>Ends</td>
<td>Means</td>
</tr>
<tr>
<td>Scope</td>
<td>Possibility</td>
<td>Probability</td>
<td>Capability</td>
</tr>
<tr>
<td>Use</td>
<td>Education</td>
<td>Analysis</td>
<td>Implementation</td>
</tr>
</tbody>
</table>

be classified under one of the following three headings: awareness, opportunity and positioning. Table 1 summarizes the key characteristics and Table 2 provides the exemplars under each category.

Table 2: Exemplar Frameworks Under Each Category

<table>
<thead>
<tr>
<th>Awareness Frameworks</th>
<th>Opportunity Frameworks</th>
<th>Positioning Frameworks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refocusing Frameworks: Identification of potential to use IS/IT in the organization. Exemplar: Strategic opportunities framework (Benjamin et.al.)</td>
<td>Systems Analysis Frameworks: Identification of information flow within the business. Exemplar: Value chain (Porter)</td>
<td>Scaling Frameworks: Identification of scale of importance of IT to an organization. Exemplar: Strategic Grid (McFarlan et. al.)</td>
</tr>
<tr>
<td>Business Strategy Frameworks: Identification of business strategy opportunities for IT. Exemplar: Five force Model (Porter)</td>
<td></td>
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</tbody>
</table>

Awareness frameworks indicate how IT can be used for strategic advantage. They provide insight to industry level rather than the firm level. They are intended to raise awareness. Opportunity frameworks are directed towards enabling the individual organization to identify suitable strategic opportunities from the use of IS. Position frameworks consider the importance of existing IS to the business. These are intended to help
managers’ plan the future development of IS given a good understanding of the current situation.

Few more models and frameworks are suggested in the recent past. Mentzas (1997) has given a five-phase SISP model. The different phases are - Strategic awareness, Situation analysis, Strategy conception, Strategy formulation and Strategy implementation planning. He concluded that strategy formulation is more a creative activity than an analytic procedure. The proposed method has the advantage of explicit and formal incorporation of structures for management involvement and supports a team approach during the process’s implementation. However, suggested approach treats planning as a one-shot activity; nevertheless IS planning operations should be on going management activities and should form parts of dynamic process of defining and monitoring corporate strategy. Hatten and Hatten (1997) have given an IS strategy framework, which lists the principal strategic issues facing a business and is structured to help IS managers find ways to use IS to deal with these issues. The framework requires a synthesis of the impacts of the factors of success for the business, and its competition, the business’s opportunities and threats, and the present and future competitive impacts of IS. The framework omits the human and political issues.

Profile of Indian Banking Sector

The Indian banking sector consists of public sector, private sector and foreign banks apart from smaller regional and cooperative banks. Public sector banks dominate the banking sector in terms of market share, but are hindered by legacy factors as well as service quality issues. Public sector banks offer services in both metro and rural areas. They have a dual business mission that of behaving like a viable profit making organization, in addition to fulfilling social mission of taking banking to the remotest villages in India. Rigidity, inability to respond quickly to changing environment, and constraints on human resources front are some of the problems of public sector banks. Business strategy of public sector banks is having mass banking systems and cost reduction. Private banks are constrained by the size factor, as they are basically niche players. Their business strategy is differentiation of products and providing value added services. Foreign banks have a limited branch network and capital commitment. They have the advantage of being able to draw upon the experience of their parent organization. They focus on high-end customers who know what they want and whose business can help sustain the IT-enabled banking services.

Authors have conducted a detailed questionnaire survey and prepared case studies of select banks to understand the present practices of SISP in banking sector in India. Details of questionnaire survey and case studies are not presented here considering the scope of this paper, however a brief learning is presented. Questionnaire survey and case studies revealed the fact that, in India, one bank might be a mature user of IT while another might be a just introducing IT because of vast geographical spread and varying nature of customer’s requirements. In other words, banks have different role of IS in their operations. IT applications is mainly governed by guidelines laid down by Reserve Bank of India (RBI) and not always based on bank’s business requirements. IS planning is more focused on technology aspects, relatively neglecting business issues. It is found that top management involvement in IS planning is not adequate. User involvement in IS planning has not been very much appreciated. Main issues in Indian banking sectors are –dual business mission commercial and social), low user participation in IS planning, low rate of absorption of technology, resistance from trade unions and least interaction of IS planners with business planners. Based on the synthesis of questionnaire survey and case studies, authors have proposed a framework in this paper and tried to illustrate its application in largest public sector bank of the country, i.e. SBI.

Critiquing Existing Frameworks and Need for a Flexible Framework

Literature review on different models and frameworks for evolving IS strategy suggest that most of the methodologies have some or the other weakness. All current SISP methodologies seem somewhat descriptive in that they do not address managerial problems of how strategic planning is to be done and how to make the best use of current methodologies. In other words, they focus on issues of ‘What should be done’, rather than ‘How to do it’ (Zviran, 1990). Palvia (1997) and Palvia et.al (1990) have highlighted the need of a refined model to identify strategic opportunities. According to them, while developing strategic information systems for developing countries government plays a significant role. This role may be regulatory, supportive or both. A firm may be able to develop an information system to address massive government regulatory requirements. Reason of IT applications in Indian banks is also to meet government/RBI norms. Another important force identified by Palvia et.al is logistics, which includes communication systems and distribution network. They argue that this strategic force may not be particularly important in developed nations, but generally very significant in developing countries. Often the logistics systems and infrastructure in such countries are far from adequate. Therefore, arguments given by Palvia et.al supports the need of a framework to suit Indian condition. Moreover, there is no universal agreement that existing methodologies are useful today, nor is the agreement that they have ever been useful (Pun and Lee, 2000). Available frameworks are predominantly based on strategic behavior of US business culture (Levy et. al. 1999).

Multi dimensional nature of SISP has been highlighted by Earl (1990) and Gailliers (1991) stressed the need for multiple method for SISP. SISP should include human, organizational and infrastructural issues (Earl 1989 Ward et.al. 1990). Waema and Walsham (1990) argued that strategy formulation is a complex social and political process, which is not adequately captured by formal rational process. This is particularly true in less developed countries like India, where decision-making procedures are rarely well established and where they are often not adhered to even when they do exist.
Political issues involve resource control, changes in autonomy, changes in management, intervention, division and use of rules and procedures. Cultural issues involve resistance to new technology, barriers between cultural groups and management style. Therefore, IS strategy formation process should be linked to important context such as business strategy, organizational culture and structure, people’s perceptions and expectations, and technical infrastructure including the availability of technical skills. They further highlight the dynamic nature of strategy by saying that strategy formation is subjected to constant modification as the perceptions and interests of key actors and groups change.

Information system planning should have the built in flexibility to allow adoption of Information System process of new opportunities as they present themselves, and thus foster creativity (Raghunathan and Raghunathan, 1991). At the same time, it should try to balance such creativity through the use of adequate control mechanisms so that frequent adaptations on the grounds of creativity do not lead to loss of control. Flexibility in IS planning is the ability of the planning systems to anticipate crises, identify opportunities and adapt to unanticipated changes (Ansoff, 1975). The use of strategic system as strategic weapon requires planned and effective organizational responses to environmental changes. These changes impinge directly on the organizational information system and can be considered to be important inputs to IS planning because of the need to recognize and respond to them, such as customer’s and user’s changing preferences and demands and technological developments. Development of technologies like Internet, Smart cards etc. must be responded quickly by the banks to get strategic advantage of information systems. The degree to which these factors are emphasized in the development of the IS plan have a direct impact on the effectiveness of the IS plan. Top management believes that IS flexibility enables strategic success and thereby leads to organizational success (Sushil, 2000-2001). For obtaining flexible information systems, users should take the responsibility of planning and suggesting the strategic uses of IS in their functional areas. Business managers should translate business strategies into IS strategies. Top management should promote innovative culture. For obtaining the flexible IS, which is the outcome of strategic planning process, the process itself has to be flexible enough. IS planning has to be enriched with integrative, innovative and interactive applications.

Critique of available frameworks: Existing methodologies do not fit the present environment of high levels of system infusion and diffusion. Doyle (1991) argues that there is an assumption that frameworks exist outside time, which may render some frameworks irrelevant, particularly when addressing the impact of new technologies. For example, the Internet is radically changing the way firms do business and make current frameworks seem parochial and dated. Positioning frameworks assume that the market place is static and that there are generic strategies for positioning oneself in that space. Because of globalization, merger, speed of product change, innovation etc., the market space is dynamic. The company needs to mould market space and position itself. This necessitates the need of a more flexible approach.

The Framework

Looking to the need of a flexible approach to SISP, a framework is proposed here using SAP-LAP methodology. The framework is presented in Figure 2. SAP has three basic components, viz. Situation, Actor and Process (Sushil 1994, 1997, 1999). Situation is the present status, potential for growth or decay, present and future state of the art etc. The participants who influence the situation and alter it by their actions or inaction are termed as actors. The procedural steps taken by the actors who alter the situation are termed as the process. LAP part of the framework again has three components, i.e. Learning issues, Actions and Performance. Learning issues emphasize the typicality of the situation as well as some features of its uniqueness. Learning issues also lead to action, which when taken would lead to improved performance.

Banking industry being a business entity has certain business objectives, mission and goals. Information technology may play a supportive role to help carry out business functions and achieve business objectives. IT may be a business partner and help in deriving a new set of business objectives. Therefore, in information intensive organizations like banking, situations can be grouped broadly into two groups. These are business domain situation and technology domain situation. Technology domain is further divided into internal and external situation. Internal situation is organization specific situation and external situation is industry specific situations. Similarly actors are also divided into internal actors and external actors. Actors, who are within the organization, are grouped under internal actors. External actors are outside the organization but play key roles in SISP. The procedural steps taken by these actors to alter the situation compore the process. We have defined a set of variables in the context of banking sector for all the components and sub components of SAP and LAP part of the framework. Detailed lists of identified variables are presented in Figures 3 and 4.

SAP part of the framework helps to identify prevalent situation in the context of SISP, key actors and present SISP practices followed by the bank. Synthesis of situational factors, roles of actors and SISP practices would result in learning issues. Here begins the LAP part of the framework. Learning issues lead to key actions to improve the situation, actor and process. Finally, the expected impact of these
The proposed framework has the following strengths. SAP analysis and LAP synthesis helps to derive IS strategy, mission of IS department, role of IS, IS applications, organizational structure of IS department (responsibility assignment) and action plan. The framework allows a feedback from the derived outcome indicated as ‘Additional Learning’. Additional learning leads to appropriate changes in the strategies. In other words, additional learning will serve as input for further SAP analysis, and result in new set of strategies and IT applications. Feedback of ‘Additional Learning’ incorporates dynamic feature to the suggested framework.

To implement the framework generously, it is suggested to apply the techniques of creative problem solving. There are various critical steps in the framework, which require creative thinking. Therefore, a checklist of possible methods is also presented in the Table 3. While applying the framework, IS practitioners can use any of the suggested methods at these steps and formulate suitable strategy for the bank.

New Features of Proposed Framework

The proposed framework has the following strengths.

- It gives a multi-paradigm approach to IS strategy formulation. It provides the management a wider scope to consider social, cultural and political environment of the bank. Framework proposes looking at the bank from various perspectives so as to add richness to the analysis, leading to more acceptable solution. Framework forces management to assess role of Government/RBI and trade unions in implementing IS projects. Such issues are more relevant in India.

- The framework is flexible and modular. It provides opportunity to foresee the problems and opportunities on the performance of situation, actor and process can be explored. To help in identification of learning issues, actions and expected impact on performance, guiding issues are presented in Figure 4.

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within a turbulent, complex and rapidly changing business and IT environment.

- Ciborra (1992) argue that strategy formulation is likely to involve elements of surprise or sudden, radical shifts in preferences and goals.
- The proposed framework favors learning over monitoring. After S-A-P analysis learning issues are derived, which help to formulate desired actions. A feedback loop of additional learning provides an opportunity of post-implementation evaluation.
- Framework provides combination of analytical and creative techniques. The former takes a structured analysis route by systematically probing and decomposing the business requirements into their constituent parts, and delivering a structured view of the business objectives, strategy, activities and information needs. The latter, has at its disposal several creative problem solving techniques (Table 3) to arrive at innovative solutions.
- Many of the Indian banks do not have a formal business strategy. IT applications are mostly driven by immediate concerns. They do not have full time staff for IS planning. Indian banks, particularly public sector banks have to serve cost conscious rural customers as well as convenience conscious metro customers. Such unique features of Indian banking sector necessitates to take a holistic view while planning for IS. The proposed framework provides a holistic approach to the management.

### Application of Framework to State Bank of India

State Bank of India (SBI) has been selected purposively for illustration of the framework. SBI is the largest bank in India in terms of profits, assets, deposits, branches and employees. With a network of over 9,000 branches in India and 52 foreign offices in 31 countries, the Bank commands about one-fifth of the total deposits and loans in all scheduled commercial banks in the country. Application of framework is illustrated by its application in SBI. Every component and sub-components of the SAP-LAP framework are discussed below.

#### SAP Analysis

### Situation

Situation is the present status, potential for growth or decay, present and future state of the art etc. Here, situation is grouped broadly into two groups. These are business domain situation and technology domain situation. Issues under these two groups are discussed below.

#### (A) Business Domain Situation

**Mission**

Stated mission of SBI encompass balanced focus of customer, shareholder and employee’s interest and emerge as world-class bank. Bank’s business mission statement is as follows.

“To retain bank’s position as the premier Indian financial service group, with world class standards and significant global business, committed to excellence in customer, shareholder and employee satisfaction and to play a leading role in expanding and diversifying financial service sector, while continuing emphasis on its development banking role”.

#### Strategic Business Units

State Bank of India being the largest and oldest Indian bank, has spread its banking interest in diverse areas over a period of hundred years. Accordingly, it has following strategic business units.

- Corporate Banking
- National Banking
- International Banking
- Associate and Subsidiaries

**Corporate Banking** is single window shop for the entire range

---

Table 3: List of Techniques which can be applied to implement the Framework

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Critical Steps in Framework</th>
<th>Available Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Generation of Learning Issues</td>
<td>Attribute Listing, Genetic Learning Approach, Gap Analysis</td>
</tr>
<tr>
<td>2.</td>
<td>Generation of Possible Actions</td>
<td>Morphological Analysis, Genetic Learning Approach, Options Field Methodology</td>
</tr>
<tr>
<td>3.</td>
<td>Prediction of Impact of Actions on Performance</td>
<td>Delphi, Brain Storming, Scenario Building, Cause &amp; Effect Analysis</td>
</tr>
<tr>
<td>4.</td>
<td>Defining IS Mission, Goals &amp; Objectives</td>
<td>TKJ Technique, Morphological Analysis</td>
</tr>
<tr>
<td>5.</td>
<td>Defining IS Strategy</td>
<td>Dialectical Approach, Brain Storming, Nominal Group Technique</td>
</tr>
<tr>
<td>6.</td>
<td>Identification of Role of IS</td>
<td>Dialectical Approach, Brain Storming</td>
</tr>
<tr>
<td>8.</td>
<td>Assignment of Responsibility</td>
<td>Attribute Listing, Critical Questioning Technique</td>
</tr>
<tr>
<td>9.</td>
<td>Implementation Plan</td>
<td>ISM, Desirability Feasibility Study, Cost Benefit Analysis</td>
</tr>
</tbody>
</table>
of financial services needed for large corporates. Two major functions, which come under this unit, are Project and Infrastructure Financing and Leasing Business.

**National Banking Unit**, through its two distinct networks, namely, Personal Banking and Commercial Banking Network, provides basic banking services to its customers. About 99% of domestic deposits and 84% of domestic advances of the bank fall in the domain of National Banking Unit.

A network of 52 overseas offices of the bank spread over 31 countries falls under the International Business Unit. Bank’s foreign offices contributed about 20% of net profit of the bank at March end 1999.

**Associate and Subsidiaries Business Unit** has seven associate banks. Currently only the Corporate Banking and National Banking units are headed by Managing Directors. Other two business units are headed by Deputy Managing Directors; consequently they are invitees to the board meetings and have to route all papers through the chairman.

**Market Segment**

Bank is operating in metro, urban, semi-urban and rural areas as well. Table 4 shows the emphasis of different segment of markets. Bank is drawing major portion of its business from branches located at metros. About 12% of the branches located in metro account for about 42% of the total bank's business. On the other hand, about 43% of the branches situated at rural area account hardly for 12% of the business. This clearly indicates the market segment where the bank has to focus.

**Critical Success Factors for Bank’s Business**

Wide branch network and well-established brand are the critical success factors for the bank’s business. The strength of SBI brand can be seen from the fact that it mobilized $4.2 billion through the Resurgent India Bond (RIB) issue in 1998, barely three months after the U.S. imposed sanctions on India and the country was downgraded by international rating agencies.

**Core Competency**

Retail banking is identified as bank’s core business in domestic operations. The ‘Personal’ segment deposits, which provide a low cost and stable resources base for the bank, constituted 57% of the bank’s total domestic deposits for the financial year ending March’2000. This clearly indicates bank’s competency and focus of business. The same is also witnessed in the statement given by the chairman in the annual report 1999-2000, “Our leadership in retail banking emanates from a strong brand name, large customer base and extensive distribution network.”

**Organizational Structure and Culture**

It is found that SBI operates through a three-tier system. A central board of directors headed by a Chairman and two managing directors manages it. Presently, the board has 13 members including one nominee director from RBI. Thirteen local boards spread across the length and breadth of the country, look after regional operations and assist the central board of directors. These regions are further classified into 52 zones and each looks after administration of around 175-200 branches. The bank also has a central committee consisting of 9 members. It seems that SBI board works independently but reality is different. The Government has kept control on the bank’s board for political objectives. Top SBI posting gets politicized with the Prime Minister’s Office (PMO) taking the final decision. Besides, the finance ministry issues more informal directives to SBI than to any other PSU bank.

**Technology Domain Situation**

Computerization in SBI can be traced back to seventies, when bank succeeded in arriving at an informal understanding with the unions for the installation of few ledger-posting machines at some specialized branches and also a mainframe computer. In recent times, SBI and other competing banks have realized the importance of IT. This can be analyzed by examining the internal and external situation in the context of technology domain.

**(i) Internal**

**IT units**: Bank has Systems and Technology wing situated at its central office at Mumbai. Chief General Manager is the in-charge of the wing. Organization chart of the System and Technology department is shown in Figure 5. Down the line, structure of IT department is such that it indicates bank’s emphasis on technology rather than business. At the zonal office level, they have MIS department, which
is a user department, the function of which is basically to generate reports required by the management from time to time.

Training of the employees is under Computer Planning and Services wing. Bank is having a separate training institute ‘State Bank Institute of Information and Communication Management’ at Hyderabad. Total branch computerization implementation is looked after by Commercial and Institutional Services. Data-net and VSAT network is dealt with by Communication Services wing. At all 13 local head offices, bank has Computer and Communication Department to take care of computerization and communication. IS planning is totally centralized at its central office Mumbai. Chief General Manager is the key person who reports to Deputy Managing Director.

In information intensive organizations like banking, situations can be grouped broadly into two groups. These are business domain situation and technology domain situation. Technology domain is further divided into internal and external situation.

**IT applications in the bank**: Following were identified as the main IT applications in the Bank.

- **SWIFT**: Society for Worldwide Inter-bank Financial Telecommunication (SWIFT) in used for exchange of financial messages worldwide. 131 domestic branches of SBI are covered under the SWIFT network.
- **Remote Access Terminals**: Bank is extending remote access facility to its corporate customers.
- **Data-net**: SBI Data-net covered 1,013 branches and is used for inter-branch/inter-office data transmission. The purpose is for reconciliation and fund settlement.
- **Accounting Applications**: Bank’s accounting applications are managed by ‘Bank Master’. Bank Master software is developed by ‘Kindle Banking Company’. It is a multi-currency accounting and management information system.
- **Trade Finance**: For managing the trade finance activities, bank is using ‘IBSNET’, software developed by Morganlabs, USA.
- **ATM**: The Bank at present has 139 ATMs, including two offsite ATMs, in 52 cities. Most of the ATMs are on site. ATMs are neither interconnected nor connected to the branches.
- **Electronic Data Interchange**: This is used for handling customs transactions at airports and seaports and has been implemented at 11 centers.
- **VSAT network**: VSAT connectivity is used for fast fund transfer and at present covers 147 critical branches rendering cash-management services.
- **Local Area Network**: Almost all-administrative offices, Staff training centers and colleges are provided with local area network. E-mail connectivity is also provided on select branches.

**Role and growth of IS in bank**: Till recently bank was using information systems for handling voluminous work. But, now bank has plans to use IT to get competitive advantage in future. SBI Chairman G.G. Vaidya says -

“We are behind others but we cannot afford to delay any further. The bank has called a dozen international and national Internet consultants to make presentations for an Internet strategy.”

Bank has plans to integrate credit card system with ATM, introduce Internet banking at all NRI, overseas, specialized, personal segment branches with e-commerce, e-banking and e-trading and networking of at least 300-400 branches (urban/metro) by March 2001. All such plans indicate that present strategic impact of IS may be low, but the bank has application under development, which will give it a strategic advantage in future. In other words, bank is in the turnaround cell of the strategic grid.

Six different stages of growth of IT in any organization as identified by Nolan (1979) are initiation, contagion, control, integration, data administration and maturity. Kanungo (1999) suggested a modified model suited to Indian organizations. Five stages suggested by him are inception, extension, stagnation/consolidation, expansion and integration. An organization can be mapped on any of these stages considering the factors like infrastructure, application portfolio, top management attitude, IT management and user’s awareness and involvement. Existing IT infrastructure in the bank suggests that bank is in the third stage of ‘Stagnation/Consolidation’ and moving towards its fourth stage. Considering the IT applications, bank is in fourth stage of ‘Expansion’. Bank is shifting from third stage to fourth stage of IS growth i.e. ‘Expansion’ considering top management attitude. Bank has a separate department for IT management and dedicated institute for training and research and development for IT related issues. The IT consultant is appointed recently. It indicates that bank is in the move towards ‘Expansion’ stage as far as IT management is concerned. From user’s participation point of view, bank is in ‘Stagnation/Consolidation’ stage because user participation in IT issues is not proactive.

**Resources**: Bank’s financial resources appear adequate. Hence, financial resources for IT implementation is not a constraint. The bank has kept more than INR 5000 million separately with IDBI under the scheme IDBI- ADS (Investment Deposit Scheme), which can be very well utilized for IT investments.
As far as IT trained human resources are concerned; bank is not going to face any problem, because it has a dedicated institute, i.e. State Bank Institute of Information and Communication Management for imparting IT training to its employees.

**User’s expectations**: It has been found during the interview that end users of the computer systems want trouble free and easy to operate systems. They also expect uninterrupted system availability. Users also realize need and importance of formal IT training not simply to operate the system but also have some knowledge about what is behind the system.

**Critical success factors**: Critical Success Factors for bank’s IT operations is availability of required IT infrastructure at the place of bank’s operations. Bank is located at very remote places, acquiring needed IT infrastructure at such location is a great challenge for the bank. Therefore, success of IT is greatly influenced by the available infrastructure.

**(i) External**

**IT based products and services**: In the Indian market, various IT based banking products, services and solutions are available. The most common of them are given below.

- Phone Banking
- ATM facility
- Credit, Debit and Smart Cards.
- Internet Banking
- Mobile Banking
- SWIFT Network
- INFINET Network
- Connectivity of bank branches to facilitate anywhere banking.

In addition to the above, software are also available to support bank’s various requirements.

- MIS helping the bank to generate RBI reports like SLR, CRR (Cash Reserve Ratio) etc.
- NPA Management, Asset & Liability Management, GAP and Trend analysis.
- Branch wise Profitability Assessment
- Intelligent Balance Sheet Analyzer
- Relational Database Management Systems for management of data mining from data warehouse.

**Use of IT by competitors**: New private sector banks and foreign banks operating in India are the main competitors of SBI. Main features of use of IT by the competitors are:

- Use of Centralized or Clustered Database
- Networking of all of their branches
- Offering Internet Banking and Mobile Banking Services
- Electronic Clearing Systems
- E-Broking
- Screen touch information kiosks
- Wide presence of ATM centers

**Customer’s expectations and social commitment**: SBI has a branch network, which is widely spread from metros to rural areas as well. Therefore, it has to meet the heterogeneous nature of expectations of the customers. It finds itself burdened with onerous task of entering into information age while serving the poorest of farmers in the remotest of places that do not have any infrastructure in place. Customers of SBI can broadly be classified in two ways:

(a) Location of Customers
   - Placed in Metros or Urban areas.
   - Placed at Semi-urban or Rural areas.

(b) Need of Customers
   - Individual Customers
   - Corporate Customers

Customers based at metros and urban areas are, in general, interested in convenience and for that they are ready to pay something extra, whereas rural based customer are interested in cheaper products. Their saving habits and credits requirements could also be different. Individual customers are interested in retail innovative and convenient products, whereas corporate customers are more interested in relationship banking. A corporate customer also wants efficient cash management, advisory and market research services from the bank.

**Actors**

**(i) Internal Actors**

- Top management as a motivating force
- Bank’s business planners
- IS team involved in planning
- Trade unions
- Business Managers and end-users of the system as IS planning is going to affect them directly
- IT training institute of the bank to provide necessary training and skills

**(ii) External Actors**

- Foreign banks and new private sector banks as major competitors
- KPMG as IT planning consultant and other software and hardware consultancy providers.
- Customers as a main stakeholder of the system because their satisfaction is of prime business objective of the bank. Therefore, while IS planning their interest has to be taken care.
- RBI and other Government agencies as regulatory bodies. Bank operating in India has to work as per the guidelines given by Indian government. Legal complications of any transactions say transactions related with Internet banking has to be resolved as per prevailing Indian rules.
(iii) Actors Variables

User's and customer's satisfaction level : End users are satisfied with computerization because it has helped to reduce their workload. It has also simplified the work of outside agencies. To customize the software, few modules are added internally. Recently, the bank has appointed management consultant KPMG for preparing long-term IT strategy for the bank. It indicates that, although bank has got a dedicated IT institute for research, development and training in IT field, it is heavily dependent on outside agencies for IT support.

Focus of IT Applications

Although the bank states that IT applications are business driven and are mainly for obtaining excellence in customer service, but very few instances can witness this. For instance, SBI’s telephone banking is confined to merely three branches and only informs a customer of the status of his account during business hours. Secondly, if the bank were serious about customer satisfaction, it would have ensured that all computerized branches were networked. Bank’s website is an information provider for the visitors. Bank’s annual report was made available on the web site for the first time in 2000. Site is not providing any account opening form, which a prospect customer can download. Focus of IT applications is mainly computerization of branches. No doubt, this is a good start but only automating the branches will not help the bank to meet its business objective and mission. Bank has, though late, realized the fact and has future plan of launching Internet banking.

Process

Level of Computerization

The bank is continuously converting the branches to fully computerized branches. Table 5 indicates the level of computerization.

The table indicates that level of computerization is quite high in metros as compared to semi urban or rural area. More than 60% of the metro branches are totally computerized, whereas hardly 2% of branches are totally computerized in rural area. Similarly, out of total business derived from metro, more than 83% is drawn from totally computerized branches (TBC). Hardly 11% of the rural business come from TBC.

Table 5 : Status of Computerization*

<table>
<thead>
<tr>
<th>Area</th>
<th>Total No. of Branches</th>
<th>No. of TBC 'A'</th>
<th>Total Business in Rs. Million 'B'</th>
<th>% of TBC 'C'</th>
<th>No. of TBC 'D'</th>
<th>Business obtained from TBC in Rs. Million 'E'</th>
<th>% of total Business obtained from TBC 'E/B' 'F'</th>
<th>% of total Business area wise 'E/EE'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metro</td>
<td>1128</td>
<td>685</td>
<td>950660</td>
<td>60.7%</td>
<td>797780</td>
<td>83.92%</td>
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</tr>
<tr>
<td>Urban</td>
<td>1661</td>
<td>807</td>
<td>545480</td>
<td>48.6%</td>
<td>468070</td>
<td>85.81%</td>
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</tr>
<tr>
<td>Semi-Urban</td>
<td>2270</td>
<td>291</td>
<td>481330</td>
<td>12.8%</td>
<td>132760</td>
<td>27.58%</td>
<td>9.29%</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>3944</td>
<td>82</td>
<td>274430</td>
<td>2%</td>
<td>30190</td>
<td>11%</td>
<td>2.11%</td>
<td></td>
</tr>
<tr>
<td>Total Σ</td>
<td>9003</td>
<td>1865</td>
<td>2251900</td>
<td>-</td>
<td>1428800</td>
<td>-</td>
<td>-</td>
<td>100</td>
</tr>
</tbody>
</table>

* As on November’ 1999. Figures are provided by SBI Central Office, Mumbai.  TBC = Total Branch Computerized.

Extent of Outsourcing

Bank is outsourcing all its IT support on outside agencies. This seems a strategic choice made by SBI. Hardware consultancy is, at present, obtained from I.I.T. Bombay, whereas various software used in the bank are developed by outside agencies. To customize the software, few modules

Top Management Involvement in IS Planning

Top management are not directly involved in IS planning process but they support the IT initiatives and realizes its need. Top management’s attitude towards technology implementation is favorable. They have realized the new way of banking. Chairman of the bank remarks, “In my view, the biggest challenge banking industry faces as it enters the millennium is technology. Those banks, which are able to keep pace with the technological innovations, alone, will be able to survive. Having realized this fact, the technology team of the bank is working round the clock in this area.”

It seems obvious that top management has now realized the importance of information technology to face increased competition. Chairman expressed his clear view that wide network will no longer be an advantage for the bank. Hi-tech banking compensates small size of the foreign and private banks.

Involvement of Business Manager and User in IS Planning

There is no direct formal involvement of business managers in this exercise. Participation of business mangers in the IS planning exercise is in the form of feedback, which is routed through Computer and Communication department. End users are also not involved in the process. User’s satisfaction level is measured by State Bank Institute of Information and Communication Management (SBIIICM) through research surveys and collected feed back is forwarded to Systems and Technology wing.
Direct interaction between key personnel of various strategic business units and IT department is also highly inadequate. IT function is treated as supportive function and this is reason that head of IT department has no representation in board of directors. Interaction between business planners and IS planners is low and users are not provided with sufficient opportunity to come up with creative ideas to use IT. Planning for IS is started, generally, at the top management level.

LAP Synthesis
Learning Issues
Synthesis of the S-A-P analysis led to following learning issues.

Strategic Thrust
Bank’s strategic thrust are-
(a) Excellence in Customer, Shareholder and Employees satisfaction.
(b) Growth as well as diversification of financial services.
(c) Bank wants to continue development-banking role.

Business Focus
Bank’s business focus is clearly in Retail/Commercial Banking. This is confirmed from the fact that more than half of the deposits come from personal segment. Personal banking business is receiving focused attention in recent years as per the Chairman’s message in the Annual Report 1999 and 2000. The retail market is high volume low value and liability oriented business for banks, and hence demands customer’s convenience, product innovations and sensitivity to pricing. SBI, by effective database management, can ensure prompt and effective credit disbursement and add in quality accounts.

Market Focus
Bank is having only 31% of the total branches in metros and urban areas covering 66% of the total business. Remaining 69% of the branches in semi-urban and rural areas are contributing to only 34% of the business. So clearly, market focus should be on metros and urban branches. While using IT for strategic purposes, requirements of metros and urban market should be given prime importance.

Customer’s Expectations
Customers in metros and urban areas are convenience conscious, whereas those in semi-urban and rural areas are cost conscious. Bank is burdened with onerous task of entering into information age while serving the poorest of farmers in the remotest of places that do not have any infrastructure in place. Bank, while deciding its strategy, must take care of the two extreme ends of the customer’s requirements and has to find a way to balance it.

Bank’s Strength and Weakness in IT
Bank’s strength is not in IT, which is very clear from its outsourcing policy. Its wide network, which was one time, thought of as strength for getting a good customer base has now become a weakness in the age of networking and e-commerce. This calls for suitable strategy to maintain bank’s strength of wide spread of branches.

Inefficiencies in Current IT Systems
Some inefficiencies identified in the implemented IS projects are:
- ATM machines are installed at many locations. They are neither interconnected, nor connected to the branch.
- Branches are having integrated computerized environment. Integration is helping the users and not the customers.
- Website of the bank is basically an information kiosk. Simple facilities like down loading of various forms (which does not require any centralized database and involvement of money transactions) are not available.

Strategic IT Opportunities
Following are the strategic opportunities, which would give a long leap to the bank in maintaining world-class standard of service.
- Networking of branches of metros and urban areas.
- Internet banking and Mobile banking services at least in metros
- Phone banking
- Installing information kiosks
- Increasing no. of ATMs and connecting them.
- Smart cards.

Interaction of IS and Business Planners
The interaction is very poor. Improvement in this aspect will lead to better integration of business with IS.

Actions
Based on the learning derived, following are the possible actions to meet the business objectives of the bank.

Ensure Involvement of Top Management, Business Managers and Users in IS Planning
As per present situation, top management support the IT initiatives and realizes its need, but they are not directly involved in IS planning process. Some strategy has to be evolved to ensure top management’s involvement. Once they are involved, they will appreciate the need of IS projects and extend necessary resources required for.

It has been observed that business managers are not directly involved in IS planning process. The focus of IT implementation is more for fulfilling Government norms. To
get strategic advantage of IT, it is necessary to have integration of bank’s business with IS. This can be achieved only when there is sufficient involvement of managers of strategic business unit in IS planning process. Planning committee must have proper representation from such business units. End users are not involved in the planning process, which otherwise is essential because ultimately systems are to be used by them. User satisfaction is of prime importance because satisfied users can only satisfy customers.

At present the bank is in ‘turnaround’ category, from where it has to move to ‘strategic’ category of the strategic grid. This is a migration from one category to the other. It needs to establish suitable mechanisms to ensure sufficient involvement of top management, business managers and users in planning process. It may also need to establish better linkages with bank’s business planning group and change the scope and focus of planning.

To ensure involvement of top management and business managers in IS planning and improve interactions of IS and business planners following steps would be helpful:

- Bank’s product development team must have representation from IT department.
- IS Planning Committee must consists of head of all strategic business units i.e. National, Corporate etc. in addition to personnel from IT department.
- Head (IT) should be a member of Board of Directors and should participate in bank’s business planning.
- A Steering Committee consists of head (IT) from all divisions (e.g. National, Corporate); key operational managers and system auditors must be used to give direction to IS planning/ implementation.
- IS Project planning and implementation team must have representation of concerned end users.

Develop Creative Culture

The stated business mission of the bank would require it to deliver innovative products. This is possible by:

(a) A strong product development capacity - requires innovative approach of product development team.
(b) The capacity to produce its products in technologically efficient manner - requires proper blending of banking with IT.
(c) Capacity to deliver products and services at world class level of cost and quality - necessary as per bank’s mission to achieve world class standard.

Most of the changes in services and products offered by SBI in the past are the result of supply driven imitative innovations. They are not demand driven or creative. This approach underestimates the role/importance of technology to gain a competitive advantage.

The bank’s business mission statement extends a promise to provide excellent service. It is not aiming to be the leader. Therefore, this would not nurture any creative innovations. However, atleast imitation of best available products and services is absolutely essential to maintain bank’s position as a premier institute and achieve stakeholders’ satisfaction.

Preparing Internal People for Change

Recent changes in the environment, expectations of customers and availability of new technology have made it essential to prepare internal bank’s people so that they can skillfully respond to change. SBI and group already have total 72 training colleges and institutes for imparting training to their employees. However, quality of training can be updated and improved to be able to change the people’s mind set in new working environment. For this it is necessary to:

- Provide new training and arrange re-skill program to enhance employee value
- Provide new orientation
- Explain new roles
- Make aware and prepare for new responsibilities

Adopting multiple distribution channels will enhance flexibility and hence customers will enjoy the facility of selecting any channel of their choice. This will ultimately result in value added services to customers.

Implementation of Customer Convenient Services/Products

Bank has implemented many IT oriented projects but these are not showing good results. Total computerization of branches has not resulted in direct appreciable benefits to the customers, particularly in Metros. For withdrawing money through ATM, customers are required to go the specified ATM, which causes inconvenience.

Bank has to reorient their attitude towards customer’s convenience.

- It is suggested to implement the concept of ‘Single Window Service’, which can be implemented without any additional IT investments.
- Instead of providing limit of withdrawal on the ATM machine, such limits can be put on ATM cards itself.
- Bank’s web site is at present not even serving the purpose of full information kiosk. Few forms like account opening form etc. can be provided to download from the site. Web site must also be made interactive for giving customized details of personal loans, deposits etc.
- Shared Payment Network System (SPNS) should be implemented in other metros to allow transactions with the ATMs of other banks. Till SPNS is in place, transactions from ATM of other bank can also be allowed upto a certain limit and reconciliation of the same can be done manually on daily basis.
- Number of offsite ATM should be increased. To save the bank’s transaction cost, customers must be motivated to
transact with the ATM only.

- Phone banking facilities should be improved by placing it at more cities and also making it available round the clock. Call centers should be set up to help and guide customers.

**Innovative IS Applications**

- **Interconnecting the ATM and branches:** The Bank at present has only 139 ATMs in 52 cities, which are not networked. Networking of the ATM facilities will in real sense boost the customer’s convenience.
- **Data warehousing and Data mining:** Because of the shrinkage in the spread and increased competition, it is necessary for the bank to increase non-interest income and try to identify and retain their best customers. The identification of the right customers can be done through data mining. Data warehousing can also be used to cross selling, application processing through credit scoring, recovery, systematic follow up and close monitoring of portfolios through strong up-to-date reporting.

**Centralize Database**

SBI is not having any centralized database. Centralized or clustered database will help to generate profit and loss statement frequently. Risk management can be made online and easier. Post sanction monitoring of credit accounts will be effective.

**Expected Impact on Performance**

**Strategic Impact on Quality/Cost of Products and Services**

- Cluster Banking, as suggested action above will result in centralization of many functions like clearing, generations of advices and forwarding schedules, follow-ups and reminders etc. It will help to reduce qualified IT staff. This will provide necessary infrastructure for e-commerce, which can be adopted in future.
- Internet banking in India has a good potential. If the banks like SBI, having a sound customer base and established brand image goes for Internet banking, there is no reason it will not result in strategic impact.

**Impact on Customer Base**

It is a fact that technology savvy private banks like HDFC bank and ICICI bank have successfully encroached on SBI’s turf, clipping away at its market share. Besides, foreign banks like ABN AMRO and Standard Chartered Bank have moved into retail banking with world class services. By introducing services and products mentioned above, the bank will be in a position to offer a tough fight to these new private banks and foreign banks. This will ultimately help the bank to maintain its customer base.

**Impact on Financial Performance**

SBI is sharing 21% of the bank advances as against 32% a decade ago. Similarly, its share in deposits is also down from 35 to 20 percent. With the introduction of convenience banking to its retail and corporate customers, the bank will be in a position to maintain its share in the Indian economy.

**Impact on Business Strategy**

Bank is planning to plant boutique branches with high-tech services in areas where the foreign and private banks have presence. By adopting the suggested approach, strategy of planting of boutique branches will no longer be required. Involvement of all stakeholders in the IS planning process will gradually facilitate innovation and creativity. This would in the long run help bank to attain leadership in the industry. Bank’s business strategy will be altered from ‘Brick and Mortar’ to combination of ‘Brick and Click’ strategy. Adopting multiple distribution channels will enhance flexibility and hence customers will enjoy the facility of selecting any channel of their choice. This will ultimately result in value added services to customers.

**Impact on Performance of Actors**

Internet banking and Networking of branches etc. will increase employee’s productivity and bank efficiency. This will ultimately increase employee satisfaction. Involvement of top business managers and users in IS planning will lead to development of realistic plans, foster creativity and help in gradually developing innovative culture.

**Outcome of SAP-LAP Part of the Framework**

Based on the above discussion of SAP and LAP components of the framework, following outcomes are derived.

**IS Mission**

“Delivering world-class IT based diversified financial products and services which should enable the bank to add value to its stakeholders in digitized and information driven market.”

This mission statement is perfectly in line with bank’s business mission statement. IS mission spells about providing world class products and services and also caters the requirements of various stakeholders i.e. Customers, Shareholders and Employees.

**IS Objectives**

IS objectives to be in tune with the business objectives would be:

(a) Acquire and implement world-class IS.
(b) Offering leading edge products and services.
(c) Imitating at a faster pace the innovative banking products and services and blending it with IT.
IS Strategy

**Outside-in strategy:** Bank has to adopt outside-in strategy. It has to acquire better knowledge about the emerging environment, changing needs and preferences of customers at a fast pace.

**Combination of defensive and offensive strategy:** A flexible strategy: When a particular technology is already widespread, bank has to adopt a defensive strategy. Increasing the number of fully computerized branches, number of ATMs etc. are the examples where defensive strategy has to be adopted. Adopting the Internet Banking and Mobile banking are the example of offensive strategy. Offensive strategies have, of course, a higher level of risk associated with them since the newer technologies may not be stable nor can be the commercial success of the particular technology driven product is guaranteed. Therefore, the best way is to adopt a flexible strategy having a combination of defensive and offensive strategy.

**Customer centric strategy:** IT should not be utilized merely to computerize a branch. Bank’s strategy should not be branch centric but it should be customer centric. IT must be oriented towards customer’s requirements. For example, installing ATM has not resulted in real customer satisfaction. Customers should be allowed to withdraw from any ATM machine. To reorient the strategy towards customers, it is necessary that bank must be able to:

- Apply one-to-one marketing principles to the customer base.
- Understand the full relationship between the bank and its customers.
- Engage customers in new ways quickly and effectively.
- Provide service whenever and where ever the customers require them.
- Provide the means for customers to serve themselves.
- Introduce new products and services speedily.
- Obtain regular feedback from the customers and give a serious thought to that.

**IS Applications**

It is found that bank is concentrating on computerized and non-computerized branches as well. Bank’s branches, which are situated in semi-urban or rural areas, cannot be fully computerized, because of infrastructure and cost conscious nature of the customers. The bank’s present strategy is to manage both types of branches. Running a branch network consisting of computerized branches and non-computerized branches under a unified command is not an easy task. Moreover it dilutes the focus of management. The two sets of branches may look like two faces of the same coin, but they are two different service outlets in the market place and call for totally different approaches in product designs and delivery mechanisms. The reasons being the differences in the choice and preferences of customers the two sets target, the way of delivering the products etc.

Having a centralized database for all the bank branches is also an impossible task. Wide network of branches, which was strength for the bank, is now becoming a problem for the bank. Therefore, the best strategy would be to create a separate umbrella of branches of metros and urban areas. All suggested actions can be easily implemented in the branches of new umbrella. It will match with the increasing demands of customers and will also give a better fight against competition.

Strategy will then be to fully computerize all branches those come under new umbrella, inter connect them and also have a cluster database for all such branches. Keeping the size of the SBI in mind, cluster-banking implementation will be practical and economical solution. In Cluster banking, one or more servers working together are to be installed at bank’s zonal offices. Branches falling under a zone will be connected using leased lines to such servers at the zone. Zonal cluster servers can be connected to servers to the head office at Mumbai. This will be a two-tier cluster implementation. Each branch will have its own server and in addition to regular workstations, will have a special workstation called the gateway PC, which will be connected to the cluster at the zonal centres through the leased lines and modem. The gateway PC will handle data communication to and from the branch.

Branch transactions entered in the branch will be first updated in the local branch server and also at the zonal cluster server by gateway PC. If communications lines are down, branch system will adopt store and forward mechanisms to update the zonal server data, whenever the communication line comes up. Cluster banking model supports true “Anywhere Banking”. When any transaction is entered, it will be posted at the branch as well as at the zonal server automatically. Customers can be offered the common services like withdrawal of cash, inquires related to balances, statement of accounts, updating the passbooks, cash or cheque deposits and issue of DD etc.

Cluster banking will also provide centralization of many banking functions like clearing, generations of advices and forwarding schedules, follow up and reminders etc. These services can be transferred at the cluster centre thereby reducing manpower requirements at the branches. ATM can also be connected to the cluster center so that any branch customer within or outside the cluster can use these ATMs.

In addition to the above, all the items discussed under the head ‘action’ will form part of IS process. Such actions will help to facilitate involvement of all stakeholders in IS planning. These will also help to create creative culture in the bank and offer customer convenient services.
Role of IS

The present role of IS is turnaround. But with the strategic initiatives suggested above, bank would shift to strategic role. Once bank attains that role, it will be necessary to maintain that role. Strategic Grid is a dynamic framework and bank may shift from one group to another. Because of strategic information systems, the bank may occupy strategic category, but it may again shift to other category over a period of time. This is because of the fact that competitors may develop a similar strategic system causing loss of competitive advantage and therefore reduced level of impact of IS on business performance. Therefore, knowledge of role of IS and its continuous monitoring is essential. This requires innovative and creative culture. Top management should appreciate the creative initiatives of the employees. To achieve such culture, a modified structure of IT department is required which is suggested below.

Structure of IS Department

Chief Information Officer of the bank should be CEO of the bank. This will facilitate the bank to shift from third stage of Nolan’s model to fourth stage, i.e. expansion stage. CIO should have the direct representation in board of directors. This will help to realize the IT mission. Business orientation in all the units of the IT department would help to better integrate business with IS. Therefore, following structure, as shown in Figure 6 is suggested. The structure with functional division will help to reorient focus of IT planning from technology to business. This will also improve coordination and communication and ultimately resulting in innovative culture.

![Figure 6: Suggested Structure of IS Department](image)

Validation of Framework

Validation is the process of establishing confidence in the soundness and usefulness of the framework. Desirability–Feasibility study is used here to validate the outcome of the framework. If the outcome of the framework is commensurate with excellence in the eyes of the respondents (IT practitioners), it is viewed as desirable. In other words, desirability study indicates degree of willingness of respondents to pursue a suggested action. All the suggested actions may not always be feasible due to economical, environmental, political, legal or other factors. Feasibility study provides an assessment that outcome is possible to achieve. Therefore, desirability-feasibility study is found as a suitable option to develop confidence on the framework.

To carry out Desirability–Feasibility study, outcomes of the framework was to head of the departments of all three divisions of systems and technology department of central office and also to head of computer and communication (C & C) departments of all thirteen centres. Respondents were asked to indicate the desirability and feasibility of each outcome of framework on a five-point scale ranging from very low to very high. After one month, they were reminded through e-mail, fax and phone. Finally, twelve responses were received. Table 6 presents the summary of designation and length of experience of the respondents.

![Table 6: Summary of Designation and Experience of Respondents](table)

Analysis of desirability and feasibility scores was done by calculating the mean of collected scores. The suggestions having average desirability or feasibility score more than three (>3) have been considered in the ‘High’ region, whereas those having scores below three (<3) were considered in the ‘Low’ region. The suggestions having scores near about three were considered in the fuzzy zone of “Medium” score.

Outcomes along with the mean scores are tabulated in Appendix I. There were no suggestions with less than three ‘Desirability or Feasibility Score’. Most of the suggestions are lying on high-high zone. There is only one suggestion regarding ‘restructuring of organization structure’ has high desirability but medium feasibility. Another suggestion regarding ‘restructuring of IT department’ has medium desirability and medium feasibility. This validates the framework. All the suggestions can not be implemented immediately; therefore a need is felt to suggest an action plan. Action plan has been categorized into five phases depending upon the desirability-feasibility scores. These action phases are:

(i) Mean Desirability Score and Feasibility Score both >= 4 - Phase I

(ii) Mean Desirability Score >= 4, Feasibility Score < 4 but in high zone - Phase II

(iii) Mean Desirability Score >= 4, Feasibility Score is in medium zone - Phase III

(iv) Mean Desirability Score and Feasibility Score are <4 but in high zone - Phase IV

(v) Mean Desirability Score and Feasibility Score both are in Medium zone - Phase V

Concluding Remarks

The framework presented in this paper is flexible and dynamic. Flexible nature of framework captures the change...
occurring within or outside the bank under consideration. Dynamic nature of the framework helps the practitioner to capture the fast changing attitude of information technology. The proposed framework favours learning over monitoring and it provides combination of analytical and creative techniques. It can serve the purpose of all groups of banks whether they serve a niche market segment or have a wide geographical spread. Limited validity of the framework was done by collecting the opinion of IT practitioners of the bank. The framework can also be validated by evaluating the effects of its application in practice. Longitudinal observations of effects of application of framework in a number of cases could develop more confidence on the framework.

Acknowledgement: The authors wish to thank the reviewers for giving valuable comments which is to improve the content and organise the paper in present form.

References
## Appendix I: Mean Scores of Desirability-Feasibility Study

<table>
<thead>
<tr>
<th>Outcome of Frame Work</th>
<th>Desirability</th>
<th>Feasibility</th>
<th>Action Phase</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Mean Value</td>
<td>Low/High</td>
<td>Mean Value</td>
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<td>(I) IS Mission</td>
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<tr>
<td>Delivering world class IT based diversified financial products and services which should enable the bank to add value to its stakeholders in digitized and information driven market.</td>
<td>4.58 H</td>
<td>4.42 H</td>
<td>4.75 H</td>
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<td>(II) IS Objectives</td>
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<tr>
<td>(a) Acquire and Implement World Class IS.</td>
<td>4.67 H</td>
<td>4.00 H</td>
<td>4.50 H</td>
</tr>
<tr>
<td>(b) Offering leading edge products and services.</td>
<td>4.50 H</td>
<td>4.08 H</td>
<td>4.50 H</td>
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<tr>
<td>(c) Imitating at a faster pace the innovative banking products and services and blending it with IT.</td>
<td>4.50 H</td>
<td>4.00 H</td>
<td>4.50 H</td>
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<tr>
<td>(III) Strategic Actions</td>
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<td></td>
</tr>
<tr>
<td>(a) Networking of Bank Branches: Cluster Banking</td>
<td>4.17 H</td>
<td>3.25 M</td>
<td>4.17 H</td>
</tr>
<tr>
<td>(b) Data warehousing and Data mining</td>
<td>4.17 H</td>
<td>3.58 H</td>
<td>4.00 H</td>
</tr>
<tr>
<td>(c) Restructuring the Organizational Structure of Bank.</td>
<td>4.00 H</td>
<td>3.08 M</td>
<td>3.33 M</td>
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<td>(d) Restructuring the IT Department (As per Fig. 8.5)</td>
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<td>3.00 M</td>
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<td>(IV) Better IS Planning &amp; Implementations.</td>
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<td></td>
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<tr>
<td>(a) Top Management Involvement in IS Planning process should be increased</td>
<td>4.58 H</td>
<td>3.75 H</td>
<td>4.33 H</td>
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<tr>
<td>(b) Head (IT) should be a member of Board of Directors and should participate in bank’s business planning</td>
<td>4.08 H</td>
<td>3.42 H</td>
<td>4.17 H</td>
</tr>
<tr>
<td>(c) Bank’s product development team must have representation from IT department</td>
<td>4.50 H</td>
<td>4.08 H</td>
<td>4.50 H</td>
</tr>
<tr>
<td>(d) IS Planning Committee must consists of head of all strategic business units i.e. National, Corporate etc. in addition to personnel from IT department</td>
<td>4.33 H</td>
<td>3.67 H</td>
<td>4.33 H</td>
</tr>
<tr>
<td>(e) A Steering Committee consists of Head (IT) from all divisions (e.g. National, Corporate), Key operational managers and System Auditors must be used to give direction to IS planning/Implementation</td>
<td>4.17 H</td>
<td>3.75 H</td>
<td>4.17 H</td>
</tr>
<tr>
<td>(f) IS Project planning and implementation team must have representation of concerned end users</td>
<td>4.33 H</td>
<td>3.75 H</td>
<td>4.33 H</td>
</tr>
<tr>
<td>(g) It is necessary to create and support innovative culture in the bank</td>
<td>4.92 H</td>
<td>3.50 H</td>
<td>4.58 H</td>
</tr>
<tr>
<td>(h) New training and re-skill program should be arranged to enhance employee value</td>
<td>4.58 H</td>
<td>3.67 H</td>
<td>4.58 H</td>
</tr>
</tbody>
</table>

### Outcome of Frame Work

<table>
<thead>
<tr>
<th>Desirability</th>
<th>Feasibility</th>
<th>Action Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Value</td>
<td>Low/High</td>
<td>Mean Value</td>
</tr>
<tr>
<td>(i) Internal people must be made aware and prepared for new responsibilities.</td>
<td>4.67 H</td>
<td>3.83 H</td>
</tr>
<tr>
<td>(V) IT Applications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Implementation of ‘Single Window Service’ concept in all computerized branches to save customer’s time</td>
<td>4.83 H</td>
<td>3.50 H</td>
</tr>
<tr>
<td>(b) Putting limit of withdrawal on ATM card instead of present practice of putting such limits on ATM machines to facilitate transaction from any ATMs of SBI</td>
<td>4.00 H</td>
<td>3.50 H</td>
</tr>
<tr>
<td>(c) Increasing the number of offsite ATMs and to motivate the customers to transact only through ATMs wherever possible</td>
<td>4.42 H</td>
<td>3.75 H</td>
</tr>
<tr>
<td>(d) Transactions (off line) from ATM of other banks should be permitted up to certain limit, the reconciliation of same can be done on daily basis</td>
<td>4.17 H</td>
<td>3.50 H</td>
</tr>
<tr>
<td>(e) All ATMs of the bank should be inter connected and connected to the bank to make real time ATM transactions</td>
<td>4.58 H</td>
<td>3.67 H</td>
</tr>
<tr>
<td>(f) SPNS should be implemented atleast in all metros</td>
<td>4.42 H</td>
<td>3.92 H</td>
</tr>
<tr>
<td>(g) Phone banking facility should be extended at more number of cities and services should be made available round the clock</td>
<td>4.33 H</td>
<td>3.50 H</td>
</tr>
<tr>
<td>(h) Common forms like account opening forms should be made available on the Bank’s Web site for down loading</td>
<td>4.33 H</td>
<td>4.25 H</td>
</tr>
<tr>
<td>(i) Web site must be made more informative by incorporating addresses of all LHO and ZO of the bank</td>
<td>4.50 H</td>
<td>4.67 H</td>
</tr>
<tr>
<td>(j) Web site must be made interactive for giving customized details of personal loans, deposits etc.</td>
<td>4.83 H</td>
<td>4.42 H</td>
</tr>
<tr>
<td>(k) Internet Banking facility should be offered atleast in metros and urban cities.</td>
<td>4.75 H</td>
<td>4.25 H</td>
</tr>
<tr>
<td>(l) Mobile banking facility should be offered atleast in metros and urban cities.</td>
<td>3.50 H</td>
<td>3.50 H</td>
</tr>
<tr>
<td>(m) Customer Information Systems should be introduced to enhance relationship banking for high net worth individuals and corporate customers</td>
<td>4.50 H</td>
<td>4.33 H</td>
</tr>
<tr>
<td>(n) Call Centers should be set up to help and guide customers.</td>
<td>4.25 H</td>
<td>4.17 H</td>
</tr>
</tbody>
</table>
Flexibility Mapping: Practitioner’s Perspective

1. What types of flexibilities you see in the practical situation of “Strategic Information Systems Planning” on the following points:
   - Flexibility in terms of “options”
   - Flexibility in terms of “change mechanisms”
   - Flexibility in terms of “freedom of choice” to participating actors.

2. Identify and describe the types of flexibilities that are relevant for your own organizational context. On which dimensions, flexibility should be enhanced?

3. Try to map your own organizational information systems on following on continua. (Please tick mark in the appropriate box(es)).

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computerization</td>
<td>(         )</td>
<td>(         )</td>
</tr>
<tr>
<td>Outsourcing</td>
<td>(         )</td>
<td>(         )</td>
</tr>
<tr>
<td>Nil</td>
<td>(         )</td>
<td>(         )</td>
</tr>
<tr>
<td>IT Applications</td>
<td>(         )</td>
<td>(         )</td>
</tr>
<tr>
<td>Technology driven</td>
<td>(         )</td>
<td>(         )</td>
</tr>
<tr>
<td>Full</td>
<td>(         )</td>
<td>(         )</td>
</tr>
<tr>
<td>Business driven</td>
<td>(         )</td>
<td>(         )</td>
</tr>
</tbody>
</table>

4. Develop a SAP-LAP (Situation Actor Process-Learning Action Performance) model of “Strategic Information Systems Planning” relevant to your organization.

Reflecting Applicability in Real Life

1. Develop the Strategic Information Systems Plan for your organization using the framework given in this paper.

2. Carry out SAP-LAP analysis of your organization on a similar basis as given in this paper.
SAP-LAP Models

Sushil
IIT Delhi

Introduction

There is a pressing need to evolve a management approach which is holistic and flexible in the light of dramatic change in various external factors of the business environment and the corresponding change in the internal factors of the organizations. The concept of ‘systemic flexibility’, dealing with options, change and freedom of choice, has been discussed in the Learning Lesson L1 (Vol. 1, No.1). Based on this concept, the SAP-LAP (Situation Actor Process-Learning Action Performance) framework has been evolved, as presented in the Learning Lesson L2 (Vol. 2, No. 1). This is a holistic framework that blends the analytic as well as synthetic paradigms on the one hand, and hard systems (optimizing) and soft system (learning) paradigms on the other.

The SAP-LAP framework consists of three entities in any context, viz. a situation to be dealt with, an ‘actor’ or group of actors who deal with it and a ‘process’ or processes that recreate the situation. In this framework, freedom of choice lies with the actor. A synthesis of SAP leads to LAP which deals with learning, action and performance.

Based on the SAP-LAP framework, we can prepare generic as well as specific models for managerial inquiry and problem solving. These models could be qualitative in terms of critical questions or may employ certain tools, such as quantitative analysis tools, matrix representation etc.

Purpose of SAP-LAP Models

We often encounter situations in managing organizations and conducting management research to carry out an in-depth inquiry of the problem/case at hand for effective action. The effectiveness of the outcome of inquiry/problem solving/case development will depend a great deal on the deep rooted and creative group learning about the key facets of the problem. Such a holistic inquiry requires some systemic aids to channelize the creative process adapting to the problem at hand. A flexible modelling framework can facilitate this action learning process to aid knowledge management. SAP-LAP framework is generic and flexible and can be used to develop generic as well as specific models for managerial inquiry and problem solving.

The purpose of a SAP-LAP model is to aid the process of analysis and idea generation about the ‘situation’, ‘actors’ and ‘processes’ and their interfaces. The model also guides the process of synthesis in terms of key learning areas, action points and performance impacts. Thus, the SAP-LAP model prepares the group for effective action in the changing situation. The model can be applied iteratively, as with each action the situation is changed and a fresh inquiry can be made.

Types of SAP-LAP Models

SAP-LAP models can be of various types depending on the purpose, application focus, comprehensiveness, time dimension, levels of inquiry and tools used for analysis as well as presentation.

Depending on the purpose of the model, the SAP-LAP models can, basically, be of two types:

i. Exploratory models : Used for managerial inquiry and case development.

ii. Normative models : Used as a guideline for implementation, e.g. strategy formulation, technology transfer, project selection etc.
Sushil

A typical SAP-LAP model for case development for core competence and flexibility is presented by Kak and Sushil (2000) which is used for developing six cases in IT and Pharma sectors. A normative model for strategy formulation and implementation using core competence and flexibility is presented by Kak (2000).

Keeping in view the application focus, the SAP-LAP models can be classified into two broad categories:

i. **Generic models:** These models are developed to make an inquiry into certain generic areas such as problem solving, change, flexibility (Sushil, 1999, 2000a), enterprise transformation (Sushil, 2000b), core competence (Kak and Sushil, 2000) and so on. These models provide guiding critical questions on the six components of SAP-LAP which can be suitably adapted as per the requirement by adding or dropping a few critical questions. A typical generic model for ‘General Problem Solving’ is shown in Exhibit 1.

ii. **Specific models:** Specific SAP-LAP models can be developed in any typical context as a plan for inquiry, e.g. study of economic reforms, recession in IT industry, dot.com revolution, market penetration, new product launch and so on.

As per the comprehensiveness, the SAP-LAP models can again be classified into two categories:

i. **Naive or atomic models:** These are preliminary models that take into consideration the six basic components of SAP-LAP framework, i.e. situation, actor, process, learning, action and performance independently without explicitly considering their interdependence or interrelationships. Though these models are naive, they can be quickly developed by brainstorming and can be applied with limited time, resources and expertise. The model presented in Exhibit 1 lies in this category.

ii. **Integrative models:** These models take care of the interaction and interdependence of the basic components, i.e. situation, actor and process. These models may either incorporate interfaces of situation, actor and process, e.g. organizational climate and culture, strategy, structure, systems, contingency etc. or may use matrix models by taking two elements on two dimensions and the third one on the matrix. A typical matrix based SAP-LAP model is shown in Exhibit 2.

---

**Exhibit 1: SAP - LAP Model for General Problem Solving**

<table>
<thead>
<tr>
<th>Situation</th>
<th>- The Journey</th>
<th>- How did we reach here?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- What is happening now?</td>
<td>- What all is expected to happen?</td>
</tr>
<tr>
<td>Actor</td>
<td>- What are the world-views?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- What roles and capabilities are exhibited?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- In what domains freedom of choice is available?</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>- What is being done?</td>
<td>What are the variables?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>What are the parameters?</td>
</tr>
<tr>
<td></td>
<td>- Why it is being done?</td>
<td>What can be changed?</td>
</tr>
<tr>
<td></td>
<td>- How is it being done?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- What else?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Why else?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- How else?</td>
<td></td>
</tr>
<tr>
<td>Learning</td>
<td>- What are the key issues related to situation?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- What are the key issues related to actor(s)?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- What are the key issues related to process(s)?</td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td>- What should/ought to be done to improve the situation?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- What can be done to improve the actor(s)?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- What ought to be done to improve/implement the process(s)?</td>
<td></td>
</tr>
<tr>
<td>Performance</td>
<td>- What will be its impact on the situation?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- How the actor(s) will be affected?</td>
<td></td>
</tr>
</tbody>
</table>
|             | - How the performance of the process(s) will be affected? | }
Keeping the **time dimension** in consideration, the SAP-LAP models can be:

i. **Static models**: In this case, we have only one model, which is a snapshot of the problem context. The models presented in Exhibits 1 and 2 lie in this category.

ii. **Dynamic models**: In this case, we can make multiple snapshots over the time. Based on a situation, an action is taken which creates a new situation leading to a new model. Many such models in succession give a fairly good picture of the evolution over the time path. An illustration of a dynamic model is presented in Exhibit 3 for the case of NIIT.

The SAP-LAP models could be **singular or plural** depending on the domains of inquiry.

i. **Singular models**: Normally, we develop only one model for the problem context assuming the unitary mode of people involved. These are simpler models and can be quickly developed and implemented, but fail to take care of multiple perspectives. Models shown in Exhibits 1 and 2 are singular models.

ii. **Plural models**: The SAP-LAP models can have multiple types of plurality. Accordingly, these can be

   - **Actors-oriented models**: In this case, we develop a separate model according to the perspective of each key actor involved.
   - **Process-oriented models**: In a case where multiple processes are involved, we may develop a separate model keeping in view each process in focus and synthesize in the end.
   - **Multilevel models**: When more than one level is involved in the problem, e.g. business level and corporate level, separate models are developed for each level, which are to be coordinated.
   - **Dynamic models**: In these models, we have plurality on the time front as illustrated in Exhibit 3.

SAP-LAP models can use **multiple tools**, both for analysis and presentation, and accordingly can be of multiple types:

i. **Bullet form models**: These are the simplest and most widely used models which utilize critical questioning as the tool and present the results of inquiry in bullet form (Exhibit 1).

ii. **Tabular models**: The models are presented in the form of tables giving the situation, actor and process variables classified according to importance or cruciality such as vital, essential and desirable. The tabular models also present the learning issues in a tabular manner giving various categories of issues (Husain and Sushil, 1997).

iii. **Matrix models**: These models present the SAP relationships in the form of a matrix. A sample model is shown in Exhibit 2.
iv. Pictorial models: These models present the key SAP-LAP issues and variables pictorially, as shown in Exhibit 3.

v. Models using multiple tools: More comprehensive SAP-LAP models can be developed by using flexsy tools such as continuum, flexibility influence diagrams, quantitative relationships/mapping etc. (Sushil, 1999).

Exhibit 3: Illustration
Dynamic SAP-LAP Models of NIIT

Introduction
- NIIT started as an IT education and training company in 1982 with less than one fifth of the revenue coming from the software development.
- Today NIIT is a 266 million USD global IT and Knowledge solutions company with almost 50% revenues coming from software business.
- NIIT has over 2000 education centres in 26 countries around the globe.
- It has 4900 employees in 37 countries in the area of education and software development.
- Assessed at SEI-CMM level 5 and following ISO 9001 processes.
- NIIT works on a unique business model where knowledge business and software business complement each other.
- NIIT’s knowledge solutions in the form of corporate virtual university have helped organizations manage smooth transition to new technologies.

Business Model
- Experience gained while working on the projects can be used to equip students with real life situation.
Response to globalization in terms of strategic alliances and focus on western market

Expanding in the areas of software solutions, knowledge solutions and e-learning in view of the opportunities and potential synergies

SAP-LAP Models

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Conclusions

Current Scenario

- Intense competition
- Education is going to be the biggest Internet application in coming future
- Requirement of Business Applications in the area of healthcare and finance.

Learnings

- NIIT has to become the technology leader
- Proactive approach-anticipate new technologies and customer needs

Action Plan

- Focus on the core competency of education business
- Focus on product development
- Explore new domain areas where IT intervention has not been considerable

Reflections

The SAP-LAP models enunciated above provide a flexible modelling framework with wide options to suit the requirements of the managerial problem under consideration. Further, these can be implemented in an innovative manner to suit the specific requirements of the problem. While implementing the models, the recommended actions should be checked for feasibility. Ultimately, an action plan is to be prepared for desirable and feasible actions in terms of time frame, responsibility and resource requirements. The lesson provides only a glimpse of the panorama of SAP-LAP models. Some of these models are well tested, whereas integrative and advanced models are to be further tested with more applications by users in a variety of areas. The SAP-LAP models are based on a generic framework, which is also manifested in specific models such as SWOT analysis (where strengths and weaknesses are ‘actor’ variables, opportunities and threats are ‘situation’ variables and the TOWS matrix (Wheelan and Hunger,
SAP-LAP Models

1998) gives the ‘process’ of strategy making), CATWOE analysis in soft systems methodology (Checkland, 1990) (where customers, Actors, Owners and Worldview are ‘actor’ variables, Transformation is ‘process’ and Environment is ‘situation’) and so on. We can use either the generic SAP-LAP models or these specific applications.

References


Self Assessment and Reflection with Reality

- Develop a naive SAP-LAP model for the context of your choice.
- Develop a SAP-LAP Model in Matrix form as given in Exhibit 2.
- Develop a dynamic and pictorial SAP-LAP model in your own context as given in Exhibit 3.
Event Diary

This section will contain events related to flexibility. Only highlights and important dates are provided. For more details, please visit the web page or contact the organizers. If you are planning any major flexibility related event (global conference/workshop/seminar), please submit the details (Event title, Dates, Place, Theme, Deadlines, Contact Info, Email, Web page, etc.) to Dr. K. Momaya at email momaya@dms.iitd.ernet.in with Subject: giftjourn@1, Event Submission.

**Event**: IAMOT 2002

The 11th International Conference on Management of Technology

**Dates**: March 10 - 14, 2002

**Place**: Fontainebleau Hilton Resort on Miami Beach, Florida

**Theme**: Drive Towards the Internet Economy: Opportunities and Challenges for Developed and Developing Regions of the World

**The deadlines**: Submission of Abstract: September 30, 2001

**Contact Address**: Send abstracts to:

Dr. Yasser Hosni
Professor, University of Central Florida
4000 Central Florida Blvd.
Orlando, Florida 32816-2450 USA
Tel: 1 407 823 5817
Fax: 1 407 823 3413
yhosni@mail.ucf.edu
Web: www.iamot.org

**Event**: The Strategic Management Society

21st Annual International Conference

**Dates**: October 21 - 24, 2001

**Place**: The Westin St. Francis
San Francisco, California USA

**Theme**: Reinventing Strategic Management: Old Truths and New Insights

For more info, please visit
http://www.smsweb.org/noflashIE/NewConferences/annual.html
Flexibility is talked about everywhere these days but not much literature is available on the subject. People usually understand flexible working practice as flexible working hours and flexi-contracts. But with the new technology various other flexible working models can be practiced.

The Complete Guide to Flexible Working gives a deeper insight into this aspect of flexibility. It also describes the various forms of flexible working practices such as flexible contracts, flexible hours, flexible location and flexible tasks. The need for flexible working was necessitated due to business factor (increased competitiveness, cost reduction, quality improvement) and social factors.

The advancement of technology has given boost to flexible working by providing new technology enabled ways of working. This guide has rightly brought up the point of this win-win situation for both employers and employees. It has also provided some interesting facts and figures to support the argument. 'Facilities flexibility' can be brought in by addressing technology, processes, management and human resources at the same time. The organisation has to understand where employees can work most effectively and create the facilities and infrastructure to enable them to do so by restructuring and redesigning office, office at home, office on move etc.

This guide suggests a way of developing a strategy for new ways of working by evolving a programme of cultural change and awareness raising to deliver full range of benefits. As very rightly stressed upon in the guide, the strategy for flexible working should essentially involve staff from the outset. While developing strategy for flexible working it should consider/account social and environmental responsibility for which this guide has used the term responsible working. For developing strategic framework, four factors, viz. facilities for work, technology and process, organisation and people, and responsible working are to be considered. It has shown the way by which facilities flexibility can be achieved, say by sharing, support service, decentralization, location, anywhere any time, third party facilities.

The guide has emphasized the importance of recruitment, training and providing good facilities for permanent support staff, as they are going to play a vital role in making 'facility flexibility' successful. The guide also presents various statistics comparing conventional and flexible working but no elaboration on methodology has been given for reaching these statistics or the details of the source they are taken from.

The strategic approach would be to collect information on how facilities are currently being used and then how the staff would prefer to work. It has also given the method by which this can be done. A study of public sector organisation shows high utilization of desk by administrative and support staff and low by managers and professionals. It also shows that an office which had 120 personnel, each of them having a desk of own, that at no point of time more than 45 desks are in use (38%) and average utilization during the working days was 25%.

As flexible working can only be brought through flexible facilities, the new information and communication technology had helped providing new flexible facilities. Convergence and 3G will further help flexible working. This guide suggests the Technology infrastructure for flexible working, like full voice and data routing, voice divert, data-dial up, voice divert, data via ISP. Making greater use of the Internet is the solution of future. Telephone is delivered via the PC using voice over IP and data connection using Internet tunneling. Flexible working could be implemented using technologies such as group ware, intranet, knowledge management, integrated messaging and others.

People are the most important resource for the organisation and so is true for organisation using or plan to use flexible working. People play a vital role to make flexible working success. A learning culture with ten principles, viz. vision, responsibility, openness, learning, support information, consultation, recognition, caring and improvement could be used to assess an organisation’s readiness for new ways of working.

Stress and working hours are showing an upward trend in today world of competition and era of globalization. But this grim situation can be changed, and the keyword to bring this change is flexibility. If the employees and employer both are flexible then employees can reduce stress, and become more productive as they achieve better work-life balance. The tools suggested in The Guide to Flexible Working are flexible hours, part-time work, job-share, term-time working, home based working, telecentre working and parental leave.

Before bringing any change, this need to be properly communicated otherwise it would have negative reaction from the staff. Same is advised in the guide, to implement new ways of working try to communicate and manage the change that is about to happen in organisation. Share the vision, make people aware and involve staff in the change programme. Proper training for staff to use technology.
needed for flexible working should be imparted. Staff should be trained in use of groupware, intranet and knowledge management. It has provided with the checklist for human resources manager around which policies for flexible working can be formed. The guide has discussed the points HR manager would require to recruit and select staff for the flexible working.

A word of caution. Too much of technology can isolate people from colleagues and business partners. The guide has very aptly said that proper steps are needed to ensure that teams continue to meet face to face. One interesting thing about these meetings is that then these meetings will more become a social, enjoyable and highly productive one as most of the transactional work is carried out electronically.

Flexible working also gives equal opportunities to those who cannot work due to temporary illness or permanent disability or various other reasons such as child care responsibility and caring for sick and disabled relative etc. Flexible working practice enables to retain key workers. The book gives an example of Sweden and Finland, where geographically dispersed population, advance telecommunication and progressive social model is combined to encourage innovative working practices.

The relation between environmental sustainability and flexible working practices could not be brought out well in the book. The guide has further drawn a relation between flexible working practice and economic regeneration. The new way of working provides work in areas where there is lack of local opportunities. The new technology which enable new ways of working offers maximum business benefits with contribution in urban and rural regeneration.

The benefits of flexible working practices, which are already achieved by the organisation, are effective and efficient service delivery, low operating and administrative cost, high business efficiency and team/personal productivity.

The guide had identified main components of a typical flexible working, structured around a number of key themes. These themes can be used to form the basis of interdisciplinary working groups for making recommendations and developing strategy for flexible working. It has given guidelines to organise a project and supported it with practical approach. It has presented the full project plan, which can be used to practice working flexibility.

The organisations innovate continuously, to make its products and services successful. But to become really successful in today’s era of competition they will also need to learn to innovate even newer ways of working as technology improvement over the time will require and provide new ways of working. The guide is well written focusing on the practical approach. But the only limitation with the guide is that it has been written specifically taking into consideration only one country, UK. This does not include any examples, facts of other countries.

Overall, this is a good reading material in area of flexible working practice.

Reviewed by
Ashish Jain, Manager, GIFT
The formulation and implementation of organizational strategy are recognized as key aspects of the management of all modern successful organizations. However, it has become a daunting task to cope up with changes in today’s hyper-competitive market place. With increasingly more global competition and the infusion of the Internet in the business world, flexibility in the strategy formulation and strategy’s implementation process has become a requirement to survive and develop new business. Many researchers over time have stressed the importance of incorporating flexibility in the formulation of business strategy, as it may help achieve better business performance. In such an environment, traditional strategic planning methods do not suffice. To keep organizations competitive, policy makers will have to overhaul the process of formulating and implementing strategic initiatives to explicitly consider flexibility at various levels in the organization. Many challenges await companies as they formulate their organizational strategy and create flexibility in business processes. Thus, organizations are obliged to continuously explore new and innovative strategies, and to seek powerful methodologies that will confer competitive advantage.

The purpose of this special issue is to group together high-quality papers that lie at the intersection of flexibility and organizational strategy issues. The term flexibility is adapted in its most generic sense and includes both the service and manufacturing environments. Examples of the subject matter of the papers suitable for this special issue include, but are not limited to, the following:

- Recent developments in strategy formulation that consider the issues related to flexibility that can help practitioners, and their integration with information technology and management sciences tools and techniques.
- Development of appropriate concepts to understand the role and significance of flexibility in organizational strategy formulation.
- Empirical research in understanding the practice of organizational strategy formulation that includes flexibility and the types and levels of flexibility possible in organizations.
- Impact of e-commerce and the Internet on organizational strategy formulation and the consideration of flexibility.
- Strategy formulations to achieve effective and flexible supply chain solutions for extended multinational enterprises.
- Strategy formulations to create and manage virtual enterprises of the future.
- Identification of critical success factors to ensure flexibility in organizations.
- Description and evaluation of information technology and software packages available to help include flexibility in organizational strategy formulation.
- Application papers of specific interest to the business community.

All manuscripts will be promptly and carefully refereed. Authors should follow the Instructions to Authors for the Global Journal of Flexible Systems Management (available from the guest editors) when preparing their manuscripts. Please submit five copies in English, in a machine readable form as an attachment to an e-mail, by no later than January 31, 2002, to one of the following guest editors:

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About GIFT

GIFT (Global Institute of Flexible Systems Management) is a professional society to enhance “flexibility” in business and management.

**Mission**
To evolve and enrich the flexible systems management paradigm for the new millennium.

**Vision**
Evolving as a global forum for interaction of all interested professionals and organizations in a truly flexible mode so as to help them create more options, faster change mechanisms and greater freedom of choice in their own settings.

**Schools**
The Institute comprises of various schools, which are autonomous bodies, dealing with contemporary areas at the cutting edge contributing to the flexible systems management paradigm. At any point of time, each member can opt for an association with any two of the following schools in the respective thrust areas:
* GIFT School of Global Management
* GIFT School of Technology and Innovation Management
* GIFT School of Information Technology & Knowledge Management
* GIFT School of E-Commerce and E-Governance
* GIFT School of Learning Organization and Strategic Transformation
* GIFT School of Quality, Productivity and Waste Management
* GIFT School of Environment Management and Sustainable Development
* GIFT School of Human Values and Management Ethos

**Publications**
- Book Series on Flexible Systems Management
- Quarterly Journal - “Global Journal of Flexible Systems Management” @journal
- Newsletter - “Flexibility”

**Membership**
The membership fees for different types of members, unless changed/revised by the Governing Council from time to time, will be as given under:

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(b) for corporate bodies having turnover more than Rs 20 Crore:

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- All individual members will get one complimentary copy of the @journal.
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All correspondence and membership applications may be addressed to the Manager GIFT at the following address:

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