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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- Actor - Process-Learning-Action-Performance) framework in varied managerial situations to cope with the challenges of the new business models and frameworks. It is a General Management Journal with a focus on flexibility.

Scope

The Journal includes 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.

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The journal is 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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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 n**"

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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* The paper is original, not submitted anywhere else.
* The length of the paper is commensurate with content.
* The title and headings are brief and catchy.
* The author(s) name and affiliation are given only on cover page.
* Abstract and keywords are provided.
* Focus on flexibility in management is kept.
* The paper incorporates innovative ideas/models in a practical framework.
* Mathematical models, if any, are given in Appendix.
* Tables/Figures are properly placed and numbered with brief titles/captions.
* References are in standard style.
* Few highlights (8-10) of two-three lines are provided to put in boxes.
* Few key variables (3-5) are identified for flexibility mapping on a continuum.
* Some key questions (2-3) are provided to reflect the applicability in real life.

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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 organisations 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.

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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:

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- * GIFT School of Technology and Innovation Management
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- Quarterly Journal - "*Global Journal of Flexible Systems Management*" giftjourn@l
- Newsletter - "Flexibility"

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Give a New 'LIFE' to Your Organization!

How lively is your organization? Is it getting crumbled under the dead weight of hierarchy, bureaucratic procedures, rules, regulations and rigidities of mind set?

*Organizations
undergoing slow
death due to
rigidities all around*

A large number of organizations are undergoing a process of slow death with different kinds of rigidities all around and find it difficult to cope with the challenges of the fast changing, turbulent and uncertain business environment. They are crying for a new life to be competitive in this dynamic business world.

*A new 'LIFE' can be
given to your
organization*

You can give a new life to your organization by injecting post-modern management thinking and processes. The four prominent ones that give a new 'LIFE' are:

- L – Learning
- I – Innovation
- F – Flexibility
- E – Entrepreneurship

*Infuse a learning
culture and make
your organization a
learning organization*

Infuse a 'learning' culture in the organization. Make your organization a 'learning organization' that develops the ability to continuously renew and adapt to the changing conditions and requirements as a living system. Some prominent examples are GE, Ford, Federal Express, and so on. A learning organization has shared vision, personnel mastery, team learning, ability to question mental models and systems thinking.

*Innovation can be taken as
base for strategy to develop
organizational ability to
create something new of
commercial value*

'Innovation' is a linked concept with learning. The organization's ability to create something new that can be of commercial value will give it an edge over the run of the mill set ups. Innovation can be on many fronts such as products, processes, procedures, etc. and could be routine, significant or radical. These may be linked with technology architecture or market architecture. Some organizations that have taken innovation as the base of their strategy are: 3M, Intel, LG, Microsoft and so on.

*Flexibility is the key
attribute of a living system
offering more options,
change-mechanisms and
freedom of choice*

The key attribute of any living system is 'flexibility' which is intimately related with learning and innovation in a two way manner. Flexibility means having more options, change-mechanisms and freedom of choice. Flexibility in an organization can be at various levels, such as flexible enterprise, flexible manager, and flexible products and services. Though every organization is a flexible organization to some extent as a living system, the extent of liveliness depends upon the level of flexibility. Some organizations having high flexibility are GE, Microsoft, Honda, ABB and so on. Enhancing the flexibility of an organization leads to more entrepreneurship also.

*Entrepreneurship
develops innovation and
risks taking capabilities*

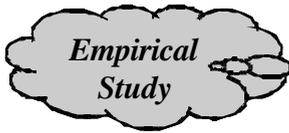
The fourth major attribute of 'LIFE' for organizations is 'entrepreneurship'. The dynamic organizations should inculcate entrepreneurship both at individual and corporate levels. It imbibes the key attributes of innovation and risk taking for tapping opportunities. HCL can be seen as an organization in the Indian context realizing its growth vision by promoting intrapreneurship.

*The four processes of
'LIFE' are learning,
innovation, flexibility
and entrepreneurship*

If an organization infuses all the four processes of 'LIFE', i.e. learning, innovation, flexibility and entrepreneurship in a synergistic manner having dynamic interplay, it develops the ability of continuous renewal and reincarnation. Each organization should examine and assess to what extent it possesses these characteristics and how can it enhance them to come out of the impending death trap.

Sushil
Editor in Chief





Strategic Flexibility and Firm Performance : The Case of US Based Transnational Corporations

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Abstract

In a fast-paced globalized world it is very important for transnational corporations (TNCs) to be competitively agile. The Asian currency crisis, shifting foreign direct investment and trade patterns, rise of regional trading blocks, and ongoing developments of the Internet have created environmental turbulence. To gain a competitive advantage, strategic flexibility has become a must for most TNCs. Based on the global strategy framework developed by Yip (1995) and the relevant strategy literature three key areas of strategic flexibility were identified. They are: (i) market flexibility, (ii) production flexibility, and (iii) competitive flexibility. The basic research question was "Does strategic flexibility improves firm profitability?" Three hypotheses were developed, and tested on data from 227 Fortune 500 companies. The independent variables were market flexibility, production flexibility and competitive flexibility, and the dependent variables were the three performance measures Return on Sales (ROS), Return on Assets (ROA) and Earnings before Interest and Tax Margin (EBITM). All three areas of strategic flexibility were found to be significantly related to the firm performance measures.

Keywords : competitive environment, firm performance, strategic flexibility

Introduction

During the last decade the global economic and political environment has changed dramatically. Dismantling of the Soviet system, economic liberalization programs in China and India, the growth of democracy in Latin America, the formation of both NAFTA and the European Union have had a tremendous impact on the global economic outlook (Tersine and Harvey, 1998). Continued globalization, coupled with the technological revolution led by the Internet has changed the way most of the transnational corporations (TNCs) operate. These changes have created both enormous opportunities and challenges for global organizations. The change in environment has forced most TNCs to develop a global strategy based on flexible systems that can adapt to the changing external environment.

This study investigates the impact of strategic flexibility on the firm profitability. The basic research question is "Does strategic flexibility lead to higher firm profitability?" For this study we define strategic flexibility as a firm's ability to respond to various demands from dynamic competitive environments (Sanchez, 1995) in a competent manner. It should be able to produce and sell the right products, at the right time, at the right place and at the right price (Roth, 1996).

Strategic Flexibility and Environmental Uncertainty

Strategic flexibility is closely linked to environmental uncertainty. As the external environment becomes more volatile TNCs need to develop greater flexibility in order to respond to the emerging conditions. According to Evans (1991) flexibility is composed of a number of "senses" including "adaptability, agility, corrigibility, elasticity, hedging, liquidity, malleability, plasticity, resilience, robustness, and versatility". He argued that each of these organizational flexibilities would be in response to some form of external environmental uncertainties or pressures. The type of reaction could be "offensive" or "defensive" and he categorized these senses into those categories.

While flexibility is normally considered solely as an adaptive response to environmental uncertainty (Gupta and Goyal, 1989), it is important to realize that a firm may use its strategic flexibility to proactively re-define market uncertainties and make it the cornerstone of its ability to compete. This is exemplified by Toyota and its actions in global automobile industry in the 1980s and the 1990s. Unfortunately, such proactive behavior in using flexibility is often neglected by researchers (Gupta and Goyal, 1989; Nilson and Nordahl, 1995; Prabhaker et al., 1995).

Strategic flexibility implies that the entity as the ability to change according to its needs. Flexibility is the ability to adapt, in a reversible manner, to an existing situation, as



opposed to evolution, which is irreversible. This notion reflects the ability to stay operational in changing conditions, whether those conditions are predictable or not, or completely different from conditions known in advance. This adaptability is required from firms that, for economic reasons, are currently turning to efficient techniques of organization and management of the zero stock, just-in-time and tight-flow type which can make them fragile. Strategic flexibility is crucial in hypercompetitive environments because, the established paradigms of sustainability of competitive advantage and stability of organizational form have limited applicability.

Strategy researchers have emphasized stability in a firm's pattern of resource commitments (Ghemawat, 1991). Through resource commitments, firms erect entry barriers (Bain, 1956), mobility barriers (Caves & Porter, 1977), and isolating mechanisms (Lippmann & Rumelt, 1982) that protect their competitive advantages. Although such patterns of resource commitments provide a firm with competitive advantage (Dierickx & Cool, 1989), they can also become impediments to strategic reorientations (Grimm & Smith, 1997).

In the last decade many industries have experienced "a fundamental shift in the rules of competition and the way the game of competition is played" (Ilinitch, D'Aveni, & Lewin, 1996: 211). Teece, Pisano, and Shuen (1997) argued that organizations should rely on dynamic capabilities to build competitive advantage in regimes of rapid change, and Sanchez (1995) and Garud and Kotha (1994)

Flexibility is the ability to adapt, in a reversible manner, to an existing situation, as opposed to evolution, which is irreversible.

suggested that strategic flexibility enables firms to compete successfully under such conditions. McGrath, MacMillan, and Venkatraman (1995) showed that firms in dynamic environments seek to continuously renew their competitive advantage through competence-generating strategic processes of comprehension and deftness. Thomas (1996) documented that the ability to take action and adopt swiftly is a primary determinant of superior performance in many industries. In a related vein, scholars who study competition on the Internet have suggested that pervasive interconnectivity and network externalities, conditions that characterize the Internet, also require that firms adopt inherently dynamic strategies, including "product versioning," rapid product development, direct relationships with users, and frequent "partnering" (Shapiro & Varian, 1999).

In order to develop strong strategic flexibility capabilities a TNC need to have the three types of flexibilities: (a) market flexibility, (b) production flexibility, and (c) competitive flexibility (Yip, 1989). This we term as the "Flexibility Triad Model".

Market flexibility deals with TNCs, ability to have a high global market share, ability to sell its major products

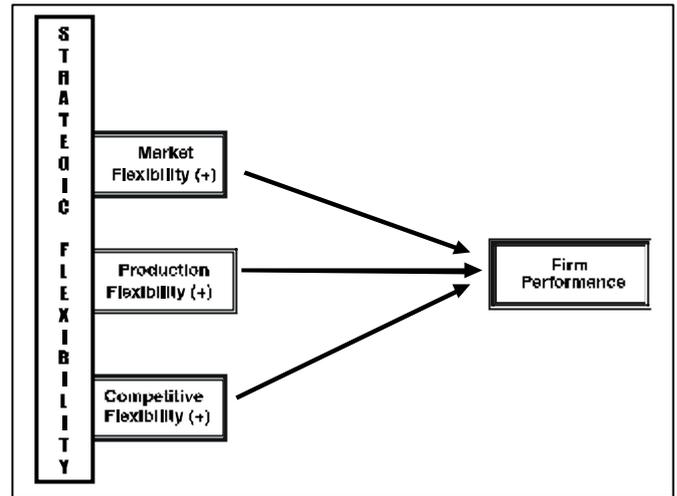


Figure 1: The Flexibility Triad and Firm Performance

in a large number of international and geographic markets, and have a strong presence in those markets that are the home bases of global competitors. For most TNCs, production flexibility arises from spreading its value creation activities in those markets where it has a major market share. A TNC can shift production from one base to another, in order to take advantage of the foreign exchange rate fluctuations and access the best factors of production (Porter, 1990). Similarly, the competitive flexibility of a TNC arises from its ability to coordinate its global competitive

moves. This helps the TNC to have a large number of competitive points and a bigger strategic space to build appropriate offensive

and defensive moves that may often include counter-parry, cross-subsidization and sequential competitive entries.

Market Flexibility

The first component of strategic flexibility is market flexibility. We define market flexibility as the ability of a TNC to recalibrate its marketing efforts in a short period of time (Grewal & Tansuhaj, 2001) in response to changing environmental context. Most TNCs operate in a large number of markets spread over various countries across the world. The more number of markets a TNC operates in, the lower is its dependence on any one or a group of markets. Hence, it can spread the market risk over a large number of markets. Similarly, if it faces stiff competition in one market it can switch its efforts to another market. The ability to cross-subsidize between business operations and country markets also goes up.

The volume of the total sales of the TNC is also important. The larger the market share the greater the market power of the TNC in that given market. This often results in a higher profitability for the TNC. It also gives the TNC ability to withstand a "marketing offensive" from a competitor. If the TNC has a large market share in some of the key markets it can effectively block the entry of new



firms and thereby reduce competitive pressures. Similarly a strong presence in the home market of a major competitor provides it with the ability to hold the competitor firm “hostage” in a cross-parry situation.

Market flexibility also includes the ability to develop and roll out a uniform product in markets with similar demand characteristics. That helps in controlling product development, promotion and other marketing costs. Similarly, global brands are a major source of competitive advantage for most TNCs. Hence, they are developed, nurtured and protected by global corporations. Globally recognized brands increases market acceptability of a product via ready recognition and reduce sales and promotional costs for the product. It also improves corporate visibility and provides the TNC with a great competitive advantages resulting in superior profitability. Hence, it may be hypothesized that:

Hypothesis 1: The greater a TNC's market flexibility, the higher will be the level of firm performance.

Production Flexibility

The second broad area we looked at was production flexibility. We defined production flexibility as the ability of a TNC to manufacture / provide goods or services, in most major markets around the world, with a short lead time at competitive costs. Where to locate manufacturing activities and coordinating them is a critical choice in developing strategic flexibility. According to Yip (1995) most TNCs have four key choices, (a) either to duplicate the activities in multiple locations, (b) setup part of the value chain at various locations that provide the best opportunity and resources to carry out that particular activity, (c) concentration production in one country and sell all over the world, and (d) outsource production in some markets and in-house production in others. Depending on the type of goods or services produced, perhaps the highest level of flexibility it may have is when it can replicate the value chain (either via in-house production or by out sourcing) in the major markets it operates in.

Market flexibility is developed, nurtured and protected by global corporations.

According to Porter's (1990) cluster analysis theory, if the TNC operates in an industry that works as a global oligopoly it may be better off by locating its production close to that of its competitor's. Such close proximity will provide the TNC chance to “keep an eye” on the competitor's activities and share the common resource base. Being located in the same cluster the TNC can swiftly react to its competitor's moves and expand or contract its production base depending on its needs.

A TNC can also create production flexibility by setting up agile manufacturing systems (Upton, 1994) which can produce various products on the same assembly line by relatively low downtimes. A prime example of this type of flexibility is the Toyota Production System that can switch

from producing one particular vehicle model to another in less than hour's time. Also, the TNC can develop a common product or service mix (Yip, 1995) and thereby increase flexibility and reduce cost per unit of production. At present Ford uses a common platform for various models of cars like the Lincoln LS and Jaguar S type though they are produced at different locations and geared to different markets. Sharing of common platforms is a key trend in the automobile industry and other assembly based industries. Common platforms also help TNCs to “Mass Customize” its products where the products share “a common core and have a customized periphery” (Yip, 1995). Such sharing reduces production cost, shortens development time, increases customer satisfaction and provides greater flexibility to the TNC. Hence, it may be hypothesized that:

Hypothesis 2: The greater a TNC's production flexibility, the higher will be the level of firm's performance

Competitive Flexibility

Competitive flexibility provides a TNC with the capability to compete in a global market that has high competitive intensity, and demand / technological uncertainty. Competitive intensity is the degree of competition a TNC faces, that requires firms to take a flexible approach so that they can adapt and improvise to the changing conditions to put their best foot forward (Moorman and Miner, 1998).

In highly competitive environments, strategic flexibility becomes a valuable asset (Aaker and Mascarenhas 1984). Often a technological shift or a strategic move by a competitor in a particular market has the potential to change the very basis of competition. Firms that have the flexibility to respond to new competitive behaviors are at a definite advantage; they can easily redeploy critical resources and use the diversity of strategic options available to them to compete effectively.

Similarly, demand uncertainty creates difficulty in assimilating information and devising strategic plans. Managing in uncertain environments requires concerted deployment of resources devoted to the product-market operations and response to demand idiosyncrasies. Competitive flexibility, by definition, emphasizes answering to the unique needs of consumers, business partners, and institutional constituents (Allen and Pantzalis, 1996). Because firms are more likely to face challenging and unique situations in uncertain markets than in stable markets, competitive flexibility becomes a key asset to a TNC at times of demand uncertainty.

Change in technology stemming from product and process innovations contributes to technological uncertainty. Strategic flexibility involves capability building to respond quickly to changing market conditions. Such capability building usually involves investing in diverse resources and possessing a wide array of strategic options (Bowman and Hurry 1993). Because technologically uncertain markets are



likely to offer a greater number and range of threats and opportunities for firms to adapt and improvise, we expect competitive flexibility to be of crucial importance in an environment that is characterized by high levels of technological uncertainty. Hence we hypothesize that:

Hypothesis 3: The greater a TNC's competitive flexibility, the higher will be the level of firm's performance.

Methods

Dependent and Independent Variables

This study follows the Global Competitive Strategy Model developed by Yip (1989), and uses flexibility measures identified by Yip (1995). We define three independent flexibility measurement variables – market flexibility, production flexibility and competitive flexibility. Each of these is a composite variable calculated as the average of four measures of flexibility. They are as follow:

Market Flexibility

- *Global Market Share (M1):* Business's Global Volume divided by the total volume of the worldwide market.
- *Global Share Balance (M2):* Index of the worldwide business's geographic split of revenues compared with that of the worldwide market.
- *Global Market Presence (M3):* Number of countries in which the worldwide business sells.
- *Marketing Element Uniformity (M4):* Share of the business's worldwide revenues accounted for by the countries that have a uniform approach.

The three measures of profitability, ROA, ROS and Earnings Before Interests and Taxes Margin are positively related with flexibility.

Production Flexibility

- *Mix Standardization (P1):* Percentage of worldwide revenues in a common product or service mix.
- *Content Standardization (P2):* Percentage of cost of product or service that is in components that are standardized.
- *Concentration of Individual Activity (P3):* Share of global spending on activity in the country with most of that activity.
- *Concentration of Entire Value Chain (P4):* Weighted average of the concentration indices of individual value activities.

Competitive Flexibility

- *Global Coverage (C1):* Share of global volume accounted for by the countries in which the worldwide business sells.
- *Global Strategic Market Share (C2):* Business's volume in globally strategic country-markets only divided by the total volume in those markets.
- *Multi-country Competitive Moves (C3):* Moves that involve three or more country markets.
- *Counter-parry Moves (C4):* Response to a competitive attack in one country with a move in a different country.

Each of the measures was converted to a five point scale and the mean for each of the independent variables were calculated based on the following formulae:

Market flexibility (MAKT) = (M1 + M2 + M3 + M4) / 4

Production Flexibility (PROD) = (P1 + P2 + P3 + P4) / 4

Competitive Flexibility (COMP) = (C1 + C2 + C3 + C4) / 4

The dependent variables for this analysis are indicators of firm's performance measured by Return on Assets (ROA), Return on Sales (ROS), and Earnings Before Interest and Tax Margin (EBITM). These variables are widely accepted measures of firm performance and have been used extensively in the strategy and international business literature (Contractor, Kundu and Hsu, 2003).

Data Collection

We developed a questionnaire to elicit responses measuring the hypothesized relationships and mailed it to all the companies on the 1999 Fortune 500 list. Initial mailing was followed up with two more mailings at two weeks intervals and a phone call after one week of the last mailing. This resulted in a total of 227 returned questionnaires, a response rate of 45.4%. Financial data items for the responding firms were extracted from the Standard and Poors' Research Insight database (Tables 1 and 2)

Table 1 : Descriptive Statistics

Label	N	Mean	SD	t Value	Pr > t
PROD	226	2.6515487	1.1513219	34.62	<.0001
MAKT	226	3.1980088	1.3301238	36.14	<.0001
COMP	226	3.8528761	1.0283117	56.33	<.0001
ROS	220	34.1429104	20.591495	24.59	<.0001
EBITM	217	13.580229	13.6743191	14.63	<.0001
ROA	225	5.9741966	6.8321381	13.12	<.0001
Beta	208	0.8863654	0.5314022	24.06	<.0001

Table 2 : Simple Statistics for the Independent Variables

Variable	N	Mean	SD	Sum	Minimum	Maximum
COMP	226	3.85288	1.02831	870.75000	1.25000	5.00000
MAKT	226	3.19801	1.33012	722.75000	1.00000	5.00000
PROD	226	2.65155	1.15132	599.25000	1.00000	5.00000

In general, these firms were found to be profitable (positive ROA, ROI, and ROE) be a little bit less risky than the market portfolio (mean beta 0.88). The sample firms had positive profit margins measured as Return on Sales (ROS) and EBIT margins.



Discussion and Results

All three measures of flexibility are significantly positively correlated with each other. The correlation between market and production flexibility is very high. A possible reason for this being that most firms establish a production facility in the host country only after they have established a market for their products in that country (Johanson & Vahlne, 1977), hence the two variables correlate with each other. The possible reason may be a construct validity issue. The measures used in developing these two variables are similar in nature hence they are highly correlated. We did not want to change the measures, as they were part of the model developed by Yip (1995).

The three measures of profitability, Return on Assets (ROA), Return on Sales (ROS), and the Earnings before Interest and Taxes Margin (EBITM) are significantly positively related with the measures of flexibility. EBITM relationship with market and production flexibility measures is positive but not significant.

We also found that the Firm Beta, the measure of relative riskiness is significantly correlated with the measures of flexibility. Interestingly while higher levels of competitive flexibility appear to be related with lower beta firms, the opposite is true for the measures of market and production flexibility. Higher beta firms tend to exhibit higher levels of market and production flexibility. It appears that as the competitive flexibility goes up the TNC develops its ability to shift production to the most favored location in a relatively short period. Also, it develops capability of engaging the competitors in multiple markets at the same time. This reduces the competitive risk in any one given market.

We explore causal relationships between the measures of firm performance and the measures of flexibility. In view of the strong correlation between the measures of production and market flexibility, we expected their confounding effects to affect the predictive ability of the variables. Therefore, we estimate three regression models for each independent performance variable. Initially we estimate a regression model of full rank, including the three flexibility variables and their interactions and follow up this analysis by two reduced rank models in each case, omitting the market flexibility and production flexibility variables in turn. The results of the reduced rank models allow us to observe the effect of each of these variables in absence of the confounding effects of the alternate variable. (see Appendix I and II)

Return on Assets (ROA) is often used to measure the efficiency of operations (Contractor, Kundu and Hsu, 2003). In this study the full rank model regression is significant with an F statistic of 5.19 ($Pr > F < 0.0001$), and an R square of 0.1256. Significant coefficients are observed for COMP

and MAKT variables, but in presence of MAKT, PROD does not exhibit additional explanatory power. The reduced rank model excluding PROD has a comparable R square of 0.1253 and an F statistic of 10.50 ($Pr > F < 0.0001$), with significant coefficients for both COMP and MAKT. The reduced rank model excluding MAKT has a lower R square of 0.0967 and an F statistic of 7.85 ($Pr > F < 0.0001$), with significant coefficients for both COMP and PROD. These results suggest that each of these measures of flexibility is important in analyzing the variation in return on assets.

Similarly, ROS is often used as a measure of the firm's profitability (Contractor, Kundu and Hsu, 2003). In this study, the full rank model regression is significant with an F statistic of 6.45 ($Pr > F < 0.0001$), and an R square of 0.1543. A Significant coefficient is observed only for MAKT variable, and in presence of MAKT, COMP and PROD do not exhibit additional explanatory power. The reduced rank model excluding PROD has a comparable R square of 0.1481 and an F statistic of 12.46 ($Pr > F < 0.0001$), with significant coefficients only for COMP. The reduced rank model excluding MAKT has a lower R square of 0.0946 and an F statistic of 7.49 ($Pr > F < 0.0001$), with significant coefficients for PROD, but once again COMP is insignificant. Thus, market and production flexibilities appear to be important in determining market power and the ability of the firm to generate higher margins.

Competitive flexibility reduce the variability of returns, and increase in market and production flexibilities increase this volatility.

EBITM is a measure of the firm's efficiency of operations before making any adjustments for leverage and tax rates. The findings are interesting in that only COMP is significant in explaining the levels of EBITM. The full rank model regression is significant with an F statistic of 5.47 ($Pr > F < 0.0001$), and an R square of 0.1357

A significant coefficient is observed only for COMP variable, and MAKT, and PROD do not exhibit additional explanatory power. The reduced rank model excluding PROD has a comparable R square of 0.1270 and an F statistic of 10.28 ($Pr > F < 0.0001$), with significant coefficients only for COMP. The reduced rank model excluding MAKT has a comparable R square of 0.1242 and an F statistic of 10.03 ($Pr > F < 0.0001$), and once again only COMP is significant. These results confirm the primary role of competitive flexibility in higher efficiency of operations.

Interesting, and somewhat unexpected results are found regarding the relative volatility of returns of the firm, measured as the market beta of the firm, and the flexibility variables. It appears that while competitive flexibility seems to reduce the variability of returns, and increase in market and production flexibilities appears to increase this volatility. The full rank model regression is significant with an F statistic of 3.30 ($Pr > F < 0.0041$) and an R square of 0.0901. Significant coefficients are observed for COMP and MAKT variables, and in presence of MAKT, PROD does not



exhibit additional explanatory power. The reduced rank model excluding PROD has a comparable R square of 0.0796 and an F statistic of 5.85 ($\text{Pr}>F<0.0007$), with a significant negative coefficient for COMP, and a significant positive coefficient for MAKT. The reduced rank model excluding MAKT has a still lower R square of 0.0579 and an F statistic of 4.16 ($\text{Pr}>F<0.0069$), with significant negative coefficient for COMP, and a significant positive coefficient for PROD.

A potential drawback of this study is that we did not control for the size of the firm. As all the responding firms belong to the Fortune 500 list of 1999 and had extensive global operations, all of them were presumed to be very large companies.

Implications for Managers

The findings of this study have several implications for the managers. The most important implication is "flexibility matters". An improvement in the market, production, or competitive flexibility increases the TNCs' overall competitive agility. The increased flexibility in turn increases its ability to respond to a changing environment and has a strong positive impact on its profitability. A second implication is that managers need to increase their firm's competitive flexibility as it reduces the TNCs' vulnerability to fluctuations in global market conditions. A third key implication is that the TNCs need to improve all three types of flexibility and develop a balance between them. Increasing market and production flexibility helps to generate higher margins by optimizing production and distribution costs but competitive flexibility has to be increased in order to reduce the overall level of risk faced by the TNC and to improve its ability to respond to the volatility of the external environment.

Issues for Further Research

In this study we have presented the framework of "Triad Model of Flexibility" which we feel is a major contribution to this literature. However, there are a number of outstanding areas and gaps that must be filled. Though the body of literature is growing the impact of the various flexibility definitions and classifications on design, implementation, justification and evaluation models needs to be further investigated. There is a need for more empirical investigation of real world practices with respect to the various flexibility categories discussed above. We also need to remember that the flexibility theory is still in its infancy. Development and evaluation of flexibility classifications and testable hypotheses will require ontological developments to help structure the theory (Narain et al, 2000).

Conclusion

The first step in creating the flexible TNC is to identify clearly what forms of flexibility can be important in its

competitive environment. As we have seen strategic flexibility is a multidimensional concept and depends on the capabilities of managers of an organization and the "controllability or changeability" of the organization. Hence, a key issue is the capacity of an organization to change while maintaining adequate control of its processes of product creation and realization. Strategic flexibility therefore represents an orderly response capability in a changing world.

To achieve strategic flexibility, a TNC must work to enhance flexible capabilities and should not focus exclusively on developing specialized routines that work well in one competitive situation, but that may not be appropriate in a changed competitive context. Flexible capabilities enable a TNC to anticipate changes in competitive requirements, draw on a broad base of knowledge, absorb new knowledge and ways of doing things, allow managerial experimentation, expand managerial mindsets, and support higher-order learning processes like "double-loop" learning (Argyris & Schon, 1978). To achieve flexible capabilities, managers must learn to manage vertically, horizontally, and ideologically. The greatest challenge to managers who want to create flexible firms is to create the "right" amount and kind of flexibility that a firm needs in its competitive environment - a task that

The greatest challenge to managers is to create right amount and kind of flexibility that a firm needs in competitive environment.

Volberda characterizes as resolving the paradox of forces for change and forces for preservation within organizations, while responding effectively to the dynamism, complexity, and unpredictability of the organization's environment (Sanchez, 2002).

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Appendix I : Pearson Correlation Coefficients

Prob > |r| under H0: Rho=0

Number of Observations

	COMP	MAKT	PROD	ROA	ROS	EBITM
COMP	1.00000	0.18589	0.23430	0.25932	0.11139	0.33366
		0.0051	0.0004	<.0001	0.0994	<.0001
	226	226	226	225	220	217
MAKT	0.18589	1.00000	0.70315	0.28686	0.36830	0.07202
	0.0051		<.0001	<.0001	<.0001	0.2909
	226	226	226	225	220	217
PROD	0.23430	0.70315	1.00000	0.22549	0.27936	0.10827
	0.0004	<.0001		0.0007	<.0001	0.1117
	226	226	226	225	220	217
ROA	0.25932	0.28686	0.22549	1.00000	0.38857	0.27055
	<.0001	<.0001	0.0007		<.0001	<.0001
	225	225	225	225	220	217
ROS	0.11139	0.36830	0.27936	0.38857	1.00000	0.65632
	0.0994	<.0001	<.0001	<.0001		<.0001
	220	220	220	220	220	217
EBITM	0.33366	0.07202	0.10827	0.27055	0.65632	1.00000
	<.0001	0.2909	0.1117	<.0001	<.0001	
	217	217	217	217	217	217

Appendix II :

Dependent Variable = Return on Assets (ROA)

Variable	Model 1	Model 2	Model 3
Intercept	-1.41	-1.42	-0.9
COMP (Competitive Flexibility)	3.23***	3.30***	3.35***
PROD (Production Flexibility)	0.04		2.58
MAKT (Market Flexibility)	2.68***	3.78***	
INTCM (Interaction of Competitive & Market Flexibility)	-0.15	-0.73	
INTCP (Interaction of Competitive and Production Flexibility)	-0.16		-0.82
INTMP (Interaction of Market and Production Flexibility)	-0.09		
Adjusted R Square	10.14%	11.34%	8.44%
F-Value	5.19***	10.50***	7.85***
Number of Observations	223	223	223

Variable	Model 1	Model 2	Model 3
Dependent Variable = Return on Sales (ROS)			
Intercept	1.44	1.47	2.3
COMP (Competitive Flexibility)	0.38	0.58	0.53
PROD (Production Flexibility)	0.38		4.10***
MAKT (Market Flexibility)	3.83***	5.65***	
INTCM (Interaction of Competitive & Market Flexibility)	-0.04	1.88	
INTCP (Interaction of Competitive and Production Flexibility)	0.78		1.97
INTMP (Interaction of Market and Production Flexibility)	0.41		
Adjusted R Square	13.04%	13.62%	8.20%
F-Value	6.45***	12.46***	7.49***
Number of Observations	218	218	218
Dependent Variable = Earnings Before Interest and Taxes Margin (EBITM)			
Intercept	-1.67*	-1.76*	-1.78**
COMP (Competitive Flexibility)	4.94***	5.09***	4.8***
PROD (Production Flexibility)	0.62		0.63
MAKT (Market Flexibility)	-0.32	0.21	
INTCM (Interaction of Competitive & Market Flexibility)	0.44	1.72**	
INTCP (Interaction of Competitive and Production Flexibility)	-0.53		1.72**
INTMP (Interaction of Market and Production Flexibility)	1.29		
Adjusted R Square	11.09%	11.47%	11.18
F-Value	5.47***	10.03***	10.03***
Number of Observations	215	215	215
Dependent Variable = Beta			
Intercept	5.75***	6.0***	6.8***
COMP (Competitive Flexibility)	-2.9***	-2.97***	-2.85***
PROD (Production Flexibility)	-0.01		2.35**
MAKT (Market Flexibility)	2.33**	3.29***	
INTCM (Interaction of Competitive & Market Flexibility)	0.67	-0.4	
INTCP (Interaction of Competitive and Production Flexibility)	0.4		-0.65
INTMP (Interaction of Market and Production Flexibility)	-1.45		
Adjusted R Square	6.20%	6.60%	4.40%
F-Value	3.30***	5.85***	4.16***
Number of Observations	206	206	206

Reflecting Applicability in Real Life

1. Show how strategic flexibility in your organization effects the firm's performance.
2. See whether in your organization flexibility actually matters.



Evolving Strategic Framework for IT Services in Japan

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Abstract

When it comes to Information Technology Services Industry (ITSI), which includes such components as System Integration, Software Development, Package Software business, Outsourcing, and various computer servicing segments, Japan has the second most active market in the world, after the US. Though the size is big, ITSI is mostly domestic oriented. Except perhaps the game software and I-Mode, no Japanese software is known outside Japan. While Japan envisions being the "world's most advanced IT nation" by year 2006, the country offers great opportunities for companies with sound strategies to tackle the characteristic features of the market. This report provides an analysis of the Japanese ITSI market by identifying its peculiar characteristics, major players, and the market needs. The characteristics, such as the low SH-Ratio (the ratio "Software Spending / Hardware Spending") identify the need for a special type of software, what the author define as "System-Adoptable-Software" for the Japanese market. By considering the dynamics of the market needs, the report provides a framework to identify the future directions of the competitors, including the Indian software companies, who are vying for a share of the big Japanese market.

Keywords : information technology, Japan

Introduction

The Information Technology Services Industry (ITSI) in Japan, which includes such components as System Integration, Software Development, Package Software business, Outsourcing, and various computer servicing segments, is about 14 trillion (roughly 115 US dollars) a year business at present, second only to the United States. Among Japan's well known ITSI products are the software related to mobile technology, such as I-Mode, and game software mounted on machines made by such companies as Sony and Nintendo. When it comes to ITSI on a global scale, however, Japan does not have any products to compete against widely used packages on the scale of Windows, Excel, or Oracle coming out, particularly, from the US.

Though the average GDP of Japan has been stagnant over the last decade, the ITSI has grown significantly. Just over the 5 year period starting from 1997 till 2002, ITSI has grown over 50 percent, thus making average double digit growth over that period (Figure 1).

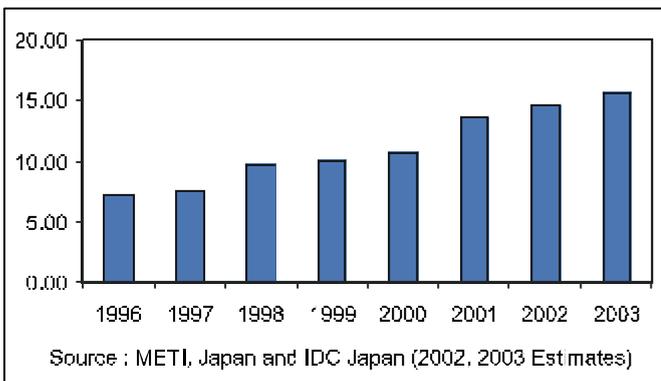


Figure 1 : Total IT Services Revenue (Trillion Yen)

Even the difficult years following the burst of the dot com bubble in year 2000 in the United States, the IT related spending in Japan has seen a positive growth. One way to look at the situation is to compare the revenue of major computer companies in Japan and the United States, Figure 2.

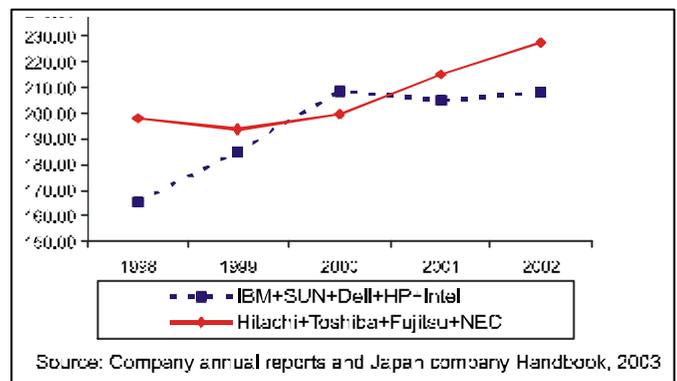


Figure 2: Comparison of US and Japan Computer Companies Revenue (\$ billion)

The chart compares the total revenue of major US computer companies: IBM, Sun, Dell, and Intel against Japanese computer makers: Hitachi, Toshiba, Fujitsu, and NEC. The interesting observation is the trend of the revenue after burst of the dotcom bubble in the US.

The growth situation in ITSI, despite the stagnant economic situation prevailing in most of the other economic sectors in Japan, has created a fierce competitive environment among domestic players in that industry. The domestic competition is being further heightened by the impact on the IT slowdown in the US in which the global IT players have found Japan as one place where they can potentially



try to provide services in order to fill in the revenue decline from the US operations.

The global IT players vying for Japanese market include not only the likes of Microsoft, Oracle, or SAP, but also the emerging software companies from outside Japan; dominant among them being the ones from China, India, Israel, Korea, Russia, and Singapore. Of particular interest on this regard is India, where according to the industry associations (Nikkei Weekly, 2001), the software companies are trying to fill a projected revenue gap created by US slowdown by targeting Japan. All the major Indian software houses now have operations in Japan. China, where software development costs are 30% lower than India, is also of interest as the fierce competition in Japan is driving domestic players to China in order to make software at a lower cost there and bring back to Japan. Because of the similarity of Kanji characters, Chinese programmers can easily adapt to develop Japanese software than their counterparts in other countries, including India.

Japan has the second most active market in the world.

In order to comprehend a strategic framework suitable for Japanese IT services, an understanding about the market dynamics, in terms of spending patterns and available resources, is necessary (see the chart in Figure 3)

From automobiles, to digital video equipment, to cameras, and to all kinds of other electronic gadgets, Japan's manufacturing prowess is well known around the world. Manufacturing is the main economic sector in Japan.

It comes as no surprise when it comes to spending on IT services, manufacturing industry is the leader. Other major areas for ITSI have been Finance, IT Services, Public Sector and Wholesale (Figure 3). Understanding the needs of each one of these industries and the potential areas for deploying IT solutions remains a major challenge for any service provider.

In terms of resources, the people directly employed in the IT services industry in Japan are about 600,000 at present. The majority of the employees, as seen in Figure 4, titled: IT Services Employment, belongs to the Systems Engineer category and Programmer category.

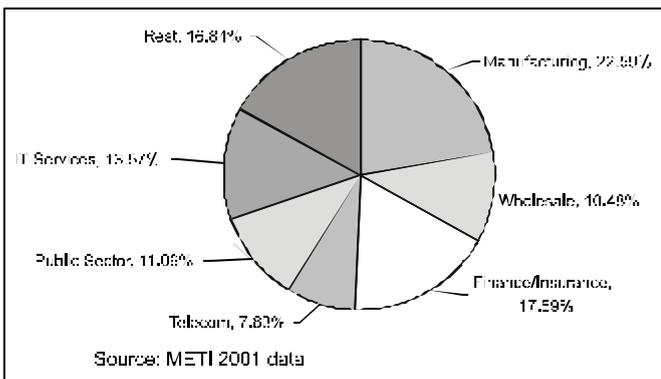


Figure 3: Main Industries using IT Services

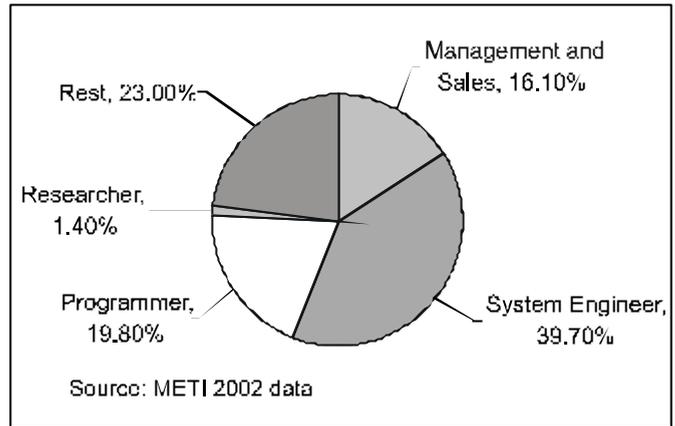


Figure 4: IT Services Employment

With initiatives by the government to increase the spending related to IT, under a project known as e-Japan, it is said that a shortage of 300,000 (Nikkei Weekly, 2001) of ITSI workers exists in the country. The shortage is said to be most critical, particularly, in programmers who know a document processing language known as XML (Nikkei Weekly, 2002) which is to be used in converting thousands, perhaps even millions, of documents to be shown via the Internet.

Taking into account the facts described above, the scenario for ITSI in Japan, then, can be interpreted as an expanding market with many opportunities and many competitors. And the competitors are finding it difficult to compete due to various factors such as lack of domestic labor, lack of experts and the high development costs. While the country is trying to define its position in the global arena as "the world's most advanced IT nation" by year 2006, it is a challenge to explore the strategic opportunities peculiar to the Japanese market (METI Japan).

Competitive Areas

The general situation for the ITSI in Japan, as discussed in the previous section, gives us an idea about the areas of business activity and the potential market segments. However, a closer insight is needed to explore the specific peculiarities of the Japanese market.

It is generally believed that Japan is five years or so behind in the implementations of IT tools compared to the US. When one considers the adaptation of tools such as Enterprise Resource Planning (ERP), Supply Chain Management (SCM), or even plane database applications, Japanese companies seem to lag. It is reported recently that the ERP software, widely used by more than 60% of U.S. and European companies, are used by only about 20% of Japanese firms (Japan Prime Minister's Office, 2001). When the Japanese corporations begin to realize the benefits of these "US-made" inventions, they will, eventually, adopt similar tools. But, often it becomes a problem because the computer systems in the US and Japan are quite different



when it comes to the integration level and are not completely capable of just installing a package and running it. To get to the roots of this issue, it is interesting to see the ratio of Software-to-Hardware, let us call this SH-Ratio, between the two countries, as shown in Figure 5.

I-Mode, for example, Japan has developed the most advanced Mobile Commerce applications in the world and leading the world on the M-Commerce revenue, as seen Figure 7. At present, Japan remains the only country with a viable M-Commerce market.

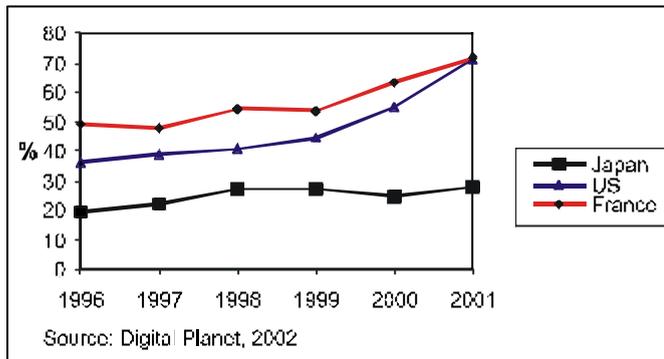


Figure 5 : Ratio of Software-to-Hardware Expenses

It must be noted in this diagram that the software counted in this comparison includes only the ready-made software and does not include the spending on custom-made software. In reality though, most of the ITSI spending in Japan, close to 50% of the total, goes to custom-made software (Figure 6).

Just over the 5 year period starting from 1997 till 2002, ITSI has grown over 50 percent.

In both the cases, the software has been closely aligned with the hardware. All the software needed for mobile application is right in the mobile handset and the applications not in the handset can be downloaded, thanks to the features, like Java capability, already built into the machine. For Game software too, the integration of software with hardware is very strong.

A closer look at the I-Mode and Game software reveals that both do not require any systems integration. Extending this concept little further, we can see that what the Japanese market need is a new kind of software, which we call, System-Adaptable-Software or SAS. If a software package possesses SAS capability, it can be adapted to the Japanese computer environment rather easily requiring minimum or no system integration expertise. When one considers the continuous low value of SH-Ratio in Japan, SAS type software would have much appeal in terms of cost savings. I-Mode and Game software belong to SAS type and they have become successful in the Japanese market.

The analysis here leads to three key features for the available opportunities in the Japanese market:

- Software Customization (SC)
- Systems Integration (SI)
- System Adaptable Software (SAS)

The contract software development is part of Software Customization.

In order to compete in the market, various business models have been developed by the competing companies. The next section explores some of the key business models.

Competitive Models

The major competitors in the Japanese ITSI market can be basically categorized into the following:

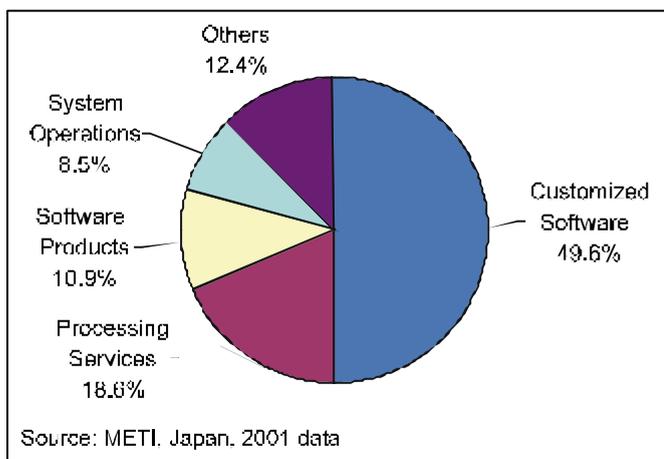


Figure 6: Spending Types

The diverse computer systems installed in Japanese companies and government organizations makes it a task to adopt a package to run on a system comprised of a network of computer systems. Hence, the usage of packaged software, developed in a foreign country, such as US, is slow to be adopted by the users, without the intermediation by the system integrators. Moreover, the involvement of system integrators adds up the costs thus raising the implementation expenses of IT services.

How about the software originated in Japan itself? The software like I-Mode and Game Software they are widely used in Japan and have spread to the world. In fact, Japan is world leader in this type of software. In the case of



- Large Hardware Oriented Companies (e.g. Fujitsu, IBM Japan)
- Large Software Companies (e.g. Microsoft, Oracle, SAP)
- Small-to-Medium Size Domestic System Integrators (e.g. NTT Data, NS Solutions, plus consulting companies like Deloitte Tohmatsu)
- Indian Software Companies (e.g. Infosys, WIPRO)
- Chinese Software Companies (Neusoft, Sun Japan Corp)
- Korean Software Companies (e.g. Ahnlab, SecureSoft)

Even the difficult years following the burst of the dot com bubble in year 2000 in the United States, the IT related spending in Japan has seen positive growth.

It is interesting to see the features of the general competitive models for the players in each one of those categories.

The comparison reveals us that the real competition in Japanese market is mostly between the large hardware, large software companies, and small to mid-size system integration companies. Majority of foreign companies, except a small group of Korean companies, are competing basically for the contract market.

The competition among the top three players in Table 1 is driving them to form various kinds of alliances with the companies in India and China, and in some cases to even places like Russia and Vietnam. Among the contract service providers, India is the technologically most sophisticated. It is true that Indian software companies have good experience in the US. But, the market needs of Japan's major ITSI players are different. As noted in our analysis, the software itself is not enough to get to the end user. The end user needs the system integration part first, and then the software integration. A paper by Momaya and Tunikipati (2001), addresses further difficulties faced by Indian software companies competing in the Japanese market.

As for China, the contract market may look better. For one the software development wages in China are about 30% cheaper than in India. Secondly, China's proximity to Japan and language favors over India.

The Korean software companies mostly compete on the strengths of their domestic market. Particularly, in the Internet related applications, Korea is quite advanced. In fact Korea's broadband technology and online game usages are considered quite high compared to Japan. Though the Korean's market share in the overall ITSI in Japan is small, their strategy seems quite viable.

The competitive situation of the major players is further explored in the next section.

Competitive Framework

Our analysis in Section 2 led us to three major areas for ITSI applications: Software Customization (SC), Systems Integration (SI), and System Adaptable Software (SAS).



We also noticed that in Japan the SH-Ratio is quite low compared to the US. In general, when a country is in the initial stages of computerization, the SH-Ratio is low, like the case in China where SH-Ratio is 8.9%, according to 2001 data (WITSA, 2002). Though Japan is quite advanced in terms of computerization, its low SH-Ratio of 27.6% is quite puzzling, especially compared to US, where the ratio was 71%, according to 2001 statistics (Japan Prime, Minister's Office, 2001) As noted earlier, the major reason is Japan's diverse use of computer systems and the need for major system integration. This characteristic feature of Japan's

IT landscape is not going to disappear soon because there is no reason to believe that the major hardware companies like Fujitsu, NEC, IBM- Japan, and Toshiba will form an alliance. So, the need for systems integration would remain for some time.

However, if there is a change in the ITSI competitive environment towards SAS type software, the software would make it easier to be adopted by the majority of Japanese computer environments, regardless of the system integration needs. One indication to this effect is the recent agreement between two rivals Sony and Matsushita to develop a modified version of the Linux operating system for digital consumer appliances.

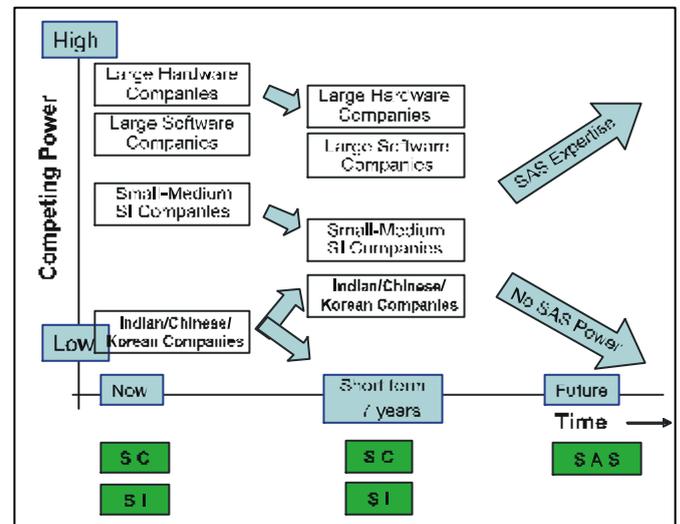


Figure 8 : Evolvement of the Competing Power of ITSI Players

Figure 8 explains the ITSI environment on a time scale. It shows the present situation where the ITSI market is mostly driven by Software Customization (SC) and System Integration (SI) needs. The SC market, which includes contract work currently done by companies in India and China, could continue for a while. But the fierce competition in the market would drive the already low profit margins further down. Looking at the Figure 8, a key strategy for the foreign companies to expand the contract work revenue is to form alliances with the major players the players in the top three categories in Table 1.



Table 1: Japanese Market : Competitors' Business Models Comparison

Player	Business Model	Advantage	Future Direction	Profit Margins
Large hardware company	Sell hardware and provide SI services	Captive market; Large market size	Provide SI consulting services; alliances with overseas software companies	High
Large software company	Sell software; customization	Good brand name; Large market size	Provide SI consulting	High
Small-Medium SI company	Recommend hardware, provide little cheaper SI	Low cost; Large market size; can use established relationships	Alliances; streamlining of operations	Medium to Low
Indian software company	Contract work	Low cost; US experience	Contract work, alliance with domestic company	Low
Chinese software company	Contract work	Low cost; Kanji capability	Contract work, alliance with domestic company	Low
Korean software companies	Compete in specialized areas (security, game)	Low cost; technical capability	Complement South Korean hardware technology	High

The SI market will also slowdown due to the consolidation of companies due to the reforms currently happening. The trend is already seen in the financial sector where most of the consolidation had occurred recently. But, if Japan needs to develop a competitive ITSI industry, the players must move to System Adaptable Software (SAS) development.

In order to develop SAS type software, considerable effort must be on research and development, requiring good R&D human resources, which at present, according to the chart in Figure 4, is less than 2% of the available pool and certainly not enough. It was recently reported that Mr. Masamoto Yashiro, President of Shinsei Bank, one of the most successful banks among the troubled banking sector in Japan, described the development of Shinsei's highly regarded computer system using software talent from India: "A vast range of approaches are required to meet

diversifying needs. We could not find such free-thinking engineers in Japan" (The Nihon Keizai Shimbun, 2002). In fact, Shinsei supposed to have a large contingent of Indian programmers working on its IT development team. So, the software companies in India and China have great potential, if they could provide the much needed R&D capability to develop SAS type software.

Conclusion

Second only to US, in terms of revenue, Japan's IT Services market is still in an expansion mode. The IT slowdown in the US has made the competition in Japanese market much more severe as many global competitors, including the Indian software companies, have focused their attention to Japan.

While the country offers many opportunities, how to approach and what kind of direction holds the future are the key factors when one considers strategies suitable for the somewhat peculiar Japanese IT environment. The market analysis done in this report finds the characteristics somewhat unique to the Japanese market, such as the low value of SH-Ratio. After analyzing the market dynamics and identifying the major market segments, this report provides the framework for understanding the appropriate strategies for major players, including the Indian and Chinese software makers.

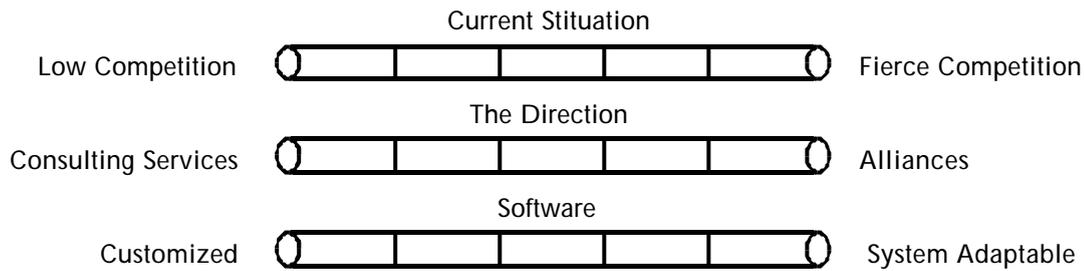
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Flexibility Mapping : Practitioner's Perspective

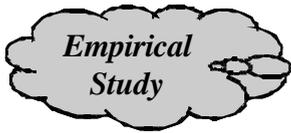
1. What types of flexibilities you see in the practical situation of "Strategic Framework" on the following points:
 - Flexibility in terms of "options"
 - Flexibility in terms of "change mechanisms"
 - Flexibility in terms of "freedom of choice" to participating actors.
2. Identify and describe the types of flexibilities in "Strategic Framework" that are relevant for your own organizational context? On which dimensions, flexibility should be enhanced?
3. Try to map your own organization on following continua (Please tick mark in the appropriate box(es))



4. Develop a SAP-LAP (Situation Actor Process-Learning Action Performance) model of "Starategic Framework" relevant to your organization.

Reflecting Applicability in Real Life

1. How does an Indian software company fit with Japan's needs?
2. What makes Japan's IT needs different from other countries?



Impact of Online Consumer Characteristics on Web-Based Banner Advertising Effectiveness

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Abstract

Web is considered to be different from most traditional mediums because it has multimedia characteristics. Businesses see the Web as an opportunity to channel their advertising. Advertising effectiveness is important to the marketers to know if their advertisements have reached their target audience effectively. This research focuses on the impact of online consumer characteristics on banner ad effectiveness. The characteristic variables included in this study are: online consumer's internal flexibility, consumer expectations, consumer involvement, and perceived personal usefulness. A survey of 158 online consumers was then conducted to gather study data. The study results validate the relationship between online consumer characteristics on banner ad effectiveness. However, the study data does not support the impact of focus and planning approach for online shopping on ad effectiveness.

Keywords : banner ad effectiveness, consumer expectations, consumer involvement, online consumer's internal flexibility, perceived personal usefulness

Introduction

World Wide Web, also known as "the Web" is considered to be different from most traditional mediums because it has multimedia characteristics. The Web can be defined as 'user-friendly graphics-capable component of the Internet' (Pugsley and Trites, 2003) and as a cross between an electronic trade show and a community flea market (Berthan et al. 1996). Web is flexible, open, informal, interactive, and converts visitors into customers. The Web has been used to disperse information to many consumers and more and more businesses are trying to incorporate the Web to their operations (Alba et al. 1997). Businesses have realized the potential benefits of the Web in direct sales, building brand awareness and providing market information for consumers. Businesses see the Web as an opportunity to channel their advertising, marketing and distribution of some of their products (Verity and Hof, 1994). In Web-based channels, the businesses can cut advertising cost by one quarter of any conventional channels, such as television, radio and magazines.

In order to reach the targeted consumers, organizations need a flexible medium. The Web would be a more viable channel for today's changing, expanding and global organizations. The marketplace is changing and it has been shifting towards on-line shopping, and virtual market businesses. Due to the change in trend of the environment, the on-line businesses have to focus more on web-based advertisements. The marketers like to draw the online-consumer's attention among thousands of other products or

brands. By the end of 2003, Internet advertising spending in the United States alone could grow to more than 13 billion (Internet Advertising Bureau 1999; Krishnamurthy 2000).

The Web is flexible in that it can present information in numerous ways including text, images, video, and sound. The multimedia aspect could make the experience more fun and stimulating, thus holding the attention of the consumer longer (Ghose and Dou 1998). The Web has been able to reach more people. In the Web channel, any online consumer can view the ad any time (24-7), and at any location. The Web is widely recognized and accessible in most parts of the world. The Web can support information in different languages and currencies. Consumers have control of exposure to advertisements on when and where they would like to see them (Gallagher et al., 2001). The consumers can close out advertisements they do not want to see or go back to the advertisements they are interested in. This will give consumers numerous opportunities to view the advertisement. It has been said that after a number of exposures to advertisements, the consumer will retain the information more (Vakratas and Ambler 1999). So, Web-based advertisements let the consumers have control over what advertisements are to be viewed and for how long. Also, consumers can arrange advertisements to their liking and to their preferred scheduling.

Web-based Banner Ad Effectiveness

Advertising effectiveness is a large part of any marketing campaign the marketers need to know if their advertisements have affected their target audience. If the campaign can



actually reach the targeted audience then the benefits would be immense. As advertising effectiveness is a primary concern for most business, trying to explain consumer characteristics in relation with ad effectiveness would be beneficial. Online advertising industry and its clients become increasingly concerned about the effectiveness of banner ads (Cross, 1999). Many businesses spend millions of dollars to target their market audience but the impact of their efforts is to be known to the management to assess their strategies.

This research focuses on the impact of online consumer characteristics on banner ad effectiveness. Banner ads are commonly placed on high-traffic websites (Dou et al., 2001) and transfer the viewer directly to the company's website for further information (English and Pearce, 1999). Banner ads appear when viewing web pages, usually placed at the top or along the sides of the Web page (Edwards et al. 2002) or a search engine's page (Sipe, 2003). Normally, the banner advertising flashes across the screen, presumably while the viewer is engaged in reading the page content (Nordhielm, 2002). Since they are generally displayed on the periphery, they do not interrupt the main activity of Web viewers. The viewer do not need to do anything to avoid the banner ads. If viewer is interested in the ad, he or she can click on the ad to obtain more information. If not, the viewer can simply ignore the ad without doing anything extra. Thereby, web surfers control their experience on the basis of their preferences (Liu and Shrum, 2002).

Why Banner Ads?

Banner ads are used as a major online advertising tool (Internet Advertising Bureau, 2000) and represent a significant portion of search engine revenues (Katz, 2000). Banner ads are the most suitable format to use because most Web users would have encountered some banner ads in their day-to-day usage. Banner ads are chosen because viewers cannot close out the ads like pop-up ads. The banner ads are embedded in the website and so it cannot be closed. Some of the banner ads are able to move with the page when it is scrolled. This might be more affective to the consumers if the ads are available at all times. Moreover, web advertisers must make decisions about the effectiveness of their banner ads (Bhat et al., 2002).

Online Consumer Characteristics

Online consumer interaction with product information is one of the critical components in B2C e-commerce environment (Bayan, 2001). In designing the banner ad, online consumer characteristics play an important role in such e-commerce environment. The research proposes online consumer characteristics influence banner ad effectiveness. The characteristics were considered in pre-experience, and

experience phases of viewing a banner-ad. Though the consumer had no association with an advertisement, the consumer may have some predictions towards it. So, in pre-experience phase, the consumer's internal flexibility and expectations from the banner ad were considered. In the viewing (experiencing) phase of the advertisement, consumer involvement and perceived personal usefulness were considered.

Literature Review

Banner Advertisement Effectiveness

Basically, advertisements communicate messages and serve two functions: to inform and to persuade (Singh and Dalal, 1999). To inform is to create awareness about the product/service and to persuade is to generate a positive attitude and behavior toward the product/service. The advertising effectiveness would be associated with the post-experience of processing any advertisement and represents the increased value to the customers (Ducoffe, 1996). Advertising effectiveness is usually described as being a 'hierarchy of effects' (Vakratas and Ambler 1999). The 'effect' mentioned is to change the consumer's mind about a product by changing their attitudes and then by acting it out (Hall 2002). The information in the advertisements could change people's perceptions and will eventually change their behavior.

Companies are considering Internet advertising as a viable alternative to traditional media. Reach and frequency are used as the standard measures for online ad effectiveness (Dreze, 1998). 'Reach' is the net unduplicated number of visitors who had an opportunity to see a banner ad one or more times and 'frequency' is the number of times the visitor had an opportunity to see a banner ad. Other Web-specific measures are click-through rates (number of clicks on a banner ad), advertising transfers (number of downloads of advertising messages) (Briggs and Hollis, 1997), visit duration, conversion rate (visit to purchase), number of transactions (Dreze and Zufryden, 1998), number of visitor sessions, average length of sessions (Keiser, 2002), sales figures, recognition, recall and rating scales (Li and Bukovac, 1999). Sales figures can be categorized into two levels: aggregate and individual. The aggregate level encompasses the studies done at the market-level data that might include market share, gross ratings and advertising expense (Vakratas and Ambler 1999). Individual level would use individual data in their studies. Examples include number of exposures and their brand choice. Recognition is among one of the most popular methods of measurement. Recognition is when the subject is given an object or image that reflects the advertisement of the brand or product. The subject has to associate the object or image with the right brand or product from memory. The higher the right association of the brand to

The characteristics variables included in this study are: online consumer's internal flexibility, consumer expectations, consumer involvement, and perceived personal usefulness.



image, the more we can assume that the advertisement is effective. Recall is another popular method of measurement. Recall is when the subject is instructed to remember any features of the advertisement or the product. This is presumably more reliable because this is done without any stimulus (Wells 2000). Rating scales is the last method of measurement mentioned. The subject will rank the advertisements on categories which include attention value, persuasiveness and memory level.

Consumer's Internal Flexibility

Upton (1994) defines flexibility as “the ability to change or react with little penalty in time, effort, cost or performance”; flexibility is the ability of a system to take different forms (Easton and Rothschild 1988). Flexibility is a multidimensional concept demanding agility and versatility; associated with change, innovation and novelty; coupled with robustness and resilience, implying stability, sustainable advantage and capabilities that may evolve over time (Bahrami 1992). Sushil (1997) defines flexibility as the dynamic interplay of the ends of an ever-expanding spectrum of options. The three key words for systemic flexibility are: options, change, and freedom of choice (Sushil, 2000). To be flexible means to have a number of options available at a decision making point, freedom of choice and the ability to change. Flexibility cannot be generated when the user is always attaching to only one option. In this case there is no freedom of choice and to become more flexible is to offer more options to choose

In order to reach the targeted consumers, organizations need a flexible medium.

from. Therefore, the flexibility of an individual depends on the freedom of choices and number of options available at a given situation. Handy (1994) calls for finding a balance between many alternatives. The 'either/or' concepts need to be replaced by 'and' conjoint (Koshnik, 1996).

The internal flexibility of an actor can be decided by mapping the actor's internal characteristics such as value system, decision-making style, thinking pattern, adaptability nature, and the actor's learning mechanism (Sushil, 2000a). In judging a situation (like banner advt.), the value system has a role in creating a bounded flexibility of the actor (online consumer). For instance, a person's value system might lie anywhere from objective to subjective or explicit to implicit. An online consumer who always uses either subjective or objective thought would be internally rigid. Similarly, different consumers have different decision-making styles, which range from pure rational to pure intuitive, or a combination of rational and intuitive. Thinking patterns of the online consumer are crucial in viewing and experiencing the banner ad. The online consumer has to balance the convergent and divergent thinking. How quickly the online consumer is able to adapt with the banner advertisement is an indicator of his/her internal flexibility. Therefore, the creation/enhancement of flexibility would depend upon the exercise of freedom of choice of the online

consumer to change across the range of options (Sushil, 2000). Online consumer, who is internally flexible, would be the one who carries a range of options at the same time (Sushil, 2001). For example, a flexible consumer is one who is simultaneously subjective and objective (Sushil 2000) in a situation like judging a banner ad. In other words, the real flexible consumer is one who evolves his/her value system and priorities and exercise the freedom of choice judiciously (Sushil, 2001) keeping in view the requirements of viewing and experiencing the banner ad. Based on this discussion, this study derives Hypothesis 1.

Hypothesis 1: Increased internal flexibility of the consumer will significantly increase the banner advertisement effectiveness.

Consumer Expectations

Consumer expectation is the pre-experience in viewing the banner ad, when the decision maker has not actually used or seen the brand or product. Consumer expectations are 'predictions made by consumers concerning what they believe will be the outcome of an exchange' (Oliver 1980). They tend not to have a strong opinion about the item but their opinion could be developed by word of mouth, advertisements and observations. Here the advertiser's job is to frame the perception of the advertisements. There are three main effects that framing can do for the decision maker (Hall 2002). The first one is that it creates an expectation for the brand or product. This causes the consumer to see the ad at certain situations. The second one is that it creates anticipation for the product; the consumer may crave for the product. One good example is food commercials. The commercials leave the consumer hungry and wanting the product. The third effect is that the consumer will try to rationalize the anticipation of the item.

Viewer may have expectations after seeing the banner ad quality and may encouraged to click for further viewing (Li and Bukovac, 1999). Visitors with a profit-motive will expect a high degree of polish in the design than with a non-profit motive (Keiser, 2002). Besides quality, visitors expect reliability, convenience, attractive appearance, and superior technology. Waite and Harrison (2002) give the following dimensions of consumer expectations of bank websites as a source of information: transaction technicalities, decision-making convenience, interactive interrogation, specialty information, search efficiency, physical back-up, and technology thrill. In other words, consumers expect some unique value and experience when they enter the digital environment (Cleary, 1999). Consumer expectations could actually help or hinder the advertisement effectiveness. This discussion provides the basis for Hypothesis 2.

Hypothesis 2: Consumer expectations have a significant influence on the banner advertisement effectiveness.



Consumer's Perceived Personal Usefulness

The motives that consumers gain from seeing advertisement to use the products is normally associated with three concepts: perceived usefulness, ease of use and perceived enjoyment (de Souza Dias 1998). These three concepts were modified in terms of product so it can be associated with a shopping or searching on-line. Perceived usefulness can be defined as the degree to which an individual believes a banner ad would fulfill his/her online shopping requirements. Thus, if a banner ad is relevant, it will automatically attract the consumer's attention (Li and Bukovac, 1999). The visitor may pay less attention to an irrelevant ad. Ease of use is the level of which the individual will think the product can free up their physical and mental efforts. Perceived enjoyment is the activity associated with the product being enjoyable. These are the main factors that consumers will consider in making an opinion on an advertisement and product. Popularity of an ad, ability of an ad to hold visitor's attention, and relevance of the ad message may also influence the consumer's perceived personal usefulness (Bhat et al. 2002).

Consumer Involvement

Once an advertisement is relevant to the consumer then the consumer will pay more attention. Consumer involvement is defined as 'the extent to which a stimulus or task is relevant to the consumer's existing needs and values' (MacInnis and Jaworski, 1989). Many are convinced that consumer involvement influences the outcome of advertisements effectiveness. The more involved a consumer is, the better will be the quality and the amount of responses (Edell and Keller, 1989). Higher the involvement, more the consumer will drill down into the advertising message. These 'drill downs' are aimed towards the explanation on persuasiveness and relevant content (MacInnis and Jaworski, 1989). The highest level of involvement is 'personal connections', where the consumer can relate to the situation in their real life while it adds more emotional ties to the advertisement.

Low involvement is seen as having little motivation to process the messages that advertisements are sending out. Less involved people usually use superficial processing techniques or can be influenced by images (Greenwald and Leavitt 1984). The low involvement restricts the decision maker into the linking of their attitudes to the advertisements. Low involvement may not link the connection of attitude and advertisement in their long term memory. Therefore, the cues could be beneficial but can become disassociated with the advertisements (Boninger et al 1997). The above discussion is leading to hypotheses 3 and 3a.

Hypothesis 3: Increased involvement of the on-line consumer significantly increases the banner advertisement effectiveness.

Web is flexible, open, informal, interactive, and converts visitors into customers.

Hypothesis 3a. Consumer's perceived personal usefulness will moderate the impact of that consumer involvement on banner advertisement effectiveness.

The study, represented by the model in Figure 1, examines the impact of consumer's internal flexibility, consumer expectations, and consumer involvement on the banner ad effectiveness. Also, it examines the moderating effect of perceived personal usefulness on the impact of that consumer involvement on banner ad effectiveness.

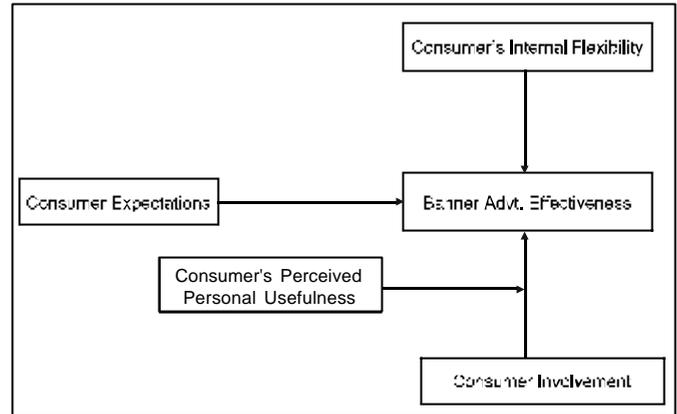


Figure 1: Proposed Research Model

Measures

Banner-ad Effectiveness

The effectiveness of an ad can be measured in numerous forms, such as attitude formation, familiarity, recall and recognition. One of the primary objectives of an advertisement is to form an attitude, preferably a positive one, towards the product or brand name. Attitude can range from positive to negative and if the consumer has a positive attitude towards product or brand name then the ad effectiveness is considered high. Marketers try to evoke a sense of familiarity with the ads to the consumers by getting the consumers to associate themselves with the situation. Having an association with an ad could make the consumers more preferable towards that ad. Recall is one of the most popular methods to measure ad effectiveness. This is also more objective because consumers have to recollect the ad from memory without any stimulus. Recognition is another popular method of measurement but is seen as not as objective. This is because consumers have a stimulus like a jingle to recollect the ad. The measures included in the study are attitude formation, familiarity, recall and recognition. The subjects were asked to relate these items to a general banner ad viewing situation.

Consumer's Internal Flexibility

The definition of flexibility involves three key words: options, changes and freedom of choice (Sushil, 2000). To define and measure flexibility the following indicators were used: the range of "options" created in the process, "number



of change mechanisms” created by continuous renewal and adaptation, and the number of “freedom of choice” domains for the actor. User's internal flexibility construct was measured by the value system practiced, decision making style used, thinking process and problem handling approach (Sushil 2000). The questionnaire items regarding this construct were related with options that are created by the subject. The questionnaire items deal with number of freedom choices for the actor.

Consumer Expectations

The expectations helps interactions to occur between consumers and businesses (Beisel and Clow 1995). They can be in forms of positive, negative or neutral expectations towards the advertisement, product or brand name. Consumers have numerous expectations but the focus will be mainly on price, quality of service, quality of interaction from the provider and the image of the business (Beisel and Clow 1995). These measurements were included in relation to the pre, duration or post phase of the decision making towards an ad. The questionnaire items for this construct were the subject's expectation on price of the product, quality of the service from the business being promoted, quality of interaction by the business being promoted and the overall image of the business being promoted through the advertisement.

Many businesses spend millions of dollars to target their market audience but the impact of their efforts is to be known to the management to assess their strategies.

Consumer Involvement

Involvement can have three antecedents including characteristics of a consumer, the stimulus and the situation (Zaichkowsky 1994). The concept of consumer involvement has some evidence that it effects the outcome of the ad effectiveness. Zaichkowsky proposed a 20-item scale called the Personal Involvement Inventory but had to revise it due to redundancy. She has now broken it down to a 10-item scale called the Revised Personal Involvement Inventory. Only 4 of the 10-item scale were used and they include: importance, interest, relevance and appeal. The subjects were asked to recall a searching or shopping experience with the Internet. Importance is the significance attached to the ad. Interest is the intellectual or emotional involvement with the advertisement, relevance is something related to what someone is seeking, and appeal is a pleasing or enjoyable emotion that is evoked by advertisement.

Consumer's Perceived Personal Usefulness

Perceived usefulness is the degree to which an individual believes that using a particular advertisement could fulfill their shopping needs. The idea that the advertisement should enable a consumer to further their decision is measured. The usefulness of the advertisement may help the consumer to reach a decision. Davis (1989) used a 4-item scale that included productivity and insight as factors to determine

usefulness in decision making. The questionnaire items for this construct were productivity, insight and ability to make further decisions for the decision maker. The subjects were asked to recollect any situation when viewing a banner ad in their shopping or searching experience.

Research Methodology

A questionnaire survey was proposed to collect empirical data about the research variables, and the hypotheses were statistically tested. Respondents were randomly drawn from the population of university senior-students. The responses from inexperienced and novice users of Internet users were removed from the pool of usable responses. Of the 750 potential participants, 158 provided usable responses, giving response rate of 21%. This response rate ratio was accepted against non-response bias for a blind mailing (Belohlav and Fiedler, 1987). Approximately, 58% of the respondents were male and 35% of them were female. Table 1 shows respondent demographics by gender and by age. Table 2 shows the respondent demographics of Web browsing experience and Internet usage hours per day. The individual responses were kept confidential in order to

encourage openness and disclosure; therefore the name of the university is not given. Table 2 shows that

Table 1: Respondent Demographics

Table 1a : Demographics of Gender	
Gender	Frequency
Male	92
Female	56
Missing data	10
Total	158

Table 1b : Demographics of Age	
Age Group	Frequency
19-24 years	68
25-28 years	61
29-35 years	18
36 and above	11
Total	158

approximately 62% of the respondents were having 3-4 years of web browsing experience and 51% of the respondents were using the Internet an average of 2-4 hours per day.

Survey Instrument

This study used the survey research methodology. The instruments for internal flexibility, consumer expectations, consumer involvement, perceived personal usefulness, and banner ad effectiveness were compiled into a single survey instrument. The initial page explained the nature and purpose of the study, guaranteed the confidentiality of user



Table 2 : Respondent Demographics of Browsing and Internet Usage

Table 2a : Demographics of Browsing Experience	
Experience in Years	Frequency
1-2 years	8
3-4 years	98
5-6 years	41
7 years and above	11
Total	158

Table 2b : Demographics of Internet usage per day	
Internet Usage Per Day	Frequency
Less than 2 hours	47
Between 2-4 hours	80
Between 4-6 hours	16
More than 6 hours	15
Total	158

responses, and contact information was provided, if the respondent had any questions. General instructions were given at the top of the instrument and specific instructions at the beginning of each section. The demographic information about the respondents and their organizations were collected by questions at the end of the instrument. A sample banner ad was given so that the respondent was visually clear before responding to the questions.

Administration of the Survey

The survey instrument was pilot tested to ensure its content validity with thirty online consumers and practitioners from field and academia. The suggestions were incorporated and subsequently some of the items were rephrased. More technical words were removed; duplicate and double-barreled questions were also removed. Initially, the pilot-tested survey instrument with the cover letter was sent to 750 potential online consumer respondents. For every three weeks from the initial mailing, a reminder was sent. Some respondents were contacted in-person for this purpose.

Banner ads. appear when viewing web pages, usually placed at the top or along the sides of the Web page or a search engine's page.

Data Analysis

The collected data was analyzed using techniques of univariate, bivariate and multivariate statistical analysis. For the univariate analysis, a frequency distribution analysis was performed to gather information on demographics such as sex, age, degree, study of year, Internet use per day and browsing experience. A reliability analysis was conducted with the use of Cronbach Alpha standards. This was to ensure that all constructs have reliable questionnaire items. Also, the measure to central tendencies was performed. Bivariate analysis was to address the relationship between the five constructs and the relationships were analyzed by correlations. The multivariate analysis was to examine the dependency of banner ad effectiveness upon others.

The inter-item reliabilities (standardized Cronbach's alpha) for banner ad effectiveness, consumer expectations, consumer involvement, and perceived personal usefulness produced acceptable reliability scores. The overall reliabilities (standardized Cronbach's alpha) for these measures are given in Table 3.

Table 3 : Overall Reliabilities (Standardized Cronbach's Alpha) for the Measures

Variable Items	Cronbach's Alpha
Ad. Effectiveness	0.686
Search Style	0.602
Banner Ad. Judgment	0.612
Focus and Planning	0.516
Consumer Expectations	0.827
Consumer Involvement	0.873
Perceived Personal Usefulness	0.812

The study employed four item-measures of internal flexibility. They were search style, banner ad judgment, focus of online searching/shopping, and planning of online searching/shopping. Attempting to aggregate the four measures of internal flexibility into a single measure produced an unacceptably low reliability score of .4670, indicating that these measures were not measuring the same construct. However, the inter-item reliability score on focus and planning of online searching produced an acceptable score of 0.8173. Consequently, the proposed research model was revised to accommodate the three types of internal flexibility (Figure 2). Accordingly, hypothesis 1 was ripped into three hypotheses as follows:

- H1a.** Increased banner ad judgment of the consumer will significantly increase the ad effectiveness.
- H1b.** Increased flexibility in search style of the consumer will significantly increase the banner ad effectiveness.
- H1c.** Focus and planning approach for online shopping of the consumer will significantly increase the banner ad effectiveness.

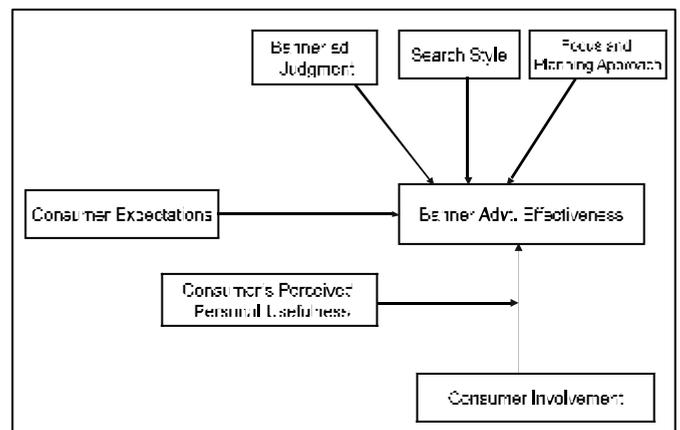


Figure 2 : Revised Model



Regression Analysis

To investigate the relationship between banner ad effectiveness and online consumer characteristics variables, moderated regression analysis was used. The analysis is helpful to validate the model of expected relationships (Parthasarathy & Sethi, 1993). The sample data met regression assumptions of normality and linearity. Descriptive statistics and correlations among the constructs are given in Table 4.

Table 4 : Descriptive Statistics: Means, Standard Deviations, and Correlations for Dependent and Independent Variables

	Mean	S.D	1	2	3	4	5	6	7
1. Ad Effectiveness	4.36	2.41	1						
2. Search Style	4.57	2.05	0.307**	1					
3. Banner Ad Judgment	5.98	1.72	0.298**	0.062	1				
4. Focus and Planning	3.19	1.73	0.118	0.034	0.036	1			
5. Consumer Expectation	3.92	1.86	0.495**	0.167	0.208	0.073	1		
6. Consumer Involvement	2.65	1.71	0.576**	0.219	0.181	0.322**	0.587**	1	
7. Perceived Personal Usefulness	2.49	1.72	0.613**	0.178	0.208	0.132	0.533**	0.552	1

* - p<0.05 Correlation is significant at the 0.05 level (2-tailed)
 ** - p<0.01 Correlation is significant at the 0.01 level (2-tailed)

The regression model used banner ad effectiveness as the dependent variable and included banner ad judgment, search style, focus and planning, perceived personal usefulness, and consumer expectations as the independent variables. To

In designing the banner ad, online consumer characteristics play an important role in the e-commerce environment.

assess the moderation effect of perceived personal usefulness on the relationship between involvement and banner ad effectiveness, interaction terms were calculated by multiplying the responses for both. These interaction terms were considered for moderated regression analysis. The results of the analysis are shown in Table 5.

Table 5 : Regression Model with Advertisement Effectiveness as the Dependent Variable

Independent Variable	Beta	t	p
Banner Ad. Judgment	0.298	2.476	0.0001
Search Style	0.307	2.660	0.0001
Focus and Planning	0.118	1.160	0.249
Perceived Personal Usefulness	0.613	7.596	0.000
Consumer Involvement	0.576	6.909	0.000
Consumer Expectations	0.495	5.589	0.000
Involvement X Perceived Personal Usefulness	0.612	7.583	0.000
R ²	0.375		
Adjusted R ²	.0319		

Research Hypotheses

The results in Table 5 indicate that 32% of the variance observed in banner ad effectiveness is explained by the independent variables. Hypothesis 1a proposed a positive relationship between consumer's banner ad judgment and banner ad effectiveness. The results of regression analysis validates the existence of this relationship (p<0.001). The beta coefficient (0.298) indicates that the relationship is positive. The degree of association between them is significant (p<0.01) and shown by correlation (r=0.3). So, Hypothesis 1a is supported by both regression and correlation analysis: a higher level of consumer's banner ad judgment influences banner ad effectiveness.

Hypothesis 1b suggested a positive relationship between consumer's flexibility in search style and banner ad effectiveness. The regression analysis supports the existence of a relationship between them (p<0.001). The beta coefficient for flexibility in search style (0.307) indicates that this relationship is positive. Therefore, Hypothesis 1b is supported by the analysis: higher the level of consumer's flexibility in search style, greater will be the banner ad effectiveness.

Hypothesis 1c assumed that focus and planning approach would influence the banner ad effectiveness. The results of the regression analysis provided no support for this (p=0.249). Therefore, focus and planning approach does not appear to influence banner ad effectiveness.

Hypothesis 2 postulated a positive relationship between consumer expectations and banner ad effectiveness. The results of regression analysis in Table 5 supports this model (p<0.001). The beta coefficient (0.495) indicates a positive relationship between the two and their correlation is significant (r= 0.495, p<0.01). Therefore, Hypothesis 2 is supported by the analysis: higher the level of consumer expectations greater will be the banner ad effectiveness.

Hypothesis 3 suggested a positive relationship between consumer involvement and banner ad effectiveness. The regression analysis supports this model (p<0.001) indicating a positive relationship (beta = 0.576) with significant correlation (r= 0.576, p<0.01). Therefore, Hypothesis 3 is supported: higher the level of involvement greater will be the banner ad effectiveness.

Hypothesis 3a assumed that consumer's perceived personal usefulness would have a moderating effect on the relationship between consumer involvement and banner ad effectiveness. The regression analysis supports this model (p<0.001) indicating a positive relationship (beta = 0.612). Therefore, Hypothesis 3a is accepted.



Dicussion

Consumer Banner Ad Judgment and Ad Effectiveness

Hypothesis 1a is supported by the data in which banner ad judgment will influence ad effectiveness. The relationship between the two is directly proportional meaning if the banner ad judgment level was to increase or decrease that ad effectiveness would change accordingly. Increase in number of options exercised in judging a banner ad could make the consumer more flexible. For example, the consumer might have started off with a subjective view but has decided to change to a combination of subjective and objective views. If the consumer was to use a combination of views first and then change to only a subjective view then the consumer would be showing decrease in internal flexibility. In order to increase the banner ad effectiveness, the ads should provide three essential items: option, change and freedom of choice.

The ads should provide more options to the consumer. These options should vary in views such as subjective views to objectives views. The consumer could choose from these two views and combinations of these two views. The ad should have an impact on the consumer to change such as in their online purchasing. The ad should help the consumer change their shopping process from being indecisive to confident in their choice of the product. The ad should also provide freedom of choices meaning the consumer is able to choose preferred judgment. For example, if a banner ad had options such as only giving price information then a consumer wanting dealer location would not find this ad useful. Therefore, this ad does not provide the consumer a freedom of choice. If a banner ad had options such as price information and dealer location then the consumer could choose what they would want from the advertisement. The consumer is not confined to one option and is free to choose their preferred option. For many advertisements, they will usually have to target specific consumers by including specific features that would appeal to their characteristics. For example, if the ad wanted to attract more males then the ad would incorporate more features that appeal to males.

Information Search Style and Ad Effectiveness

Hypothesis 1b is supported by the data in which search style will influence ad effectiveness. Consumer may search for comprehensive information or limited information or combination of the both. Exercising more options in consumers search style could actually make the consumer more flexible. For example, a consumer starting off with only a comprehensive search may want to change to a combination of comprehensive and limited search. In this example the consumer is exercising more options in their search style.

The advertisements should capitalize on the relationship between these two items to increase their effectiveness. The ad should be able to provide a range of options or search styles to the consumer. The consumer should have freedom of choice and not have to use a particular search style by force. If the advertisement only allows limited information search then a consumer wanting more comprehensive information is either forced to use the limited information search or leave the ad. If the consumer leaves the advertisement then it would be doing the opposite of what the advertisements is trying to achieve. The ad should also allow the consumer to change their search style when needed. If a consumer realizes a certain search style is not allowing them to proceed with their online purchasing then a switch in search style is required.

Consumer Expectations and Ad Effectiveness

Hypothesis 2 is supported by the data in which consumer expectation will influence ad effectiveness. This is a proportional relationship in which if the consumer expectations were to increase or decrease that ad effectiveness would change accordingly. Consumer

The three key words for systemic flexibility are: options, change, and freedom of choice.

expectation is when the consumers has a sense in what they believe is a quality price, quality of service, quality of interaction of service and the image of the business being promoted. Methods to increase consumer expectation could be to provide affordable prices, quality services, quality interactions of services and good image of the business being promoted.

The idea for most people is that the more expensive the products will mean a better quality business. The high end products could then persuade the consumers that this is a superior business and thus be more willing to buy the product or from the business. Another method could be to show only good quality service within the ad. The ad could make use of quotes from happy consumers and depict a situation where customer service is occurring. The idea is to create to the consumer that the business is supportive in their ways to make the customers come first. By implementing this idea in the consumer's head; the consumer may be more apt to dealing with a business that has a customer focus. Promoting a good quality interaction is also useful for the consumer. It shows that the staff is friendly and ready to serve to your needs. The next method is to provide a trustworthy image of the business being promoted. This may depend on the target consumers for the business. For example, if the target consumers are pet lovers then the image of the business could be that its products are tested without harm to animals. Another example is if the target consumers are young people then the image has to provide that the business is trendy and chic. By enhancing or adding some of these feature into the ads, it may increase the advertisements effectiveness.

Consumer Involvement and Ad Effectiveness

Hypothesis 3 is supported by the data in which consumer involvement will influence ad effectiveness. This is a proportional relationship in which if the consumer involvement was to increase or decrease that ad effectiveness would change accordingly. These results are consistent with other researches done on consumer involvement and ad effectiveness (Batra and Stayman 1991, Gillis 1988, Venkataramani Johar 1995). Consumer involvement could include such items as being intellectually or emotionally attached, allured by the appeal of the object, being important and relevant. When the consumers' involvement increases it could mean they are more intrigued by the objects' intellectually, emotionally, by appeal and importance or relevance. Decreasing consumer involvement could mean they are less intrigued by the objects' intellectually, emotionally, by appeal and importance or relevance. Advertisements could increase their effectiveness by harnessing this relationship to increase consumer involvement and thus increase ad effectiveness. Methods to increase consumer involvement could be increasing intellectual or emotional attachments, increase appeal, make ads more important and relevant.

The ads could try to make a theme of the ad on the consumer's level of thinking or education. For example, if the ads' targets are scholars then the ad would try to make the situation alluring to them by using sophisticated words or controversial situations. The target consumer with the higher intellect could be more intrigued about the situational setting. This idea would apply the same with emotions. The ad could apply situations were the target consumer could emotionally related to and therefore be more intrigued by the ad. The ads should also try to appeal more to the sense of the consumers. Appeal could be in forms of color, textures or even taste. For example, ads dealing with foods can present the food so enticing that sometimes the viewers start to taste and smell the food. The ads should be perceived as having a quality that is important or relevant to what the consumer is looking for. The banner ad should be placed in a web site that would be more relevant and important. For example, if the banner ad was selling golf shoes then the ad in a golf site would prove to be more relevant and important then placing the ad in a computer hardware web site.

Moderating Effect of Consumers Perceived Personal Usefulness

Hypothesis 3a is supported by the data in which consumers perceived personal usefulness will moderate consumer involvement that influence ad effectiveness. There are two proportional relationships; consumer involvement with ad effectiveness and consumer perceived personal usefulness

with ad effectiveness. If consumer involvement increase or decrease then ad effectiveness will also increase or decrease. If consumers perceived personal usefulness changes this will impact the relationship between consumer involvement and ad effectiveness. Thus the changes in consumer perceived usefulness will indirectly have an impact on ad effectiveness. Advertisements should take this relationship into account to boost their ad effectiveness. Methods to increase ad effectiveness could be to provide intellectually or emotional attachment, more appeal to the senses, more importance or relevance to the consumer, more information to further consumer's decision, more productive and insightful information.

The next method is to improve consumer involvement. The ad could apply situations were the target consumer could emotionally or intellectually be involved and therefore be more intrigued by the ad. The ads should also try to appeal more to the sense of the consumers. Appeal could be in forms of color, textures or even taste. The ads should be perceived as having a quality that is important or relevant to what the consumer is looking for. Placement of ads could be essential in attracting the target consumers. Placing an ad about cheap hotel rates would be more beneficial if it was on airline websites.

The internal flexibility of an actor can be decided by mapping the actor's internal characteristics such as value system, decision-making style, thinking pattern, and adaptability nature.

The next method is to improve the consumers' perceived personal usefulness. To help consumers further their decision may be done by providing more detailed information. The information should have an impact on the consumer's decision making by eliminating any insecurities about the product or the business. By clarifying these insecurities, this could help the consumer come to a decision much earlier. Productive information could mean providing better access to detailed information such as better navigation or less navigation. The ad should also give the consumer better insight in the product or business that is being promoted. Insight could include how the product was manufactured, who makes the products or if it's applicable to the consumers motives to buy the product. This insight could reveal crucial information in the consumer's choice to purchase this product or from this business. By enhancing these items in the advertisement it could increase the ad effectiveness.

Conclusions and Limitations

This study dealt with web based advertisements but more specifically with banner ads. Banner ads were chosen because of their presence in the Internet and it was thought that the respondents would be more likely subjected to banner ads then any other kinds of web based ads. Other research could be conducted on consumer characteristics with other types of web-based ad such as pop-ups or supersentials. This study has included the respondents who would be more comfortable with the Internet environment. These subjects

would have an average of 5- 9 years of browsing experience. The subjects might have a bias towards web advertisements because they were subjected to them at a higher amount than the subjects that have less browsing experience. A study could investigate if the respondent's browsing experience or Internet usage would be different than results obtained in this study.

A majority, 51 %, of the respondents taken by the sample were from information systems. This could skew the results because people in this degree would have a better working environment with the Internet. They could be more subjected to banner ads than the rest of the sample. A sample with equal percentages of degrees would be beneficial. Another problem that was raised from this research was that some of the respondents were confused with banner ads and pop-up ads. Nonetheless, the confusion was minimal because of the majority the respondents were from technology based disciplines.

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Flexibility Mapping : Practitioner's Perspective

1. What types of flexibilities you see in the practical situation of *your company's "Web-based Banner Advertising"* 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 in *"Web-based Banner Advertising"* relevant to your organizational context? On which dimensions, flexibility should be enhanced?
3. Try to map your own organization on following continua (Please tick mark in the appropriate box(es))

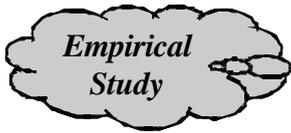
	Banner-ad Features Included for Target Audience					
Male-features	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Female-features
	Helping the Consumer's Online Shopping					
Indecisive	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Confident
	Banner-ad's influence on Consumer's search style					
Limited Information	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Comprehensive Information
	Decision-making Styles of Online Consumer					
Rational	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Intuitive
	Thinking Pattern of Online Consumer					
Convergent Thinking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Divergent Thinking

4. Develop a SAP-LAP (Situation Actor Process-Learning Action Performance) model of *"Web-based Banner Advertising"* relevant to your organization.

Reflecting Applicability in Real Life

1. Analyze the internal flexibilities of the potential online consumers in your organizational context. Match with the external flexibilities provided by the banner ad.
2. Identify the ways of increasing the banner-ad effectiveness based on your online consumer characteristics.





Culture, Environmental Pressures, and the Factors for Successful Implementation of Business Process Engineering and Computer-Based Information Systems

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Abstract

The objective of the study is to identify the effect of culture and environmental pressures on the factors of successful implementation of Computer-Based Information Systems (CBIS)/ Business Process Reengineering (BPR) projects based on the experience and perception of chief information officers in India and in the U.S. about computerization/BPR projects in their organizations. For the organizations that have not been able to initiate such projects, the objective is to include the inhibiting factors so as to identify the relationships with culture and the environmental pressures.

The findings suggest that environmental pressures and cultural factors play an important role in changing the mind-set of employees to facilitate the successful implementation of CBIS/BPR projects in India. In case of the United States based organizations, the culture plays an important role in facilitating the successful implementation of both CBIS/BPR projects. However, most of the environmental pressures were found having positive significant correlation with the severity in implementation of CBIS/BPR projects for US based organisations.

For successful implementation of CBIS/BPR projects, the factors used are technological factor, managerial factor, human factor and user training, behavioral factor, project related factor, and government policy and support in the country. The culture is measured by using variables power distance, uncertainty avoidance, individualism, and masculinity. The environmental pressures are measured using variables frequency of changes in marketing practices, rate of product obsolescence, prediction of competitor's actions, prediction of consumer test/product demand, and frequency of changes in mode of production/services.

In the comparative study between India and the United States, we have collected the quantitative data through a survey of chief information officers in India and the United States. This data has been analyzed by using the correlation analysis and validated by factor analysis and discriminant analysis.

Keywords : BPR projects, CBIS, cultural and environmental pressures, successful implementation

Introduction

The worldwide spread of IT is well documented, with diffusion from developed to developing countries and the Newly Industrialized Economies (NIEs) in Asia (Mody and Dahlman, 1992). Most businesses in the industrial world could not compete, and many could not even survive without computers and software (Jones, 1994). Now IT is an integral part of the products and services delivered to customers (Henderson and Lentz, 1995/1996).

Today, multinational corporations and governments increasingly use IT for international business and commerce. While advanced countries have made use of this technology for years, IT has also started to make inroads into lesser-developed countries (LDC's) as well (Palvia and Palvia, 1992). Thus, the level of IT adoption is different from country to country, as are each country's key management information systems or CBIS issues (Palvia & Palvia, 1992). Businesses are generally regulated by a government policy in India (Palvia and Palvia, 1992). However, beginning with

the New Computer Policy of 1984 (Dhir, 1992; Menon, 1990), the government aggressively promotes the increased use of IT in business and industry.

The United States remains the world leader in IT (Westwood, 1995). The average IT investment in U.S. organizations is 4% of their sales revenue, and it contributes up to 50% in total capital costs (Broadbend and Weill, 1997). The U.S. service sector has 85% of its IT installation base. Strategic Planning Services/Spectrum Economics projected the global IT spending on hardware, software, networking and other components at \$2,000 billion for the year 2003, and \$2,600 billion for the year 2005 (Campbell, 2000).

Computer related technology or any other technology is essentially neutral: whether IT's application succeeds or fails depends entirely on the decisions that are made on how it shall be used (Bostrom and Heines, 1977). Also, the impact of IT in less developed countries depends on its adaptation to the local environment (Montealegre, 1998). Effective



implementation of IT depends on the organization's vision of change, either by deliberate design or as an emergent phenomenon.

A report by Sandish Group International on the success of software projects reveals that in the United States 31.1% of projects are not completed; 52.7% are completed but with an average cost overrun of 189%, and many of these did not contain all the functionalities of original specifications; and 16.2% are completed in-time and on-budget (Hays, 1997; Turban et al., 2001). Ambler (1999) found that the estimated failure rate of large-scale software development since the early 1980s is 85%. Jeong and Klein (1999) note that more complex systems are susceptible to a high failure rate. CSC Consulting estimated the failure rate for BPR is on the order of 70 percent (Stanton et al, 1992).

Literature Review

This section is divided into six parts: environmental pressures, organization as a socio-technical system; culture/use of computer, stages of IS growth, factors affecting successful implementation of CBIS, and reasons of failure for BPR projects.

Environmental Pressures

With blurring national boundaries, the number of competing organizations and knowledge workers has been increasing. Further, the environment is turbulent, changes rapidly, and in unpredictable manner (Scott-Morton, 1991; Turban et al., 2001). Environment generally changes much faster than organizations. The characteristics of the environment includes time compression-amazing short product life cycle, strategic discontinuity-compete in uncertainties, blurring organizational boundaries-increase collaboration, knowledge intensity, increase returns to the scale, and customer focused (El Sawy et al, 1999). New technology, new products, and changing public tastes and values (many of which results in new government regulations) put strains on any organization's culture, policies, and people (Schein, 1985). Sutcliffe (1997) stated that the US industries with their backs against the wall from increased foreign competition, fought, in past decade, to regain their position as global leader using business process reengineering and information technology. In successful implementation of computer-based information systems/business process reengineering the environmental pressures play an important role in converting mind-set of the organization's employees (Agrawal et al., 2003).

Organization as a Socio-Technical System

A socio-technical systems approach views a work system as an open system, made up of technical and social subsystems (Schoderbek et al., 1986). The output of the work systems depends on the interaction between its subsystems.

The technical system deals with the processes, tasks, and technology needed to transfer inputs to outputs (Bostrom, 1980), whereas the social system is concerned with attributes of people (e.g., attitudes, skills, and values), the roles they enact, the reward systems, and the authority structure. To optimize the entire work system, the interaction of both subsystems must be jointly optimized (Huse and Cummings, 1985).

Culture/Use of Computer

Theories in sociology, psychology, and organizational behavior suggest that a theory that applies in one culture does not necessarily apply, in total, to other cultures (Hofstede and Bond, 1988). Haire, Ghiselli, and Porter (1966) determined that national differences make a consistent and substantial contribution to the differences in a manager's attitudes: two-thirds national and one third individual. Herbig and Day (1990) indicate that certain socio-cultural conditions have to be in place for innovation to occur.

People interact with the IS through a human interface. Culture impacts attitudes towards the use of computers. This impact is enunciated by various theories. The study of Compeau and Higgins (1995) discusses the role of individuals' beliefs about their ability to competently use computers, a.k.a. computer self-efficacy. Theory of Reasoned Action (Fishbein and Ajzen, 1975) maintains that individuals would use computers if they could see positive benefits (outcomes) associated with using them. Davis (1989) included two constructs in his Technology Acceptance Model (TAM). He highlights two constructs: perceived usefulness and perceived ease of use. Task-technology fit (TTF) implies matching the capability of the technology to the demands of the task (Goodhue and Thompson, 1995). Also, both theory (Fishbein and Ajzen, 1975) and a recent path analysis (Baroudi et al, 1986) suggest that satisfaction leads to usage rather than usage stimulating satisfaction. There is increasing evidence that the effective functioning of an application depends on its ease of use or usability (Goodwin, 1987).

Hofstede (1984) identified four basic dimensions accounting for variations in culture. In this study we have used these four parameters for measurement of culture: Individualism versus Collectivism: The extent to which the individual expects personal freedom versus the acceptance of the responsibility to family, tribal or national groups. More individualism will result in more innovation. Power Distance: The degree of tolerance and inequality in wealth and power indicated by the extent to which centralization and autocratic power are permitted. Higher innovation capacity is more available in societies having less power structure or little difference in power status within organizations. Risk (Uncertainty) Avoidance: The extent to

Environmental pressures play an important role in creating a receptive mind-set of the organizations employees for CBIS/BPR projects.

which a society avoids risks and creates security by emphasizing technology and buildings, laws and rules, and religion. A high-risk avoidance environment is not conducive to entrepreneurship and hence dampens innovations. Masculinity versus Femininity: The extent to which the society differentiates roles between the sexes and places emphasis on masculine values of performance and visible achievements. Masculinity refers to assertive, competitive, and firm, whereas femininity culture refers to soft, yielding, dependent, intuitive, etc. Radical innovation thrives in more masculine societies.

Stages of IS Growth

Depending upon the level of IS growth, the IT strategy is formulated by the organizations. A proper IT strategy corresponding to a matching stage of IS growth leads to a successful implementation of IS applications in the organizations. Nolan (1979) indicates that organizations go through six stages of IT growth: initiation, expansion, control, integration, data administration, and maturity. Venkatraman (1994) has argued that enterprises pass through levels of IT-enabled transformation, which range from localized automation (exploitation), internal integration, business process redesign, business network redesign, to business scope redefinition.

The United Nations classified countries according to their computer industry development potential (CIDP) as follows: advanced, operational, basic, or initial (Porat, 1977). Palvia and Wang (1995) have developed a model of country specific CBIS issues. In the model they have added between operational and advance level, one more category named "newly industrialized countries" (NIC). According to this model, the level of IT adoption and the sophistication of the corresponding management issues increases from one stage to the next, i.e. from underdeveloped to developing to newly industrialized to advanced nations.

Palvia and Palvia (1992) focused on CBIS key issues in India, a nation classified as "operational" by the United Nations, and compared them to U.S. key issues. They concluded that, the level of IT adoption and CBIS issues are different from country to country. In the United States, operational and control issues have dropped to the background, and strategic and newer issues have come to the forefront, whereas the important issues in India are currently operational and control oriented. Further, it is not necessary that CBIS development in lesser-developed countries, like India, must parallel the "bottom-up" evolutionary cycle experienced in the US. It is conceivable that developing nations, with proper planning and advances in technology, can leapfrog into advanced strategic uses of IT.

Culture impacts attitude towards the use of computer. National differences make a consistent and substantial contribution to the differences in manager's attitude: two third national and one third individual.

Factors Affecting Successful Implementation of CBIS

CBIS implementation is often considered as the introduction of change (Keen, 1981). Reengineering implementation is also viewed as a large-scale organizational change (Davenport, 1993). Therefore, it is reasonable to assume that reengineering implementation can benefit from an understanding of some of the same problems faced in general IS implementation.

Various prior studies have indicated that management issues judged to be the most important in MIS, change with time (Harrison and Farn, 1990). Bailey and Pearson (1983) identified 39 distinct factors that influence a user's IS satisfaction and make IS successful. Li (1997) identified seven additional factors with additional classification for IS success and found their relevance in the study as the valid factors for IS success. Previous research indicates that a fully developed model may need to include factors related to culture, IT infrastructure, political/economic system, and government policies (Ives and Jarvenpaa, 1991).

In today's environment, users/customers are faced with similar products, too many options, and lack of time. The customer's natural reaction is to look for the cheapest, the most familiar, or the best quality product (Kalkota and Robinson, 1999). The growth in end-user computing, shifting of IT resources to the hands of user departments, availability of knowledge workers, trend towards usage of packaged software, and availability of quality packaged solution, leads to elimination of most of the factors related to quality. Increased competition leads to a receptive environment for adoption of technology. The remaining factors from the preceding discussion and additional factors identified from other studies are grouped with respective citations in Table 1.

Reasons of Failure of BPR Projects

In his study (Jeong, 1995) has identified 64 factors as BPR implementation problems and categorized the factors as: management support problems, technological competence problems, process delineation problems, project planning problems, change management problems, and project management problems. Based on a survey, he concluded that the most important five factors were: need for managing change is not recognized, management's short term view and quick fix mentality, rigid hierarchical structure, line managers unreceptive to innovation, and organizational resistance to change. The factors from the preceding discussion and additional factors identified from other studies are grouped with respective citations in Table 2:

Table 1 : Determinants of Successful Implementation of CBIS Projects Used in this Study

Factors	Citation
Technological	<ul style="list-style-type: none"> Palvia and Palvia (1992) identified key MIS issues in India with their ranking (2. Human resources and personnel for MIS. 6. Continuing training & education of MIS staff. 7. Maintenance of software. 7. Standards in hardware and software. 9. Data security. 10. Packaged application software availability. 12. Maintenance of hardware. 14. Need for external/environmental data. 14. MIS productivity/effectiveness. 17. Computer hardware.) Technological newness (Jeong and Klein, 1999) Personnel shortfalls (Boehm, 1989)
Managerial	<ul style="list-style-type: none"> Palvia and Palvia (1992) identified key MIS issues in India with their ranking (1. Understanding and awareness of MIS contribution. 4. Educating senior managers about MIS. 13. Aligning MIS with organization. 16. Application portfolio. 18. MIS strategic planning. 22. Fear of loss of management authority. 23. Fear of loss of employment. Top management support (Jeong, 1995).
Human factor and user training	<ul style="list-style-type: none"> Palvia and Palvia (1992) identified key MIS issues in India with their ranking (1. Understanding and awareness of MIS contribution. 5. User friendliness of systems. Lack of user experience on applications (Jeong and Klein, 1999).
Behavioral	<ul style="list-style-type: none"> Palvia and Palvia (1992) identified key MIS issues in India with their ranking (3. Quality of input data. 10. Cultural and style barrier. 23. Fear of loss of employment.) Lack of user support (Jeong and Klein, 1999).
Project related	<ul style="list-style-type: none"> Application complexity and lack of clarity of role definition among the team members (Jeong and Klein, 1999). Sufficient resources, competent-team-members, and adequate communication (Jeong, 1995). Project size, Lack of team's general expertise, Lack of team's expertise with the task, Lack of team's development expertise, Resources insufficient, Lack of clarity of role definitions, Lack of user experience, and Application complexity (Jeong and Klein, 1999)
Government policy and support in the country	<ul style="list-style-type: none"> Palvia and Palvia (1992) identified key MIS issues in India with their ranking. (19. Effect of country's political climate on MIS. 20. Telecommunications. 21. Government control.)

Model and Hypothesis Formulation

The relevant variables identified are as follows: technological factor, managerial factor, human factor and user training, behavioral factor, project related factor, government policy and support in the country, power distance, uncertainty avoidance, individualism, masculinity, frequency of changes in marketing practices, rate of product obsolescence, prediction of competitors actions, prediction of consumer test/product demand, and frequency of changes in mode of production/services.

Table 2 : Determinants of Successful Implementation of BPR Projects Used in this Study

Factors	Citation
Technological	<ul style="list-style-type: none"> Inadequate tools for the developers and users (Mathews, 1995). A less than favorable IT implementation climate (Shabana, 1995). Lack of expertise in IT in the organization (Davidson, 1993). Limited telecommunication infrastructure (Davenport, 1993; Venkatraman, 1994). Limited IS application infrastructure (Davenport, 1993, Davidson, 1993).
Managerial	<ul style="list-style-type: none"> Jeong (1995) - Need for managing change is not recognized (1), Management's short-term view and quick fix mentality (2). Flawed objectives (Mathews, 1995). Failure in committed leadership (Hammer et al, 1995; Mathews, 1995; Shabana, 1995) Uncertainty about reengineering project's timeframe (Shore, 1992).
Human factor & user training	<ul style="list-style-type: none"> Inadequate training to affected personnel (Davenport, 1993; Davidson, 1993).
Behavioral	<ul style="list-style-type: none"> Jeong (1995) - Rigid hierarchical structure in the organization (3), Line managers in the organization unreceptive to innovation (4). Jeong (1995) Failure to anticipate and plan for the organizational resistance to change (5). Resistance to change (Grover et al., 1995; Hammer and Stanton, 1995; Shabana, 1995) Inadequate attention to employee concerns (Grover et al., 1995). Failure to consider existing organizational culture (Davenport, 1993; Davidson, 1993).
Project related	<ul style="list-style-type: none"> Inadequate and inappropriate staffing (Grover et al., 1995; Hammer and Stanton, 1995). Lack of oversight during implementation and follow up phase (Grover et al., 1995). Lack of appropriate planning (Davidson, 1993). Failure to commit the required resources (Morris and Brandon, 1993). Lack of expertise in business reengineering (Davenport, 1993). Lack of appropriate BR methodology (Davenport, 1993; Klein, 1994).
Government policy and support in the country	<ul style="list-style-type: none"> Lack of external consulting support (Harrison and Pratt, 1993).

The model (Figure 1) showing the relationships among the variables has been prepared using the model prepared by Agrawal et al. (2003). The severity of implementation problems is a dummy variable included for the sake of clarity in the diagram. The factors to the left represent the severity of implementation problems and the factors to the right represent the cultural and environmental factors. The following hypothesis and goal were developed.

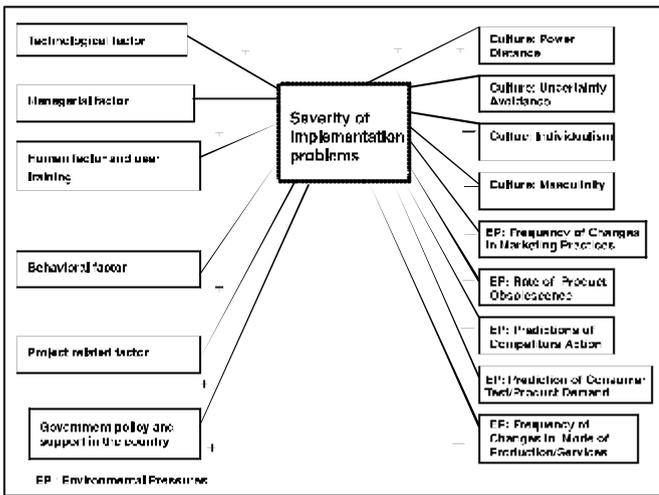


Figure 1: Conceptual Model -Culture, Environmental Pressures and Factors for Successful Implementation of Computerization and BPR Projects
(Source: Adopted from Agrawal et al. 2003)

Hypotheses and Goal

- *H1*: The severity in environmental pressures (frequency of changes in marketing practices, rate of product obsolescence, prediction of competitors actions, prediction of consumer test/product demand, and frequency of changes in mode of production/services) are negatively correlated with severity of implementation problems (technological factor, managerial factor, human factor and user training, behavioral factor, project related factor, and government policy and support in the country).
- *H2*: Power distance and uncertainty avoidance are positively correlated with severity of implementation problems (technological factor, managerial factor, human factor and user training, behavioral factor, project related factor, and government policy and support in the country).
- *H3*: Individualism and masculinity are negatively correlated with severity of implementation problems (technological factor, managerial factor, human factor and user training, behavioral factor, project related factor, and government policy and support in the country).
- *Goal 1*: Determine the critical factors of the failure of computer-based information systems/business process reengineering projects (Note: In this research, failure of CBIS and BPR also includes those projects that were not undertaken).

In open market economy, using IT, the corporations should transform themselves for survival and growth.

Methodology

This study has been confined to manufacturing, telecommunication (hardware), computer hardware, banking, hotels, computer software, and airlines. This particular study has been defined as an exploratory and descriptive “survey”

approach in order to achieve more generalizability and additional richness. The study is divided into three phases.

Phase 1 Exploratory Study

In the first phase, a literature search, an obvious first step in an exploratory study, was conducted. Then, interviews were conducted. The data gathered from a literature search and interviews were analyzed, and a revised version of the problem list and a questionnaire was developed.

Phase 2 Survey, Construct Validity, and Data Analyses

In the second phase, a questionnaire survey was used to answer the research questions. The data are quantitative in nature. The data were used to test the hypotheses using correlation and multiple regressions. Principal component factor analyses along with Varimax rotation were performed to test the construct validity of the questionnaire.

Phase 3 Computation of Discriminant Functions

To determine if statistical differences exist between the average score of manufacturing and service sectors within Indian organizations, discriminant analysis using stepwise variable selection method has been carried out.

The discriminant analysis is also carried out for manufacturing and service sectors in the United States.

Implementation of Research Methodology

Questionnaire Design

The questionnaire uses the Likert scale with nine intervals, from low to high, with equal weights. Because of the difficulties in measurement, open-ended questions were avoided. The questions are mutually exclusive.

Questionnaire Validation and Testing

The questionnaire validation exercise was divided into four parts: face validity, criterion validity, content validity, and construct validity. In construct validity, to determine the number of factors for each construct, an Eigenvalue greater than one rule was employed. While 0.30 has been suggested as sufficient, only loadings greater than 0.32 in absolute value were used in this study (Churchill, 1979). The questionnaire items were found significantly loaded (Appendix I) and grouped under the variables they ought to measure. There are variables loaded on more than one factor, but there was no variable found not loaded on any of the factors significantly – possible association of variables is one reason, which could be attributed to the loading of more than one construct on the same factor. The construct validity is not more or less than a scientific process (Bausell, 1986). It is, therefore, difficult to assert that construct validity of a measure is established. An instrument may need several administrations before its construct validity can be ensured. Further, due to multiple variations and combinations in each study, a general model as proposed in Figure 1 is

considered uniformly to facilitate the needed comparison between organizations of India and the United States. In spite of seeming limitations, this gives the confidence that the questionnaire administered had enough construct validity. After field-testing, the questionnaires were mailed for survey research.

Administering the Instrument

The questionnaire survey was administered following the guidelines suggested by Dillman (1978, and 2000). For the United States, stratified sampling was used. In India, a judgment sampling was used.

A total of 423 in India and 384 questionnaires in the United States were mailed. After about three weeks a follow up letter was mailed requesting that that the completed questionnaires are returned at the respondents' earliest convenience. Out of the questionnaires received, the total usable responses were 112 from India and 89 from the United States. This has resulted in a response rate of 26.48 percent in India and 23.18 percent in the United States. This response rate compares favorably to mail surveys reported in the IS literature many of whom have less than 25 percent response rate (Jeong, 1995).

Data Processing and Results

The results of statistical analysis are presented to show the degree of association among the variables and examine the statistical significance of the model presented. The significance level of 0.01 and 0.05 are very common in a larger sample size. In our case the sample size is 112 (India) and 89 (U.S.A.); thus, the significance level of 0.1 is considered appropriate. Further, for generalization of model, and considering the number of combinations of options in the study, the significance level of 0.1 is justified. Software package SPSS version.10 has been used for statistical analysis to validate hypotheses and for the discriminant function analysis. For discussion on relative significance, the mapping of mean values is done using the criteria given below in Table 3. Because the nine intervals could not be divided equally with meaningful separation points, the upper and lower extreme values taken relatively of smaller range.

This part is divided into six sub-parts: culture, effect of environmental pressures, ranking of variables and data items,

Table 3 : Mapping of the Mean Values of Data Items and Variable Used for the Study Using Likert's Scale of Nine Intervals.

Range of Mean Values	Level of Significance
Up to 1.500	Very Low
From 1.501 to 3.500	Low
From 3.501 to 5.50	Moderate
From 5.501 to 7.50	High
Above 7.500	Very High

results and analysis, validation of hypotheses, and comparison of manufacturing sector and service sector (results of stepwise statistical discriminant function analysis).

Culture

For cross comparison the culture is measured based on four parameters: power distance, uncertainty avoidance, individualism, and masculinity. Table 4 contains mapping of mean values for both the countries. The mean values are also plotted in Figure 2.

Table 4 : Mapping of Mean Values of Variables Measured in Questionnaire Part C.

Variable Description	Variable Code	India	U.S.A.
Power distance (degree of inequality among people which the population of a culture considers normal)	V219 (C8A)	High	Moderate
Uncertainty avoidance (degree to which people in a culture feel uncomfortable with uncertainty and ambiguity)	V220 (C8b)	High	Moderate
Individualism (degree to which people in a culture prefer to act as individuals rather than members of groups)	V221 (C8C)	Moderate	Moderate
Masculinity (degree to which value like assertiveness, performance, success, and competitiveness prevails among people of a culture over gentle values like quality of life, maintaining warm personal relationships, service, care of the weak, etc.)	V222 (C8D)	Moderate	Moderate

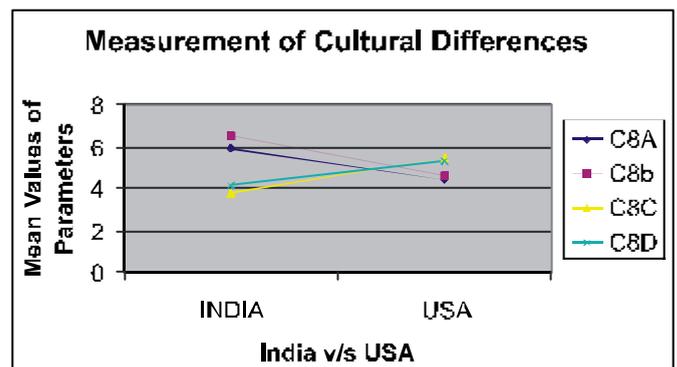


Figure 2 : Cultural Difference Between the Organizations of India, and the United States.

In comparison with the values in India, organizations in the United States are having moderate values for power distance, and uncertainty avoidance. These attitudes seem to be contributing significantly in the successful usage and implementation of IT. Further within moderate range the organizations in the United States are having values for individualism, and masculinity closer to the upper limit, while in India, it is at lower end of the range. In the Figure 2, the parameters on Y-axis represent mean values of

variables V219(C8A), V220(C8b), V221(C8C), and V222(C8D). On X-axis the values on the left hand side are pertaining to the organizations in India, and on right hand side, the values are pertaining to the organizations in the United States.

The category wise results (Table 5) reveal that in the United States, there is a significant difference in individualism between manufacturing (5.02) and service sectors (5.95). The difference can be explained considering the nature of work in service sector, i.e. more independent compared to more team work in manufacturing sectors. Further, in India the difference in values of masculinity between manufacturing sector (3.55) and service sector (4.9) can be explained considering the fact that service sector requires more customer focused approach, and needs more efforts for getting and retaining customers.

and competitors. This parameter differentiates both countries and seems to be a major contributor in developing a positive mind set for incorporating changes with the help of IT/BPR. Further within moderate range the organizations in the United States are having value for predictions of competitor's actions closer to the upper limit, while in India, it is near the lower end of the range. In the Figure 3, the parameters on Y-axis represent mean values of variables V212(A9a), V213(A9b), V214(A9c), V215(A9d), and V216(A9e). On X-axis the values on the left hand side are pertaining to the organizations in India, and on right hand side, the values are pertaining to the organizations in the United States.

The category wise results (Table 7) show the significant difference among manufacturing and service sectors in case of rate of obsolescence of products (India and the United

Table 5 : Mean Values of Variables for Category Wise, and Cross Comparison: Culture

Sr. No.	Code	Description	India			USA		
			Total	Mfg	Ser	Total	Mfg	Ser
1	V219 (C8A)	Power distance (degree of inequality among people which the population of a culture considers normal)	5.94	6.271	5.53	4.43	4.45	4.41
2	V220 (C8b)	Uncertainty avoidance (degree to which people in a culture feel uncomfortable with uncertainty and ambiguity)	6.51	6.82	6.13	4.581	4.6	4.57
3	V221 (C8C)	Individualism (degree to which people in a culture prefer to act as individuals rather than members of groups)	3.77	3.75	3.8	5.494	5.02	5.95
4	V222 (C8D)	Masculinity (degree to which value like assertiveness, performance, success, and competitiveness prevails among people of a culture over gentle values like quality of life, maintaining warm personal relationships, service, care of the weak, etc.)	4.16	3.55	4.9	5.314	5.02	5.6

Effect of Environmental Pressures

The mapping of mean values for both the countries in given below in Table 6 and their relative differences are also depicted in Figure 3.

In comparison with the values in India, organizations in the United States have significant difference in frequent changes in marketing practices to keep up with its market

Table 6 : Mapping of Mean Values of Variables

Variable Description	Variable Code	India	U.S.A.
The changes in Marketing Practices to keep up with its market and competitors	V212 {A9(a)}	Moderate	High
The rate of obsolescence of your product	V213 {A9(b)}	Moderate	Moderate
Predictions of competitors actions (fairly easy to very unpredictable)	V214 {A9(c)}	Moderate	Moderate
Forecast of demand and prediction of consumer test (easy to very difficult)	V215 {A9(d)}	Moderate	Moderate
The mode of production/services (well established to subject to very much change)	V216 {A9(e)}	Moderate	Moderate

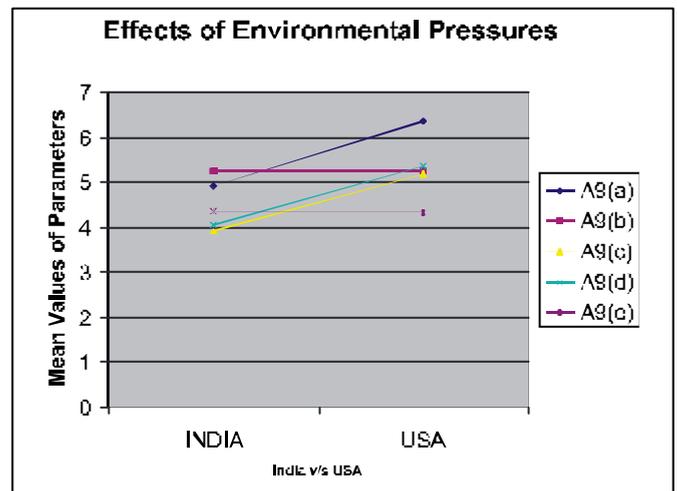


Figure 3 : Comparison of Parameters Used to Measure the Effects of Environmental Pressures Between the Organizations of India, and the United States.

States); forecast of demand and consumer test (the United States), and the mode of production/services (the United States). In manufacturing sectors the values are higher compared to service sectors. This difference can be argued, considering that in service sector the mode of services are relatively more stable compared to the products in manufacturing sector.

Table 7 : Mean Values of Variables for Category Wise, and Cross Comparison: Effect of Environmental Pressures

Sr. No.	Code	Description	India			USA		
			Total	Mfg	Ser	Total	Mfg	Ser
1	V212 {A9(a)}	The changes in marketing practices to keep up with its market and competitors	4.93	4.617	5.28	6.368	6.62	6.13
2	V213 {A9(b)}	The rate of obsolescence of your product	5.26	6.067	4.35	5.244	5.98	4.58
3	V214 {A9(c)}	Prediction of competitors action	3.93	3.508	4.41	5.182	5.3	5.07
4	V215 {A9(d)}	Forecast of demand and prediction of consumer tests	4.04	3.733	4.38	5.352	5.67	5.04
5	V216 {A9(e)}	The mode of production/services, i.e., well established or subject to very much change	4.35	4.638	4.08	4.333	4.95	3.76

Ranking of Variables and Data Items

Tables 8 and 9 contain the ranking of variables and the data items based on their mean values. The results support the arguments that for the successful implementation of projects, human and managerial/project related factors are more severe compared to technological factors.

Based on the above results the following can be concluded: Goal 302 (Determine the critical factors of failure in computer-based information systems/business process

reengineering projects. [Note: In this research, failure of CBIS and BPR also includes those projects, which were not undertaken]).

- *Computerization projects:* Ranking of variables and data items for the organizations in India and the United states Refer to Tables 8 and 9.
- *BPR projects:* Ranking of variables and data items for the organizations in India and the United states Refer to Tables 8 and 9.

Table 8 : Ranking of Variables Based on Mean Values for Cross Comparison

Sr. No.	Code	Description	India			USA	
			Failure of Computerization Projects	Failure of BPR Project	BPR Project not Undertaken	Failure of Computerization Projectis	Failure of BPR Project
			Ranking	Ranking	Ranking	Ranking	Ranking
1	V201	Technological factor	5	5	4	5	5
2	V202	Managerial factor	4	3	2	2	4
3	V203	Human factor and user training	3	4	3	4	3
4	V204	Behavioral factor	1	1	1	3	2
5	V205	Project related factor	2	2	N.A.	1	1
6	V206	Government policy and support in the country	6	6	5	6	6

N.A.: Not Applicable

Table 9 : Ranking of Data Items Based on Mean Values for Cross Comparison

Sr. No.	Code	Description	India			USA	
			Failure of Computerization Projects	Failure of BPR Project	BPR Project not Undertaken	Failure of Computerization Projectis	Failure of BPR Project
			Ranking	Ranking	Ranking	Ranking	Ranking
1	D2	Resistance for change	4	9	4	6	4
2	D6	Inappropriate planning	3	5	N.A.	4	5
3	D7	Lack of perceived benefits	19	10	2	10	11
4	D8	Inadequate End-user support	7	3	6	3	3
5	D13	High risk of failure	14	4	5	12	14
6	D14	Unfavorable culture of the organization	8	14	1	8	7
7	D19	Non Scientific management philosophy of the management	5	13	7	13	16
8	D20	Inadequate level of such projects in the country	22	1	3	24	24
9	D22	Lack of perceived ease of use	9	16	13	5	6
10	D24	Large project size	1	7	9	1	1
11	D25	Application complexities	2	2	16	2	2

N.A.: Not Applicable



Results and Analysis

The results of correlations are placed in Appendix II. To make comparison the significant results are tabulated in Appendix III. The interpretation of the results is given below:

Frequent Changes in Marketing Practices

India: A negative correlation between frequent changes in marketing practice and severity in implementation problems (technological factor, managerial factor, human factor and user training, behavioral factor, project related factor, and government policy and support in the country) supports the argument that this variable helps in the growth of CBIS applications in the organizations. Further, the negative correlation between frequent changes in marketing practice and severity in implementation problems (behavioral factor) reveals a positive mind-set of employees during implementation of the BPR projects. However a positive correlation between frequent changes in marketing practice and severity of implementation problems (human factor and user training) indicates the resistance for undertaking BPR initiatives because of inadequate IT solution/training in the organizations.

U.S.A.: A positive correlation between frequent changes in marketing practice and severity in implementation problems (human factor and user training) can be argued considering that the organizations are having inadequate IT solution/training for their employees in implementation of CBIS and BPR projects. Further, the positive correlation between frequent changes in marketing practice and severity in implementation problems (government policy and support in the country) reveals that the massive lay-off of employees may be a big concern during implementation of the BPR projects.

Rate of Obsolescence of the Product

India: A negative correlation between rate of obsolescence of the product and severity in implementation problems (technological factor, managerial factor, human factor and user training, behavioral factor, project related factor, and government policy and support in the country) supports the argument that this variable helps in the growth of CBIS applications in the organizations. Further, the negative correlation between rate of obsolescence of the product and severity in implementation problems (technological factor, and project related factor) reveals a positive mind-set and a confidence of employees during implementation of the BPR projects. However a negative correlation between rate of obsolescence of the product and severity of implementation problems (technological factor) indicates the mitigation of the resistance for undertaking BPR initiatives in the organizations.

U.S.A.: A positive correlation between rate of obsolescence of the product and severity in implementation problems (managerial factor, and human factor and user training) can be argued considering that the fear prevails for high risk of failure, lack of strong leadership within the organizations, and there may be inadequate IT solution/training for their employees in implementation of CBIS and BPR projects.

Prediction of Competitors Actions

India: A negative correlation between prediction of competitor's actions and severity in implementation problems (managerial factor, human factor and user training, behavioral factor, and government policy and support in the country) supports the argument that this variable helps in the growth of CBIS applications in the organizations. Further, the negative correlation between prediction of competitor's

Corporations should prepare themselves to quickly adapt to the requirements of using complex and integrated software solutions.

actions and severity in implementation problems (behavioral factor) reveals a positive mind-set of employees during implementation of the BPR projects. However a positive correlation between prediction of competitors actions and severity of implementation problems (technological factor, and government policy and support in the country) in case of implementation of BPR projects can be argued considering inadequate availability of resources/infrastructure and fear of lay-off of employment in the organizations. Lastly, the positive correlation between prediction of competitor's actions and the severity of implementation problems (human factor and user training) indicates the resistance for undertaking BPR initiatives because of inadequate IT solution/training in the organizations.

U.S.A.: A positive correlation between prediction of competitors actions and severity in implementation problems (technological factor, managerial factor, and project related factor) can be argued considering that high rate of obsolescence of technology, lack of leadership support, high risk of failure of projects, fear of lay-off from employment, and the organizations are having inadequate IT solution/training for their employees in implementation of CBIS and BPR projects. Further, the positive correlation between prediction of competitor's actions and severity in implementation problems (government policy and support in the country) reveals that the massive lay-off of employees may be a big concern during implementation of the BPR projects. However, a positive correlation between predictions of competitors actions the severity of implementation problems (government policy and support in the country) can be argued considering a fear of lay-off from the employment due to free market policy of the government, which has resulted in acute competition.



Prediction of Consumer Test/Product Demand

India: A negative correlation between prediction of consumer test/product demand and severity in implementation problems (human factor and user training) supports the argument that this variable helps in the growth of CBIS and BPR applications in the organizations. Further, a positive correlation between prediction of consumer test/product demand and severity of implementation problems (human factor and user training) indicates the resistance for undertaking BPR initiatives because of inadequate IT solution/training in the organizations.

U.S.A.: A positive correlation between prediction of consumer test/product demand and severity in implementation problems (managerial factor) can be argued considering that the organizations are having high risk, lack of leadership support, and inadequate IT solution for their employees in undertaking CBIS projects. Further, the positive correlation between prediction of consumer test/product demand and severity in implementation problems (managerial factor, human factor and user training, and behavioral factor) reveals that the projects are having high risk, along with the lack of leadership support, and inadequate IT solutions/training supplemented by fear of massive lay-off of employees may be a big concern during implementation of the BPR projects. This argument is supported by the negative correlation between prediction of consumer test/product demand and severity in implementation problems (technological factor) which shows that, to meet the changing needs of the organizations, the employees are willing to undertake more BPR projects if there concerns are addressed properly.

Shrinkage in product life cycle is facilitating implementation of CBIS/BPR projects in Indian organizations while it is causing heavy resistance in United States organizations.

Frequency of Changes in Mode of Production/Services

India : There are no significant results obtained.

U.S.A.: A positive correlation between frequency of changes in mode of production/services and severity in implementation problems (human factor and user training) can be argued considering that the organizations are having inadequate IT solution/training for their employees in undertaking CBIS and BPR projects.

Power Distance

India: A positive correlation between power distance and severity in implementation problems (managerial factor, human factor and user training, project related factor, and government policy and support in the country) supports the argument that this variable helps in the growth of CBIS applications in the organizations. Further, a positive correlation between power distance and severity in implementation problems (managerial factor) supports the argument that this variable helps in the growth of BPR applications in the organizations. However, a negative

correlation between power distance and severity in implementation problems (technological factor) reveals that the employees are not willing to have a close interaction/monitoring by managers while learning/using the technology in BPR implementation. They may have a fear of nagging reactions of the management and would like to operate under free environment as far as possible. However a negative correlation between power distance and severity of implementation problems (human factor and user training) indicates also that the employees are not willing to have a close interaction/monitoring by managers while learning/using the technology in initiating BPR projects. They may have a fear of nagging reactions of the management and would like to work under free environment as far as possible.

U.S.A.: A positive correlation between power distance and severity in implementation problems (managerial factor, and project related factor) supports the argument that these variables help in the growth of CBIS and BPR projects.

Uncertainty Avoidance

India: A positive correlation between uncertainty avoidance and severity in implementation problems (technological factor, managerial factor, human factor and user training, behavioral factor, project related factor, and government policy and support in the country) supports the argument that this variable helps in the growth of CBIS applications in the organizations. Further, a positive correlation between uncertainty avoidance and severity in implementation problems (managerial factor, human factor and user training, behavioral factor, and government policy and support in the country) also supports the argument that this variable helps in the growth of BPR applications in the organization.

U.S.A.: A positive correlation between power distance and severity in implementation problems (managerial factor, and project related factor) supports the argument that these variables help in the growth of CBIS and BPR projects.

Individualism

India: A negative correlation between individualism and severity in implementation problems (technological factor, managerial factor, human factor and user training, behavioral factor, project related factor, and government policy and support in the country) supports the argument that this variable helps inversely in the growth of CBIS applications in the organizations. Further, the negative correlation between individualism and severity in implementation problems (technological factor, managerial factor, human factor and user training, behavioral factor, and project related factor) supports the argument that this variable helps inversely in the growth of BPR applications in the organizations. However, a positive correlation between individualism and severity of implementation problems

(behavioral factor) indicates the resistance for undertaking BPR initiatives because of more individual control of employees on the processes and therefore he can dictate his terms to alter the decision in the organizations.

U.S.A.: A negative correlation between individualism and severity in implementation problems (government policy and support in the country) support the argument that this variable helps inversely in the growth of CBIS applications. Further, a negative correlation between individualism and severity in implementation problems (managerial factor, human factor and user training, behavioral factor, project related factor, and government policy and support in the country) support the argument that this variable helps inversely in the growth of BPR applications.

Masculinity

India: A negative correlation between masculinity and severity in implementation problems (managerial factor, human factor and user training, and government policy and support in the country) supports the argument that this variable helps inversely in the growth of CBIS applications in the organizations. Further, a negative correlation between masculinity and severity in implementation problems (managerial factor, human factor and user training, and behavioral factor) supports the argument that this variable helps inversely in the growth of BPR applications in the organizations. However a positive correlation between masculinity and severity of implementation problems (technological factor, and behavioral factor) indicates the resistance for undertaking BPR initiatives because of fear of massive lay-off, inadequate technological infrastructure, and newness in the technology in the organizations. The resistance can be made successful with the help of human power through labor unions/associations.

U.S.A.: A negative correlation between masculinity and severity in implementation problems (government policy and support in the country) supports the argument that this variable helps inversely in the growth of CBIS and BPR applications.

Validation of Supporting Hypotheses

Based on the results and above interpretation, the goal and hypotheses can be concluded (Appendix IV)

The results obtained from statistical correlation analysis can be argued for Indian organizations as below:

- The projects of computerizations and BPR are viewed positively by the employees of the organizations during implementation because of change in their mind-sets influenced by change in culture and environmental factors. In some cases there is a resistance and that can be overcome with strong leadership support and proper training and incentives.

- There still exists the resistance for initiation of BPR projects in the organizations where there is no history of implementation of BPR projects. The organizations needs extensive leadership drive and training programs to change the mind set of employees.
- The organizations need to infuse culture which facilitates the successful implementation of CBIS and BPR projects.

In case of the United State's organizations the significant positive correlation with environmental pressures can be explained by discussing the past experience of the executives of US organizations. The US industries regained their leadership global position in the last decade using IT and BPR (Sutcliff, 1997). Considering their past experience, the executives of the US industries might be of the opinion that all the problems can be solved by using more and more IT applications. This may not be perceived true at lower level in the organizations. There may be one or any combination of the following problems in undertaking CBIS/BPR projects beyond a reasonable level:

- The rate of obsolescence of technology is very high and a continuous up-gradation of IT skills/infrastructure in the organizations may not be feasible. This may cause excessive investment and also stresses in employees.
- Higher IT investment and BPR projects may result in fear of abnormal lay-offs which will de-motivate employees in undertaking more CBIS/BPR projects.
- Every problem of the organization can not be solved by BPR/IT applications.

Considering the above arguments, it looks like that the effect of implementation of BPR/CBIS projects may have the behavior as given in Figure 4. The employees of the Indian organizations have positive mind-set because of environmental pressures, which facilitates the Implementation of CBIS/BPR projects successfully. On the contrary the United States organizations have a positive correlation with severity in environment. This effect seems to run in cyclic order as given in the Figure 4.

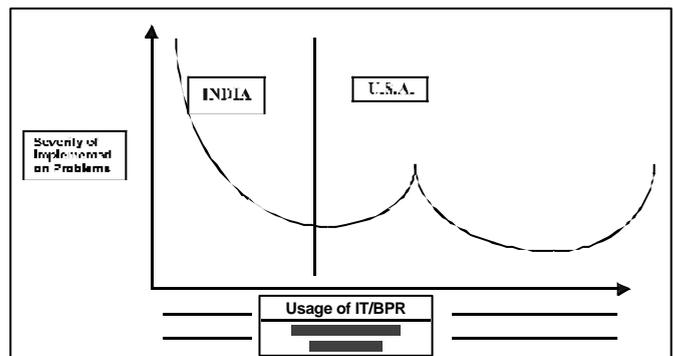


Figure 4 : Effect of environmental pressures on severity of implementation problems.

Discriminant Variables

To determine if significant differences exist between the average score profiles of manufacturing and service sectors of each country, multiple discriminant analyses have been carried out. The other purpose of this analysis was to know which of the independent variables account most for the differences in the average score of profiles of the two groups (Green and Donald, 1979).

The results of stepwise (statistical) discriminant function analyses show that there are significant differences in the values of manufacturing sector and service sector in the case of number of variables. The results are tabulated in Tables 10, 11, and 12. The classification procedure classifies substantially more than the number of cases should be correct by chance (Tables 10, and 11). The results (Table 15) can be interpreted as following:

and government affiliation with labor unions. Since the BPR is new in India, and its applications are mainly in manufacturing with associated complexity of projects, the satisfaction level is justified. Because of growth in white collar workers, growth in knowledge workers, and potential cost savings in support functions driven by competition, in the past, the organizations initiated the IT applications in the service sector. In the service sector, the knowledge workers take the lead in computerization projects to offset the competition.

U.S.A.: In the past, the major emphasis was on improving the productivity; hence the major concentration was in manufacturing sector. Subsequently, the service sector is also considered by the organizations due to intensive competition, with emphasis on customer-focused approach, for future improvements. The above trend can be justified

Table 10 : Classification Results

Original Count	India						USA					
	Failure of Computerization Projects			Failure of BPR Projects			Failure of Computerization Projects			Failure of BPR Projects		
	Group 1	Group 2	Total	Group 1	Group 2	Total	Group 1	Group 2	Total	Group 1	Group 2	Total
Group 1 (M.S.)	59	3	62	59	3	62	40	3	43	39	4	43
Group 2 (S.S.)	2	48	50	35	15	50	2	44	46	3	43	46
Original %												
Group 1 (M.S.)	95.16	4.84	100.0	95.16	4.84	100.0	93.02	6.98	100.0	90.70	9.30	100.0
Group 2 (S.S.)	4.00	96.00	100.0	70.00	30.00	100.0	4.35	95.65	100.0	6.52	93.48	100.0
% of "grouped" cases correctly classified			95.54			66.07			94.38			92.13

Table 11 : Prior Probabilities for Groups

Group	India						USA					
	Failure of Computerization Projects			Failure of BPR Projects			Failure of Computerization Projects			Failure of BPR Projects		
	Prior Prob.	Cases Used in Analysis		Prior Prob.	Cases Used in Analysis		Prior Prob.	Cases Used in Analysis		Prior Prob.	Cases Used in Analysis	
		Un-Wt.*	Wt.*		Un-Wt.*	Wt.*		Un-Wt.*	Wt.*		Un-Wt.*	Wt.*
Group 1 (M.S.)	0.5	53	53	0.5	28	28	0.5	38	38	0.5	35	35
Group 2 (S.S.)	0.5	45	45	0.5	15	15	0.5	41	41	0.5	34	34
Total	1.0	98	98	1.0	43	43	1.0	79	79	1.0	69	69

* Un-Wt.: Unweighted; Wt.: Weighted

India: In the past, the major emphasis was on improving the productivity; hence, the major concentration was in the manufacturing sector. Subsequently, the service sector is also considered by the organizations for future improvements. The above trend can be justified considering the organizations in India are at operational level of IS growth, and the resistance in the manufacturing sector is higher for computerization applications because of strong labor unions

considering the organizations in the United States have tough, competitive pressures. The resistance in the manufacturing sector is higher because of strong labor unions and low consulting support in BPR, since the BPR concept is not very old and its applications mainly affect the manufacturing sector, as compared to the service sector. The higher obsolescence in technology also requires continuous updates through changes in processes and

Table 12 : Results of Discriminant Analysis: Summary of Comparison Between Manufacturing Sector and Service Sector

Independent Variables (Predictors)	Significant higher values in MS(manufacturing sector) or SS(service sector) as indicated in the applicable columns below			
	India		USA	
	Comput-erization	BPR	Comput-erization	BPR
V203: Human factor and user training			MS	MS
V204: Behavioral factor			MS	
V205:Project related factor			SS	MS
V206: Government policy and support in the country.	MS		MS	MS
V207: Severity of implementation problems.	MS		MS	
V209: Degree of complexity in project compared to the original estimated.	MS			
V210: Performance on projects.	MS			
V211: Satisfaction level.	SS	MS		
V221 (C8C): Individualism			SS	
V222 (C8D): Masculinity	SS			

replacement of hardware and software supported by suitable training programs. Because of growth in white collar workers, growth in knowledge workers, and potential cost savings in support functions driven by competition, in the past, the organizations initiated the IT applications in the service sector. In the service sector, the knowledge workers take the lead in computerization projects to offset the competition. Further, the integration in applications makes projects very complex, requiring sophisticated project management approaches.

Limitations of the Study

As with any other study, this research also has several limitations that need to be discussed. First, the list of variables pertaining to IT related issues might reflect some biases. Although the literature was thoroughly reviewed, and additional perspectives were obtained from IS academicians and managers, we do not claim that these are the only variables that could be included. Thus, it must be stressed that any interpretation of the findings must be made in light of the selected set of variables, issues, and categories. Availability of literature in the area of information technology in context to developing countries was found to be scarce and limited. Any research that uses data gathered for inferential statistics assumes that the data are collected randomly from the population. Random sampling

was used in the case of organizations in the United States, while stratified judgment sampling has been used in the case of organizations in India. Further, the questionnaire survey involved people from various departments such as information systems, administration, accounting/finance, production, etc. A balance among the number of respondents from each department could not be achieved. Secondly, with organizations in India, multiple samples have been collected because the executives of these firms showed keen interest in this study, and in India there is a limited number of organizations with experience of IT applications for more than five years. In India, the choice of firms for questionnaire survey was restricted to technological hubs located in northern, southern, and western parts of the country. There exists a base of firms scattered in other parts of the country, which could not be included in the sample. Additionally, samples were collected from the manufacturing sector (telecommunication hardware, computer hardware, and other manufacturing industries) and service sector (banking, hotels, airlines, and computer software industries). Other types of organizations like insurance, financial institutions, etc. are not included in the sample. Thus, any inferences based on the results might be restricted to the companies listed in the directory.

Suggestions for Further Work

As this study lays the foundation for further work in the area of number of IT-enabled business transformation, it provides several useful study opportunities for future research. The results suggest that it might be useful to develop a number of comprehensive models. Thus, future research can extend this study to include additional factors such as organizational maturity, IS sophistication, etc, and test a variety of such factors. In studying this, future research is recommended to use more rigorous methodologies using longitudinal approaches and non-linear relationships. Further, with a broader sample and number of variables, the more generalized model can be developed.

All corporation problems can not be solved by using more and more IT applications.

Concluding Remarks

The main objective of this study was to arrive at a better understanding of the number of issues pertaining to information technology in India and learning from the experience of the United States, who is the world leader in IT applications. This research has allowed us to investigate a number of issues pertaining to successful implementation of business process engineering and computer-based information systems. Factors contributing to the various trends/problems/opportunities have been identified. A framework has evolved to show the inter relationships among these factors.

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Appendix I : Factor Analysis : Factors and Variables through the Construct of Items Loaded

Factor	Eigen Value	Variances %	Cumulative %	Variable Construct Loaded
ORGANIZATIONS IN INDIA- FAILURE IN COMPUTERIZATION				
1	4.834	19.338	19.338	D (9**, 14, 16**, 17, 19**, 20, 21)
2	2.58	10.32	29.657	D(8, 15, 19, 22**)
3	2.032	8.126	37.783	D(5, 7, 13, 21**)
4	1.619	6.475	44.258	D(3, 4, 9)
5	1.375	5.501	49.759	D(6, 11, 18)
6	1.227	4.907	54.666	D(24, 25)
7	1.138	4.552	59.218	D(12, 22, 23)
8	1.103	4.414	63.632	D(2, 10, 11**, 16)
9	1.064	4.257	67.889	D(12**, 26)
ORGANIZATIONS IN INDIA- FAILURE IN BPR				
1	5.472	21.888	21.888	D(4, 5**, 6**, 14, 15, 21, 22, 25)
2	3.631	14.523	36.411	D(3, 9, 22**, 24)
3	2.14	8.559	44.97	D(6, 13, 17**, 19)
4	1.877	7.51	52.48	D(7, 14**, 18**, 22**, 23)
5	1.751	7.003	59.483	D(10**, 14**, 16, 17, 21**, 22**)
6	1.488	5.953	65.436	D(5, 8, 14**, 18**, 20)
7	1.251	5.003	70.439	D(10, 13**, 18, 26)
8	1.132	4.526	74.965	D(11, 12)
9	1.087	4.35	79.315	D(2, 5**, 17**, 25**)
ORGANIZATIONS IN USA- FAILURE IN COMPUTERIZATION				
1	5.281	21.124	21.124	D(2, 4, 7, 14**, 16**, 18, 19**, 23**)
2	3.393	13.571	34.695	D(10, 13, 14, 15**, 17, 22)
3	2.122	8.489	43.184	D(6, 8, 15, 17**)
4	1.808	7.207	50.391	D(3, 5, 7**, 11, 19)
5	1.601	6.402	56.794	D(23, 24, 25)
6	1.388	5.553	62.346	D(2**, 11**, 12, 16**, 17**, 23**, 26)
7	1.218	4.874	67.22	D(8**, 9, 16, 22**)
8	1.094	4.376	71.596	D(10**, 18**, 19**, 21)
9	1.044	4.177	75.773	D(7**, 10**, 20)
ORGANIZATIONS IN USA -FAILURE IN BPR				
1	6.683	26.733	26.733	D(3, 4, 5**, 7, 10**, 11**, 13**, 14, 16, 26)
2	3.53	14.121	40.853	D(3**, 4**, 6, 8**, 13**, 14**, 15, 17)
3	1.967	7.868	48.721	D(5, 11, 18, 19, 20, 22**, 23**)
4	1.775	7.098	55.82	D(4**, 10, 12, 23, 24, 25)
5	1.649	6.597	62.417	D(8, 9, 10**)
6	1.182	4.727	67.144	D(2, 13, 22)
7	1.043	4.171	71.315	D(5**, 13**, 17**, 21)

** Items loaded on multiple factors, but having relatively lower significance and are above the cut-off value of 0.32 (absolute value).

Appendix II : Results of Statistical Correlation

INDIA-Comp Failure		1001A	1001A	1001A	1001A	1001A	1001A
Correlations							
A9A	Pearson Correlation	-0.20	-0.24	-0.33	-0.32	-0.18	-0.32
	Sig. (2-tailed)	0.04	0.02	0.00	0.00	0.06	0.00
	N	110.00	103.00	109.00	109.00	110.00	108.00
A9B	Pearson Correlation	-0.26	-0.33	-0.24	-0.41	-0.20	-0.16
	Sig. (2-tailed)	0.01	0.00	0.01	0.00	0.04	0.09
	N	109.00	102.00	108.00	108.00	109.00	107.00
A9C	Pearson Correlation	0.01	-0.26	-0.37	-0.25	-0.12	-0.29
	Sig. (2-tailed)	0.91	0.01	0.00	0.01	0.23	0.00
	N	108.00	101.00	107.00	107.00	108.00	106.00
A9D	Pearson Correlation	0.12	-0.13	-0.25	-0.15	0.03	-0.03
	Sig. (2-tailed)	0.22	0.19	0.01	0.13	0.77	0.78
	N	108.00	102.00	107.00	107.00	108.00	106.00
A9E	Pearson Correlation	-0.01	-0.12	-0.02	0.06	0.04	0.05
	Sig. (2-tailed)	0.94	0.24	0.80	0.56	0.68	0.61
	N	108.00	100.00	107.00	107.00	108.00	106.00
C8A	Pearson Correlation	0.12	0.17	0.24	0.07	0.25	0.35
	Sig. (2-tailed)	0.21	0.09	0.01	0.47	0.01	0.00
	N	108.00	102.00	107.00	107.00	108.00	106.00
C8B	Pearson Correlation	0.16	0.31	0.43	0.35	0.32	0.32
	Sig. (2-tailed)	0.09	0.00	0.00	0.00	0.00	0.00
	N	109.00	103.00	108.00	108.00	109.00	107.00
C8C	Pearson Correlation	-0.27	-0.46	-0.47	-0.38	-0.22	-0.16
	Sig. (2-tailed)	0.00	0.00	0.00	0.00	0.02	0.09
	N	110.00	103.00	109.00	109.00	110.00	108.00
C8D	Pearson Correlation	-0.03	-0.22	-0.36	-0.11	0.02	-0.20
	Sig. (2-tailed)	0.77	0.03	0.00	0.26	0.80	0.04
	N	109.00	103.00	108.00	108.00	109.00	107.00
INDIA-Fail BPR							
Correlations							
A9A	Pearson Correlation	0.14	-0.24	-0.23	-0.29	0.13	0.10
	Sig. (2-tailed)	0.38	0.11	0.13	0.05	0.42	0.52
	N	43.00	43.00	43.00	43.00	43.00	43.00
A9B	Pearson Correlation	-0.33	-0.18	-0.23	0.01	-0.48	-0.14
	Sig. (2-tailed)	0.03	0.25	0.14	0.94	0.00	0.36
	N	43.00	43.00	43.00	43.00	43.00	43.00
A9C	Pearson Correlation	0.30	-0.16	-0.15	-0.27	0.19	0.31
	Sig. (2-tailed)	0.05	0.31	0.33	0.08	0.22	0.04
	N	43.00	43.00	43.00	43.00	43.00	43.00
A9D	Pearson Correlation	0.03	-0.16	-0.28	-0.20	0.03	0.05
	Sig. (2-tailed)	0.85	0.31	0.07	0.19	0.87	0.74
	N	43.00	43.00	43.00	43.00	43.00	43.00
A9E	Pearson Correlation	0.00	0.15	0.06	0.06	-0.18	-0.12
	Sig. (2-tailed)	0.98	0.35	0.70	0.69	0.24	0.45
	N	43.00	43.00	43.00	43.00	43.00	43.00
C8A	Pearson Correlation	-0.31	0.35	0.05	0.07	-0.08	-0.07
	Sig. (2-tailed)	0.04	0.02	0.74	0.65	0.61	0.64
	N	43.00	43.00	43.00	43.00	43.00	43.00

Appendix II : Cont...

Appendix II : Cont...

INDIA-Fail BPR							
Correlations		1B013A	1B013A	1B013A	1B013A	1B013A	1B013A
C8B	Pearson Correlation	0.16	0.54	0.52	0.51	0.13	0.31
	Sig. (2-tailed)	0.31	0.00	0.00	0.00	0.41	0.04
	N	43.00	43.00	43.00	43.00	43.00	43.00
C8C	Pearson Correlation	-0.47	-0.43	-0.54	-0.32	-0.27	-0.06
	Sig. (2-tailed)	0.00	0.00	0.00	0.04	0.08	0.69
	N	43.00	43.00	43.00	43.00	43.00	43.00
C8D	Pearson Correlation	-0.10	-0.36	-0.35	-0.39	0.12	0.01
	Sig. (2-tailed)	0.53	0.02	0.02	0.01	0.46	0.97
	N	43.00	43.00	43.00	43.00	43.00	43.00
INDIA-NO BPR							
Correlations		1B013A	1B013A	1B013A	1B013A	1B013A	1B013A
A9A	Pearson Correlation	-0.22	0.28	0.34	0.10	0.12	-0.04
	Sig. (2-tailed)	0.12	0.44	0.01	0.46	0.39	0.76
	N	53.00	10.00	52.00	52.00	53.00	51.00
A9B	Pearson Correlation	-0.58	-0.18	0.06	-0.16	0.09	0.18
	Sig. (2-tailed)	0.00	0.59	0.68	0.25	0.54	0.22
	N	52.00	11.00	51.00	51.00	52.00	50.00
A9C	Pearson Correlation	-0.09	0.49	0.27	-0.07	0.13	0.12
	Sig. (2-tailed)	0.55	0.13	0.05	0.61	0.38	0.41
	N	51.00	11.00	50.00	50.00	51.00	49.00
A9D	Pearson Correlation	-0.03	0.30	0.25	0.07	-0.03	-0.05
	Sig. (2-tailed)	0.86	0.37	0.08	0.64	0.82	0.76
	N	51.00	11.00	50.00	50.00	51.00	49.00
A9E	Pearson Correlation	-0.13	0.48	0.13	-0.01	0.07	-0.03
	Sig. (2-tailed)	0.36	0.16	0.39	0.95	0.61	0.83
	N	51.00	10.00	50.00	50.00	51.00	49.00
C8A	Pearson Correlation	-0.14	-0.31	-0.30	-0.08	-0.08	0.09
	Sig. (2-tailed)	0.31	0.41	0.04	0.59	0.59	0.55
	N	51.00	9.00	50.00	50.00	51.00	49.00
C8B	Pearson Correlation	-0.07	0.13	-0.21	-0.02	0.00	-0.01
	Sig. (2-tailed)	0.64	0.71	0.13	0.87	0.98	0.96
	N	52.00	11.00	51.00	51.00	52.00	50.00
C8C	Pearson Correlation	0.03	-0.54	-0.06	0.47	0.15	0.06
	Sig. (2-tailed)	0.81	0.11	0.66	0.00	0.29	0.69
	N	53.00	10.00	52.00	52.00	53.00	51.00
C8D	Pearson Correlation	0.29	0.29	0.03	0.36	-0.03	-0.11
	Sig. (2-tailed)	0.03	0.42	0.84	0.01	0.84	0.44
	N	52.00	10.00	51.00	51.00	52.00	50.00
USA-Comp Fail							
Correlations		1C013A	1C013A	1C013A	1C013A	1C013A	1C013A
A9C	Pearson Correlation	0.22	0.28	0.11	0.16	0.40	0.20
	Sig. (2-tailed)	0.04	0.01	0.32	0.14	0.00	0.07
	N	88.00	84.00	88.00	87.00	88.00	88.00
A9D	Pearson Correlation	-0.06	0.43	0.13	0.22	-0.17	0.09
	Sig. (2-tailed)	0.60	0.00	0.22	0.04	0.11	0.39
	N	88.00	84.00	88.00	87.00	88.00	88.00
A9E	Pearson Correlation	0.01	-0.04	-0.02	-0.10	0.11	-0.01
	Sig. (2-tailed)	0.93	0.73	0.84	0.35	0.32	0.90
	N	87.00	83.00	87.00	86.00	87.00	87.00
C8A	Pearson Correlation	0.17	0.24	0.20	0.15	0.23	0.09
	Sig. (2-tailed)	0.12	0.03	0.06	0.17	0.03	0.40
	N	86.00	81.00	86.00	85.00	86.00	86.00
C8B	Pearson Correlation	-0.04	0.24	0.14	0.06	0.22	-0.05
	Sig. (2-tailed)	0.70	0.03	0.21	0.61	0.04	0.67
	N	86.00	81.00	86.00	85.00	86.00	86.00
C8C	Pearson Correlation	0.04	-0.11	-0.16	0.02	-0.17	-0.18
	Sig. (2-tailed)	0.74	0.34	0.14	0.83	0.13	0.10
	N	87.00	84.00	87.00	86.00	87.00	87.00
C8D	Pearson Correlation	0.05	-0.07	0.00	0.12	0.00	-0.29
	Sig. (2-tailed)	0.65	0.50	1.00	0.29	1.00	0.01
	N	86.00	84.00	86.00	85.00	86.00	86.00
USA- BPR Fail							
Correlations		1B013A	1B013A	1B013A	1B013A	1B013A	1B013A
A9A	Pearson Correlation	0.05	0.16	0.29	0.11	0.10	0.25
	Sig. (2-tailed)	0.65	0.17	0.01	0.35	0.39	0.03
	N	77.00	76.00	77.00	77.00	77.00	77.00
A9B	Pearson Correlation	-0.03	0.23	0.38	-0.01	0.09	0.18
	Sig. (2-tailed)	0.77	0.05	0.00	0.95	0.44	0.13
	N	76.00	75.00	76.00	76.00	76.00	76.00
A9C	Pearson Correlation	0.27	0.24	0.12	0.09	0.41	0.14
	Sig. (2-tailed)	0.02	0.03	0.28	0.41	0.00	0.22
	N	78.00	77.00	78.00	78.00	78.00	78.00
A9D	Pearson Correlation	-0.20	0.38	0.20	0.24	-0.12	-0.03
	Sig. (2-tailed)	0.07	0.00	0.07	0.03	0.28	0.77
	N	78.00	77.00	78.00	78.00	78.00	78.00
A9E	Pearson Correlation	0.14	0.05	0.32	0.10	0.16	0.05
	Sig. (2-tailed)	0.23	0.65	0.00	0.41	0.15	0.70
	N	77.00	76.00	77.00	77.00	77.00	77.00
C8A	Pearson Correlation	0.09	0.23	0.19	0.03	0.28	-0.05
	Sig. (2-tailed)	0.46	0.04	0.11	0.80	0.01	0.67
	N	76.00	75.00	76.00	76.00	76.00	76.00
C8B	Pearson Correlation	-0.03	0.25	0.15	0.12	0.21	-0.08
	Sig. (2-tailed)	0.77	0.03	0.21	0.29	0.06	0.51
	N	76.00	75.00	76.00	76.00	76.00	76.00
C8C	Pearson Correlation	-0.08	-0.42	-0.47	-0.32	-0.34	-0.28
	Sig. (2-tailed)	0.50	0.00	0.00	0.00	0.00	0.01
	N	77.00	76.00	77.00	77.00	77.00	77.00
C8D	Pearson Correlation	-0.10	-0.18	-0.17	-0.07	0.07	-0.31
	Sig. (2-tailed)	0.39	0.12	0.14	0.56	0.55	0.01
	N	76.00	75.00	76.00	76.00	76.00	76.00

Appendix III : Correlation Analysis of Variables

		India						USA					
		V201	V202	V203	V204	V205	V206	V201	V202	V203	V204	V205	V206
A9A	Fail. COMP Fail.BPR No.BPR	NEG05	NEG05	NEG05 POS05	NEG05 NEG05	NEG10	NEG05			POS05 POS05			POS05
A9B	Fail. COMP Fail.BPR No.BPR	NEG05 NEG05 NEG05	NEG05	NEG05	NEG05	NEG05 NEG05	NEG10		POS05 POS05	POS05 POS05			
A9C	Fail. COMP Fail.BPR No.BPR	POS05	NEG05	NEG05 POS05	NEG05 NEG10		NEG05 POS05	POS05 POS05	POS05 POS05			POS05 POS05	POS05
A9D	Fail. COMP Fail.BPR No.BPR			NEG05 NEG10 POS10				NEG10	POS05 POS05	POS10	POS05		
A9E	Fail. COMP Fail.BPR No.BPR									POS05			
C8A	Fail. COMP Fail.BPR No.BPR	NEG05	POS10 POS05	POS05 NEG05		POS05	POS05		POS05 POS05			POS05 POS05	
C8B	Fail.COMP Fail.BPR No.BPR	POS10	POS05 POS05	POS05 POS05	POS05 POS05	POS05	POS05 POS05		POS05 POS05			POS05 POS10	
C8C	Fail.COMP Fail.BPR No.BPR	NEG05 NEG05	NEG05 NEG05	NEG05 NEG05	NEG05 NEG05 POS05	NEG05 NEG10	NEG10		NEG05	NEG05	NEG05	NEG05	NEG10 NEG05
C8D	Fail.COMP Fail.BPR No.BPR	POS05	NEG05 NEG05	NEG05 NEG05	NEG05 POS05		NEG05						NEG10 NEG05

NEG = Negative; POS = Positive; Suffix 05 = Correlation is Significant at 0.05 level (2-tailed); Suffix 10 = Correlation is significant at 0.1 level (2-tailed). Fail.COMP = Failure in CBIS Project, Fail.BPR = Failure in BPR Projects, No.BPR = BPR projects not undertaken.

- Frequent changes in marketing practice:

Appendix IV : Conclusion of Hypothesis and Goal

H1: The severity in environmental pressures (frequency of changes in marketing practices, rate of product obsolescence, prediction of competitors actions, prediction of consumer test/product demand, and frequency of changes in mode of production/services) are negatively correlated with severity of implementation problems (technological factor, managerial factor, human factor and user training, behavioral factor, project related factor, and government policy and support in the country).

	India	U.S.A.	Comments
Frequency of changes in marketing practices is negatively correlated with severity of technological factor.	Accept (Fail. Comp)		
Frequency of changes in marketing practices is negatively correlated with severity of managerial factor.	Accept (Fail. Comp)		
Frequency of changes in marketing practices is negatively correlated with severity of human factor and user training.	Accept (Fail. Comp) Do Not Accept (No.BPR)**	Do Not Accept (Fail. Comp)** Do Not Accept (Fail.BPR)**	** Significant positive correlation
Frequency of changes in marketing practices is negatively correlated with severity of behavioral factor.	Accept (Fail.Comp) Accept (Fail.BPR)		
Frequency of changes in marketing practices is negatively correlated with severity of project related factor.	Accept (Fail. Comp)		
Frequency of changes in marketing practices is negatively correlated with severity of government policy and support in the country.	Accept (Fail. Comp)	Do Not Accept (Fail.BPR)**	** Significant positive correlation
Rate of obsolescence of the product is negatively correlated with severity of technological factor.	Accept (Fail. Comp) Accept (Fail.BPR) Accept (No.BPR)		

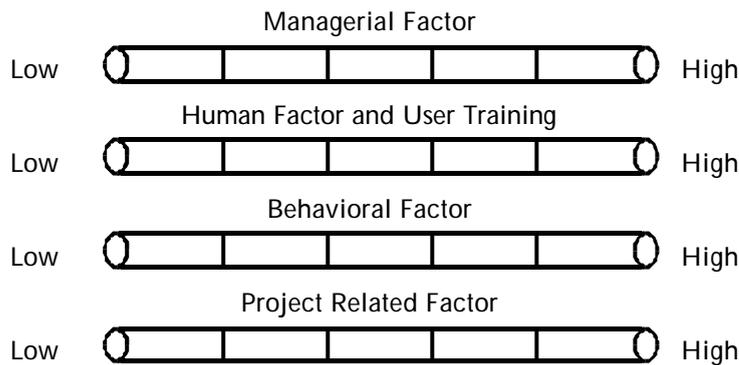
	India	U.S.A.	Comments
Rate of obsolescence of the product is negatively correlated with severity of managerial factor.	Accept (Fail. Comp)	Do Not Accept (Fail. Comp)** Do Not Accept (Fail.BPR)**	** Significant positive correlation
Rate of obsolescence of the product is negatively correlated with severity of human factor and user training.	Accept (Fail. Comp)	Do Not Accept (Fail. Comp)** Do Not Accept (Fail.BPR)**	** Significant positive correlation
Rate of obsolescence of the product is negatively correlated with severity of behavioral factor.	Accept (Fail. Comp)		
Rate of obsolescence of the product is negatively correlated with severity of project related factor.	Accept (Fail. Comp) Accept (Fail.BPR)		
Rate of obsolescence of the product is negatively correlated with severity of government policy and support in the country.	Accept (Fail. Comp)		
Prediction of competitor's actions is negatively correlated with severity of technological factor.	Do Not Accept (Fail.BPR)**	Do Not Accept (Fail. Comp)** Do Not Accept (Fail.BPR)**	** Significant positive correlation
Prediction of competitor's actions is negatively correlated with severity of managerial factor.	Accept (Fail. Comp)	Do Not Accept (Fail. Comp)** Do Not Accept (Fail.BPR)**	** Significant positive correlation
Prediction of competitor's actions is negatively correlated with severity of human factor and user training.	Accept (Fail. Comp) Do Not Accept (No.BPR)**		** Significant positive correlation
Prediction of competitor's actions is negatively correlated with severity of behavioral factor.	Accept (Fail. Comp) Accept (Fail.BPR)		
Prediction of competitor's actions is negatively correlated with severity of project related factor.		Do Not Accept (Fail. Comp)** Do Not Accept (Fail.BPR)**	** Significant positive correlation
Prediction of competitor's actions is negatively correlated with severity of government policy and support in the country.	Accept (Fail. Comp)	Do Not Accept (Fail.BPR)** Do Not Accept (Fail. Comp)**	** Significant positive correlation
Prediction of consumer test/product demand is negatively correlated with severity of technological factor.	Accept (Fail.BPR)		
Prediction of consumer test/product demand is negatively correlated with severity of managerial factor.	Do Not Accept (Fail. Comp)**	Do Not Accept (Fail.BPR)**	** Significant positive correlation
Prediction of consumer test/product demand is negatively correlated with severity of human factor and user training.	Accept (Fail. Comp) Accept (Fail.BPR) Do Not accept (No.BPR)**		** Significant positive correlation
Prediction of consumer test/product demand is negatively correlated with severity of behavioral factor.		Do Not Accept (Fail.BPR)**	** Significant positive correlation
Prediction of consumer test/product demand is negatively correlated with severity of project related factor.			
Prediction of consumer test/product demand is negatively correlated with severity of government policy and support in the country.			
Frequency of changes in mode of production/services is negatively correlated with severity of technological factor.			
Frequency of changes in mode of production/services is negatively correlated with severity of managerial factor.			
Frequency of changes in mode of production/services is negatively correlated with severity of human factor and user training.		Do Not Accept (Fail.BPR)**	** Significant positive correlation
Frequency of changes in mode of production/services is negatively correlated with severity of behavioral factor.			
Frequency of changes in mode of production/services is negatively correlated with severity of project related factor.			
Frequency of changes in mode of production/services is negatively correlated with severity of government policy and support in the country.			

	India	U.S.A.	Comments
H2: Power distance and uncertainty avoidance are positively correlated with severity of implementation problems (technological factor, managerial factor, human factor and user training, behavioral factor, project related factor, and government policy and support in the country).			
Power distance is positively correlated with severity of technological factor.	Do Not Accept (Fail.BPR)**		** Significant negative correlation
Power distance is positively correlated with severity of managerial factor.	Accept (Fail.Comp) Accept (Fail.Comp)	Accept (Fail.Comp) Accept (Fail.BPR)	
Power distance is positively correlated with severity of human factor and user training.	Accept (Fail.Comp) Do Not Accept (No.BPR)**		** Significant negative correlation
Power distance is positively correlated with severity of behavioral factor.			
Power distance is positively correlated with severity of project related factor.	Accept (Fail.Comp)	Accept (Fail.Comp) Accept (Fail.BPR)	
Power distance is positively correlated with severity of government policy and support in the country.	Accept (Fail.Comp)		
Uncertainty avoidance is positively correlated with severity of technological factor.	Accept (Fail.Comp)		
Uncertainty avoidance is positively correlated with severity of managerial factor.	Accept (Fail.Comp) Accept (Fail.BPR)	Accept (Fail.Comp) Accept (Fail.BPR)	
Uncertainty avoidance is positively correlated with severity of human factor and user training.	Accept (Fail.Comp) Accept (Fail.BPR)		
Uncertainty avoidance is positively correlated with severity of behavioral factor.	Accept (Fail.Comp) Accept (Fail.BPR)		
Uncertainty avoidance is positively correlated with severity of project related factor.	Accept (Fail.Comp)	Accept (Fail.Comp) Accept (Fail.BPR)	
Uncertainty avoidance is positively correlated with severity of government policy and support in the country.	Accept (Fail.Comp) Accept (Fail.BPR)		
H3: Individualism and masculinity are negatively correlated with severity of implementation problems (technological factor, managerial factor, human factor and user training, behavioral factor, project related factor, and government policy and support in the country).			
Individualism is negatively correlated with severity of technological factor.	Accept (Fail.Comp) Accept (Fail.BPR)		
Individualism is negatively correlated with severity of managerial factor.	Accept (Fail.Comp) Accept (Fail.BPR)	Accept (Fail.BPR)	
Individualism is negatively correlated with severity of human factor and user training.	Accept (Fail.Comp) Accept (Fail.BPR)	Accept (Fail.BPR)	
Individualism is negatively correlated with severity of behavioral factor.	Accept (Fail.Comp) Accept (Fail.BPR) Do Not Accept (No.BPR)**	Accept (Fail.BPR)	
Individualism is negatively correlated with severity of project related factor.	Accept (Fail.Comp) Accept (Fail.BPR)	Accept (Fail.BPR)	
Individualism is negatively correlated with severity of government policy and support in the country.	Accept (Fail.Comp)	Accept (Fail.Comp) Accept (Fail.BPR)	
Masculinity is negatively correlated with severity of technological factor.	Do Not Accept (No.BPR)**		** Significant positive correlation
Masculinity is negatively correlated with severity of managerial factor.	Accept (Fail.Comp) Accept (Fail.BPR)		
Masculinity is negatively correlated with severity of human factor and user training.	Accept (Fail.Comp) Accept (Fail.BPR)		
Masculinity is negatively correlated with severity of behavioral factor.	Accept (Fail.BPR) Do Not Accept (No.BPR)**		** Significant positive correlation
Masculinity is negatively correlated with severity of project related factor.			
Masculinity is negatively correlated with severity of government policy and support in the country.	Accept (Fail.Comp)	Accept (Fail.Comp) Accept (Fail.BPR)	
Goal 1: Determine the critical factors of the failure of computer-based information systems/business process reengineering projects (Note: In this research, failure of CBIS and BPR also includes those projects that were not undertaken).			
Ranking of variables and data items	Tables: 9 and 10	Tables: 9 and 10	
Note : In all remaining blank cells : Do Not Accept because of insignificant results.			



Flexibility Mapping : Practitioner's Perspective

1. What types of flexibilities you see in the practical situation of factors for "Successful Implementation of BPR" on the following planes :
 - Flexibility in terms of "options"
 - Flexibility in terms of "change mechanisms"
 - Flexibility in terms of "freedom of choice" to participating actors.
2. Identify and delineate the types of flexibilities in "Implementation of BPR" that are relevant for your own organizational context? On which planes does the flexibility needs to be enhanced ?
3. Try to map your own organization on the following continua.
(Please tick mark in the appropriate box(es)).



4. Develop a SAP-LAP (Situation Actor Process-Learning Action Performance) model of "Implementation of BPR" relevant to your organization.

Reflecting Applicability in Real Life

1. What is the status of 'growth' and 'change' flexibility in your organization? How will you utilize the findings of this study to enhance them?
2. Design a strategic transformation plan for your organization by using the findings of this article.





Managing the Manufacturing Flexibility in a Piston Ring Manufacturing Plant – A Case Study

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Abstract

The present manufacturing systems have become very complex. This requires the manufacturing systems to rapidly adjust itself to changes, complexities, and uncertainties. Therefore, flexibility is needed. At the same time, productivity is also desired due to resource crunch and severe competition. This paper presents an approach for managing flexibility in a piston ring manufacturing firm, keeping productivity improvement in mind. The values of various types of flexibility have been found at various intervals of time for the plant. Various types of productivity have been calculated for the corresponding time intervals. The trends of flexibility and productivity have been determined. An approach has been suggested for managing flexibility in future. A hierarchy of flexibility, listing the order in which various types of flexibility should be focused in future, is also given. SAP (situation-actor-process) analysis has been carried out to arrive at learning issues.

Keywords : manufacturing flexibility, productivity, SAP analysis

Introduction

The manufacturing systems in the modern era have become very complex as a variety of materials, machines, tooling and other inputs are being employed for production purpose. This complexity along with market uncertainties require the manufacturing system to respond quickly to changes. For that, flexibility is needed. Flexibility is the ability of a system to respond or react to a change with little penalty in time, effort or cost (Upton, 1994). The change may be internal or external. Flexibility is also the ability to do things differently or do something else should the need arise (Bahrami, 1992). Flexibility is the exercise of free will or freedom of choice on the continuum to synthesize the dynamic interplay of thesis and antithesis in an interactive and innovative manner, capturing the ambiguity in systems and expanding the continuum with minimum time and efforts (Sushil, 1997). Flexibility is a multi-faceted concept with different connotations (Sushil, 1999). Strategic, organizational, financial, information systems and manufacturing flexibility have been identified as the cornerstones of enterprise flexibility (Sushil, 2000). There are various types of flexibilities. A comprehensive classification of flexibility is provided (Browne et. al., 1984) by describing eight types of flexibilities. Besides flexibility, proper utilization of resources is essential due to unprecedented competition coupled with acute resource crisis. Enhancement in productivity is the key to success. One of the method of improving productivity is to measure productivity. Productivity can be measured either as total productivity or partial productivity, i.e., material productivity, labor productivity, energy productivity, and equipment productivity. The paper presents an approach for managing flexibility in a piston ring manufacturing plant, keeping productivity improvement in mind.

Methodology for Measurement of Flexibility and Productivity

The methodology involves measurement of existing levels of different types of flexibilities. For this, various parameters contributing towards a particular type of flexibility are identified. A paired comparison of these parameters is carried out by drawing a position matrix to find out their weight. Further, questions have been framed related to these parameters in a specially designed questionnaire to know the response of the manufacturing firm to these parameters. Various types of flexibilities have been measured on 0-1 scale as explained in Appendix I. The trends in various types of flexibilities have been measured by comparing their values with the values of the last year and with that of five years back. At the same time, productivity values (partial as well as total) of the manufacturing firm have been found out for the corresponding periods by finding actual output and various types of inputs in monetary terms. The trends of various types of productivities have also been determined. Correlation have been established between various types of flexibilities and productivities. Based on the past trends and existing levels of various types of flexibilities and keeping in mind the correlation between flexibilities and productivities, an approach has been suggested for managing flexibility in future.

Relationship Between Various Types of Flexibility and Productivity

The relationships between various types of flexibility and productivity have been determined by finding out product moment correlation. Data has been collected from 50 enterprises in India regarding levels of various types of flexibility and values of productivity. The results of the correlation are entered in Table 1. The results depict that



routing flexibility is positively and significantly related with material productivity. This may be attributed to the fact that with higher routing flexibility, the work-in-process reduces and due to this the deterioration of WIP also decreases, thus, increasing material productivity.

$p < 0.05$ level). This may be attributed to the fact that design change flexibility may result in increase of the skill levels of the workers in producing different types of products. This would result in enhancing labor productivity.

The correlation matrix depicts that machine flexibility is not significantly related with any factor productivity or total productivity.

Table 1 : Correlation Matrix Between Various Types of Flexibility and Productivity

Sr. No	Productivity Flexibility	Material	Energy	Labor	Equipment	Total
		1.	Routing	0.296*	0.239	- 0.237
2.	Volume	0.059	0.363**	- 0.176	0.017	- 0.111
3.	Product	0.325*	0.029	- 0.093	0.054	0.091
4.	Product mix	0.171	0.059	0.051	0.010	0.318*
5.	Labor	0.077	0.022	0.149	- 0.040	0.287*
6.	Design-change	0.177	0.106	0.279*	0.006	0.242
7.	Machine	0.081	0.123	0.183	- 0.071	0.154
8.	Planning	0.285*	0.293*	- 0.210	0.104	0.139
9.	Communication	0.152	0.154	- 0.072	- 0.140	0.281*
10.	Total	0.305*	0.162	- 0.025	0.018	0.288*

* Significant at $p < 0.05$ level $r = 0.279$
 ** Significant at $p < 0.01$ level $r = 0.361$

Planning flexibility is significantly and positively related with material productivity ($r = 0.285$, significant at $p < 0.05$ level). This may be explained by the fact that firms with higher planning flexibility generally do not stock large inventories of finished products. This reduces the expenditure on material storage cost and material deterioration, thus, improving material productivity. Planning flexibility is also significantly and positively related with energy productivity ($r = 0.293$, significant at $p < 0.05$ level).

Communication flexibility is positively and significantly related with total productivity ($r = 0.281$, significant at $p < 0.05$ level). Communication flexibility helps in taking quick decisions. This is expected to result in better utilization of resources, thereby increasing total productivity.

Total flexibility is positively and significantly related with material productivity ($r = 0.305$) at $p < 0.05$ level, and with total productivity ($r = 0.288$) at $p < 0.05$ level.

Present Status

Goetze (I) Limited, Bahadurgarh (Punjab), a private limited company, came into being in 1954 through a collaboration between Escorts Ltd. and Goetze Werke AG of West Germany. The plant turns out a wide variety of piston rings for bi wheelers, heavy/light commercial vehicles, motor cars, tractors, and stationary engines ranging from 38 mm to 160 mm diameter. The company is catering to the requirements of all market leaders in original equipment manufacturing and

also to replacement as well as export market. The company has maintained steady growth in piston rings in view of ready acceptability of its products. From the modest production of 22,517 rings in 1957, it touched a figure of 19 million in 1995-96.

In view of advancement in the technology and customer requirements, Goetze Ring plant has been the pioneer in manufacturing high value piston rings, spheroidal graphite cast iron (KV1) rings, molybdenum coated rings, profile ground rings, and thin rings. At present, the plant has captured around 48% of the market share. Around 750 persons are working in the plant out of which more than 85% are workers. The company got ISO certification from NQA, QSR in 1996.

The plant is continuously going in for upgradation of technology and automation. The plant has also been

Volume flexibility is positively and significantly related with energy productivity ($r = 0.363$, significant at $p < 0.01$ level). Volume flexibility gives the company the ability to respond in case of over demand and under demand. An increase in volume flexibility increases energy productivity as higher production volume decreases energy required per unit production. Likewise, product flexibility is significantly related with material productivity ($r = 0.325$, significant at $p < 0.05$ level). Generally product flexibility is mainly introduced by bringing in and using state of the art technology. This leads to less scrap or wastage of materials, thus increasing material flexibility.

Education and training of workforce plays a vital role in increasing manpower flexibility.

Product-mix flexibility is significantly and positively related to total productivity ($r = 0.318$, significant at $p < 0.05$ level). Product-mix flexibility is achieved by reducing set-up times and change-over times for variety of products made, thereby, reducing lead time and waiting time. Thus, most of the time is utilized in actual production operations, resulting in effective use of resources, thus, increasing total productivity.

Labor flexibility is significantly and positively related with total productivity ($r = 0.287$, significant at $p < 0.05$ level). Labor flexibility is achieved by having people with multiple skills, good education level, and accommodating nature. All these ingredients of labor flexibility would result in better utilization of human resources. This results in the increase of total productivity.

Design-change flexibility is significantly and positively related to labor productivity ($r = 0.279$, significant at



modernized by bringing in CNC machines, and special purpose high production machines. Table 2 shows various types of flexibility values in 1991-92, 1994-95, and 1995-96. The percentage changes in flexibility in 1994-95 and 1995-96 as compared to that in 1991-92 are also

in the plant. The product flexibility increased by 24.39 % from 1991-92 to 1994-95, and by 38.24% from 1991-92 to 95-96.

Table 2 : Flexibility Values

Sr. No	Flexibility	1991-92	1994-95	1995-96	% Change 94-95 vs 91-92	% Change 95-96 vs 91-92
1	Processing	0.6655	0.6671	0.6503	0.24	-2.28
2	Volume	0.4017	0.5835	0.6934	45.25	72.61
3	Product	0.4931	0.6134	0.6817	24.39	38.24
4	Product-mix	0.4366	0.6840	0.7488	56.66	71.50
5	Manpower	0.6711	0.7251	0.7841	8.04	16.83
6	Design-change	0.5043	0.5677	0.6208	12.57	23.10
7	Machine	0.5187	0.5222	0.5018	0.674	- 3.25
8	Planning	0.7251	0.8026	0.8068	10.68	11.26
9	Communication	0.35	0.60	0.60	71.42	71.42
10	Total	0.4857	0.6479	0.7073	33.39	45.629.

shown. Table 3 shows values of various types of productivity along with percentage changes for the corresponding years.

Table 3 : Productivity Values

Sr. No	Flexibility	1991-92	1994-95	1995-96	% Change 94-95 vs 91-92	% Change 95-96 vs 91-92
1	Equipment	25.76	54.121	53.64	110	108
2	Manpower	3.782	5.864	6.004	55	58.75
3	Material	4.55	5.75	5.27	26.37	15.8
4	Energy	12.469	14.24	16.01	14.2	28.39
5	Total	1.178	1.328	1.304	12.73	10.69

Status and Trends of Flexibility

Changes in various types of flexibilities that have occurred in Goetze (I) Limited, Bahadurgarh plant are as follows:

Product Flexibility

The company started its operations with manufacture of compression rings and oil rings from standard cast iron material. Lower sharp rings were developed in 1992. In these rings, the bottom side of the ring was given a chamfer of 0.15 mm to provide scrapping edge instead of the usual chamfer range of 0.2 - 0.4 mm. These rings were also specially designed based on the requirement of Escorts company for their top compression ring. In 1995, the company came out with a new type of ring named IKA. The IKA ring is made of CI which is completely heat treated before performing machining operations on it. The IKA ring is very useful for higher loads. These factors have contributed towards product flexibility

Flexibility in day-to-day management of workforce along with focus on flexibility make a lot of contribution towards the goal of achieving flexibility.

Product-mix Flexibility

The ring plant is fully equipped to produce a large variety of rings. Various types of rings manufactured in the plant are compression rings, scraper rings, and oil rings. These rings may be plain rings, chromium plated or molybdenum coated. The plant is also fully equipped to do phosphating or tin coating of the rings, if desired by customers. Another variation is from the point of view of cross-section of the rings. There is a large variation in sizes of rings as well as section of the rings, which contributes to product-mix flexibility. There is considerable variation in share of each type of ring in total production. Till 1995, the plant was using three types of materials for ring production - standard cast iron (STD), cast iron with spheroidal granules heat treated (KV1), and steel. In 1995, another type of material, IKA, was developed. This increase in variety of materials used for manufacture of rings has also contributed to increase in product mix flexibility. Besides these materials, steel (90 Cr Mo V 18) is also being used for manufacturing piston rings for heavy duty high performance engines.

A number of operations. for different variety of rings (whether compression ring, scrapper ring, or oil ring) are being done on same machines. This parameter contributes a lot in increasing product mix flexibility as it is easier to process product mix. The negligible effort and cost required in rescheduling product mix in case of machine breakdown has also led to increase in product mix flexibility. The product-mix flexibility has increased by 56.66 % from 1991-92 to 1994-95, and by 71.50% from 1991-92 to 1995-96.

Volume Flexibility

The plant has considerably enhanced its volume capability over the years by investing in new machines/equipment, and improving upon the existing equipment, procedures, and practices. The production levels have jumped to 13,079,436 in 1991-92; 19,146,134 in 1994-95; and 19,892,911 in 1995-96. There has also been considerable increase in volume flexibility. The acquisition of CNC machinery and equipment as well as special and dedicated machines was aimed to give higher output. The increase in volume flexibility from 1991-92 to 1994-95 has been 45.25% and the increase has been 72.61% from 1991-92 to 1995-96.

Machine Flexibility

Most of the machines used are special purpose machines. Facilities exist for chrome plating and molybdenum coating of rings.



Double spindle honing machines carry two spindles and therefore, two rings can be honed at a time. These machines, to some extent, contribute towards machine flexibility.

The acquisition of CNC double cam turning and CNC splitting machine has been helpful in improving machine flexibility as changeover times have reduced. There is not much change in overall machine flexibility over the last five years. The machine flexibility increased marginally by 0.674% from 1991-92 to 1994-95, and decreased by 3.25% from 1991-92 to 1995-96.

Design- change Flexibility

At present, the company is making nearly 50 types of rings which have different cross-sections. Every year, there are design changes in the rings as per customer requirements. Nearly 30 - 35 new rings are introduced every year which have a different size or cross-section from the existing rings. A high degree of design-change flexibility is present in the system, which is depicted by large product range manufacturing, and design changes incorporated every year. The changes in the design are made as per customer demands.

There has been an increase of 12.57% in design change flexibility from 1991-92 to 1994-95, and an increase of 23.10% in the last five years.

Routing Flexibility

Nearly 80% of the machines installed in the shop are rigid special purpose machines designed specially for performing specific operations on rings, but have the facility of change of tooling, for processing different sizes of rings. This feature of rigid special purpose machines limits the processing flexibility as only one type of operation can be done on a particular type of machine.

The company has recently invested a lot of money in CNC machines. The managers' view point in procuring these machines is mainly for achieving higher level of quality as these machines are being used only for precision work. However, instead of increasing machine flexibility, these CNC machines have indirectly increased routing flexibility as now it is possible to route the rings through conventional as well as CNC machines.

In some cases, the sequencing of operations can be interchanged to tackle machine breakdown. Due to these factors, there is a marginal increase of 0.24% in routing flexibility from 1991-92 to 1994-95, and decrease of 2.28% from 1991-92 to 1995-96.

Planning Flexibility

The planning for production of rings is done by making a master schedule based on the annual demand. The operation schedule is then formulated based on monthly demand. Daily production schedules are finally derived from the monthly schedules keeping the requisite parameters in mind.

The master schedule is made flexible and modifications can be made in it depending on customer needs. The monthly schedules although rigid, can be changed based on urgency from the customers. Sometimes, some particular type of rings can be given priority over others, if desired. Overall the system has the flexibility to change its monthly operation schedules for production planning. With diversification in product variety and product mix, planning flexibility has also increased from 1991-92 to 1995-96. The planning flexibility increased by 10.68% from 1991-92 to 1994-95, and by 11.26% from 1991-92 to 1995-96.

Communication Flexibility

Over the years, the plant had been using the conventional information system. During the last five years, some investments have been made in information management. Some of the functional areas have been computerized. The material purchase section has been computerized and production planning is being managed on computers. It is planned to manage store items especially finished stock through use of computers. The use of computer has led to increase in communication flexibility as now the available information is shared by many persons.

The computers have also been helpful in making planning decisions and modifying them. The use of computers has led to increase in communication flexibility by 71.42% from 1991-92 to 1995-96.

Labour Flexibility

The workforce in the ring plant has decreased from 811 in 1991-92 to 768 in 1994-95, and 746 in 1995-96. The company has been involved in delayering at lower level. Out of 654 workers working at present in the plant, nearly 150 workers have been trained to work on four to five machines in case of worker' absenteeism. The plant has been divided into a number of sections. Within the section, the workers have been imparted training in running four to five machines. This has increased labour flexibility. The company runs training programmes which has led to development of knowledge, skills, and attitudes of the workers and managers. These factors have been responsible for increasing labour flexibility by 8.04% from 1991-92 to 1994-95, and by 16.83% from 1991-92 to 1995-96.

Total Flexibility

The total flexibility has shown an upward trend throughout the last five years period. It increased by 33.39% from 1991-92 to 1994-95, and by 45.62% from 1991-92 to 1995-96.

Status and Trends of Productivity

The equipment productivity increased by 110% from 1991-92 to 1994-95, and by 108% from 1991-92 to 1995-96. The labour productivity increased by 55% from

Building sustainable competitive edge enables the manufacturing system to respond to large number of customers which leads to enhanced flexibility.



1991-92 to 1994-95 and by 58.75% from 1991-92 to 1995-96.

The energy productivity increased by 14.2% and 28.39% from 1991-92 to 1994-95 and 1995-96 respectively. The material productivity witnessed an increase of 26.37% from 1991-92 to 1994-95, and an increase of 15.8% from 1991-92 to 1995-96. The development of new material IKA has decreased material productivity in 1995-96, as scrap percentage is more in IKA material. Total productivity of the plant increased by 12.73% from 1991-92 to 1994-95, and by 10.69% from 1991-92 to 1995-96.

Future Order of Flexibility Acquisition

From the analysis of the percentage changes in various flexibilities, it is clear that volume flexibility, product-mix flexibility, and communication flexibility are the ones to which the plant is giving priority. The ring plant is producing large volume of piston rings of various sizes and different cross-sectional design. At the same time, number of raw materials are being used for the rings. therefore the plant needs volume flexibility as well as product mix flexibility. At the same time, design change flexibility is also required. By and large, the plant is moving in the right direction by focusing on these flexibilities as is clear from the percentage changes in the last five years. The plant should further focus on design-change flexibility and labour flexibility, as reflected in Figure 1. Design-change flexibility can be increased by bringing changes in methods of design. Use of computer software like Auto CAD and others increase design-change flexibility. Presently drawings are being made manually. Design-change flexibility will also lead to increase in product-mix flexibility. Labour flexibility can be further increased by conducting training programmes for workers. Another flexibility that needs to be focused is planning flexibility. Planning flexibility will contribute towards increase in volume flexibility. It will also increase material productivity, which declined by 8.34 % in 1995-96 as compared to that in 1994-95. Increase in planning flexibility will also contribute towards total productivity. Total productivity had shown a downward trend in 1995-96, decreasing by 1.8 %. Based on the above discussions, the plant needs to focus on various types of flexibilities in the following order:

- i) Volume Flexibility
- ii) Product-mix Flexibility
- iii) Design- change Flexibility
- iv) Labour Flexibility
- v) Planning Flexibility
- vi) Product Flexibility
- vii) Routing Flexibility
- viii) Communication Flexibility
- ix) Machine Flexibility

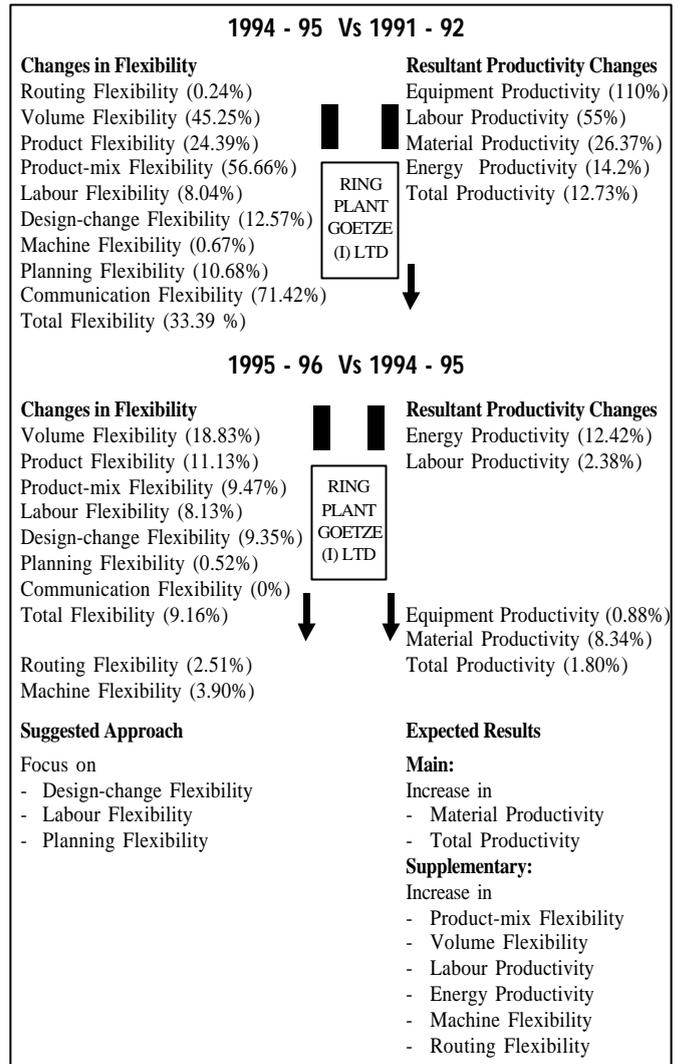


Figure 1 : Trends of Flexibility and Productivity and Suggested Future Approach

SAP Analysis

SAP (situation-actor-process) analysis has been carried out to determine the approach adopted by the enterprise for managing flexibility. SAP analysis (Sushil, 1994, 1997) is a method of analyzing case study. In SAP analysis, the case has been described through three basic components (situation, actor and process) that define the dynamic interplay of reality. From the analysis, learning issues have been explored.

Situation

- Ring plant of Goetze (I) Ltd. is the largest firm dealing with production of piston rings.
- Increasing demand for higher production and design-changes in piston rings.
- Ring plant involved in building its own technology base.

Main Actors

- Managing Director of the plant as the key-decision maker.



- Top management executives as a dedicated lot.
- Employees of the firm as highly motivated workforce.
- Competitors as technology gatekeepers.
- Goetze Werke, AG of Germany as technology providers to the plant.

Process

- The company went in for technology upgradation by acquiring high production machines as well as CNC machines.
- The company went in for developing new material for rings.
- Adapting the acquired technology to local conditions to make the technology more effective.
- Developing training centre for training of employees.
- The company developed technology for chrome coating, and molybdenum coating of piston rings to gain competitive advantage over others.

Learning Issues

- Acquisition and adoption of state-of-art technology may not necessarily lead to increase in machine flexibility. It may however contribute towards increase in other types of flexibility.
- Education and training of workforce plays a vital role in increasing manpower flexibility.
- Flexibility in day-to-day management of workforce along with focus on flexibility make a lot of contribution towards the goal of achieving flexibility.
- Adapting the equipment and machinery to local conditions by bringing changes in them increases product mix flexibility as changeover times are reduced.
- Building sustainable competitive edge enables the manufacturing system to respond to large number of customers which leads to enhanced flexibility.
- Delaying in the system leads to better internal flexibility of the plant.
- Increase in volume flexibility contributes towards energy productivity, as with increased volumes, energy required per unit of product decreases.
- Labour flexibility leads to improvement in total productivity due to better and effective utilization of resources.

Delaying in the system leads to better internal flexibility of the plant.

- Communication flexibility leads to increase in total productivity as by having higher communication flexibility, the capability to respond quickly increases.
- Higher routing flexibility contributes towards material productivity as work-in-process decreases with routing flexibility.
- Product-mix flexibility contributes to increase in total productivity.
- Design-change flexibility increases labour productivity.
- Product flexibility contributes towards increase in material productivity.
- Planning flexibility leads to better utilization of equipment, thus increasing equipment productivity.

Conclusions

Flexibility is a multi-dimensional concept. Flexibility is required to respond to uncertainties and changes. There are various types of flexibility namely routing, volume, product, product mix, labor, design change, machine, planning, communication and total flexibility. A particular type of flexibility can be measured taking into account the weight of various parameters contributing to it and the response of an enterprise to these parameters. The paper highlights the fact that it is possible to manage flexibility keeping productivity in mind as different types of flexibility have significant relationship with various types of productivity. However, the type of flexibility to be acquired will also depend on the present levels of flexibility, cost aspects and preparedness of an enterprise to acquire flexibility.

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Appendix I

Various types of flexibility of the company have been measured based on weight of various parameters contributing to a specific type of flexibility and the response of the company to various questions based on these parameters. For example- routing flexibility has been worked out from the response of the company to the questions, set on the following aspects:

- a. Type of machine tools and tooling installed
- b. Purpose for which CNC machines have been acquired
- c. Ability of the manufacturing system to incorporate continuous improvement in productivity, quality and reduction of cost.
- d. Number of major changes made in process design in the past.
- e. Number of minor changes made in process design in the past.
- f. Amount of buffer stocks of materials kept on machines to accommodate breakdown.
- g. Ease or difficulty level with which shift of operation from one machine to another in case of machine breakdown is done.
- h. Extent to which sequencing of operations can be changed in case of breakdown of machinery.
- i. Effort and cost needed to reschedule in case of a breakdown.
- j. Rescheduling time required in case of a breakdown.
- k. Extent to which managers cooperate towards any change in the process.
- l. Extent of line balancing in production area.
- m. Type of material handling equipment being used.

To determine relative weights of these parameters, analytic hierarchy process has been employed. Each parameter has been compared with other parameters pairwise. The comparison has been carried out. The comparison was done on a qualitative scale of very low, low, medium, high, and very high as the difference between the importance of two parameters. However the response was written in quantitative terms by converting the qualitative response using the following scale:

Very Low	Low	Medium	High	Very High
1	3	5	7	9

The weight of each parameter towards routing flexibility has been determined by calculating Eigen vector and normalizing it. The contribution of different factors towards routing flexibility is shown as follows :

Weight of Various Factors Contributing to Routing Flexibility

Parameter	a	b	c	D	e	f	g
Weight	0.084	0.037	0.00234	0.017	0.00606	0.00022	0.419
Parameter	h	i	j	k	l	m	
Weight	0.00004	0.2629	0.169	0.0000004	0.0000037	0.007	

The routing flexibility has then been calculated by using the following formula :

$$\text{Routing Flexibility} = (W_x \times S_x / 4)$$

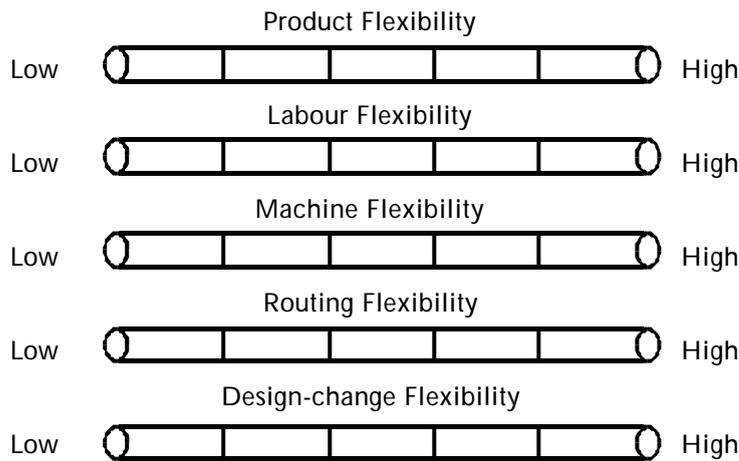
where W_x is the weight of xth factor contributing towards routing flexibility and S_x is the score of question based on xth factor.

Similarly, different types of flexibility have been measured by considering various parameters affecting them. Having measured the various types of flexibility, total flexibility (TF) of the company has been measured.



Flexibility Mapping : Practitioner's Perspective

1. Which variants of flexibility do you envision in a practical situation of a "Managing Manufacturing Flexibility" on the following planes :
 - Flexibility in terms of "options"
 - Flexibility in terms of "change mechanisms"
 - Flexibility in terms of "freedom of choice" to participating actors.
2. Identify and delineate the types of flexibilities in "Manufacturing System" that are relevant for your own organizational context? On which planes does the flexibility needs to be enhanced ?
3. Try to map your own organization on the following continua.
(Please tick mark in the appropriate box(es)).



4. Develop a SAP-LAP (Situation Actor Process-Learning Action Performance) model of "Manufacturing Flexibility" relevant to your organization.

Reflecting Applicability in Real Life

1. What are flexibility levels in your organization?
2. How flexibility can be enhanced in your organization keeping productivity in mind?
3. On what types of flexibility, should your organization focus?





Flexible Organizational Culture: Perception of IT Managers

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Introduction

Various types of flexibility are function, financial temporal, numerical, legal, skills, job, location, work pattern and wage cost flexibility

The new millennium heralds an age of total flux and a scenario of intense competition. Everyday brings forth new challenges, skill sets, information and technologies. To survive the winds of intense competition, organizations need to acquire the right approach. There is an appreciation and adoption of new managerial strategies like strategic management, flexible work culture, job redesign, organizational reengineering etc.

This paper focuses on one of the most popular organizational experiments today, that of flexibility in work schedules in organizations. This study gives the perception of flexibility as a job design paradigm, by IT managers of a famous American IT organization and the perceived problems related to it. It is a study on the correlates of the perception of flexibility by the employee.

Flexibility in management can be of various types, such as functional flexibility, financial flexibility (Atkinson, 1984; Nollen and Gannon 1996) temporal flexibility (Blyton and Morris 1992) numerical flexibility, legal flexibility, skills flexibility, job flexibility, location flexibility, work pattern flexibility, and wage cost flexibility. There are multiple connotations attached to the concept of flexibility. According to Sushil (1997) it implies openness in thinking adaptiveness, to the environment, responsiveness to change, necessity of action contingency, non rigidity, variability of parameters and specifications, multiplicity of process setting freedom, liberalization, informal attitude adjustment, compromise autonomy of function, agility in action, resilience in system, elasticity, looseness, customized or tailor made solutions, and broadening of mind.

The success of flexibility is dependent on attitude of employees, positive attitude for flexibility and approach needed for its success

Success of flexibility practice in the organization is dependent to an extent on the attitudes of the employees towards it. Bernard (1938) expressed the view that a major part of an organization's success depended on obtaining cooperation from its personnel.

The criticism however is that there is a lack of effort in gaining the employees commitment. There needs to be support and positive attitude for the flexibility approach to bear fruits. Flexibility is an excellent example of making human resource planning work for an organization (Ingram, 1998)

Corporate is characterized by short-term contract culture

Prof. Gary. L. Cooper refers to flexibility in the organization as "Americanization of Work." He says that the corporate world today is characterized by short-term contract culture with outsourcing, downsizing and long working hours. According to him the Americanized scenario has (a) Leaner organizations (b) intrinsic job insecurity and (c) long working hours. This has adverse effect on employer attitude and behavior. The problem of long working hours can be managed by using flexi-time but other problems associated with contractual work culture persist. So now the important question is "Can human being cope with permanent job insecurity without the security of organizational structure?" (This culture had an important role in providing training and development to the employee.)

Flexible work culture leads to increased job insecurity, low morale, demotivation and erosion of loyalty

A lot of work is being done to see the relation of flexibility with behavioral variables like organizational commitment, loyalty, motivation, work satisfaction etc. According to Brian Towers (1998), antecedents of commitment include perceptions of fairness, met expectations



and an opportunity to exercise responsibility. The insecurity of the present work environment leads to a transgression of the traditional psychological contract. Guest and Dewey (1991) have reported in their work in the electronics industry in the U.K., that the typical trend is a low employee commitment in a flexible work culture. Morris et al (1993) give a more optimistic picture when they suggest that the right HRM policy and practice can help reduce this trend and increase commitment. For this either the corporate culture needs to be changed or employee involvement needs to be increased.

Flexible work culture leads to increase in profitability and productivity

Anitto Kasvio at the University Of Tampere is working on the changing work culture and development of flexible work arrangements in Finnish companies.

A cohort of 5000 British Managers (2001) were taken in a quality of working life survey. It was seen that flexible work culture led to increase in job insecurity, lowered morale, erosion of motivation, and most important erosion of loyalty, though it did lead to increase in profitability and productivity.

The flexible (contractual) culture as in individualistic work culture neither expects protection nor owe loyalty

If we consider Hofstede's framework of value we can say that countries which are high on collectivism are characterized by a tight social framework in which people expect others to look after them and protect them when they are in trouble. In exchange of this security they feel they owe absolute loyalty to the group. The people of a country high on collectivism (i.e. India, Japan) are predisposed towards such a collectivistic culture and exposure to a different work culture produces inherent contradictions. The individualistic work culture as in flexible (contractual) culture lacks this psychological contract and people neither expects protection nor owe loyalty. These young professionals do not trust the welfare state (example retirement benefits) as the older generation did. Therefore they try to guarantee their professional career and try taking care of personal finances. Impact on social and emotional aspects suggest that these people may develop a certain narcissism in their attitudes which may develop to the "Corrosion of Character" (Richard Sennet 1998). A new category of net slaves may develop (Lesser and Baldwin 1999). When people have developed a strong emotional dependence to their work and work based social relationships they have very little to build upon if they lose them.

Flexibility arouses anxiety not just because it stands on the precipice of the unknown ,but more because it represents a challenge to personal identity. It challenges identity as human beings are integrated whole beings and the short term contractual nature of work goes contrary to a stable identity.

Flexibility arouses anxiety as it represents challenge to personal identity

The worker is more of a consultant. If one is not skilled in the art of consultancy or selling one's labor repeatedly on short-term contract and of living on contract-to-contract, then there are real questions about the hybrid. These new age employees see their career as consisting of short-term projects. They do not seem to be inclined to contribute to the organization development or long-term goals. This does not contribute to the growth and expansion of the organization.

Flexi-time allows everybody to follow his or her own timetable and goals at one's own pace. For example work of 5 different people is to be coordinated and brought together, and achieving this becomes a perpetual problem. In an individualistic culture as in flexible work culture, people are focused on their own goals ,which might not necessarily need co-ordination with others. As a result people are more self oriented and less team and socially oriented. The advantages of working in a team example-creative inputs, speed, lesser burden etc are thereby lost.

Flexible work culture lacks psychological contract

People who have been brought up in a very rigid authoritarian family set up, tend to seek authority and feel lost and anxious in a flexible situation. They perform well when they are told what to do and are given feedback from time to time. Flexible work culture assumes a certain level of maturity and sense of responsibility that might not be necessarily there in the whole population.

Flexible work culture assumes a certain level of maturity and sense of responsibility

In contractual work culture the involvement of the employees with the organization is limited only to their personal work and personal goals. The more a person is involved with an organization greater is the identification with that organization. Since the people are not



involved in other extracurricular activities of the organization their identity is tied only with their own work. This bears on their loyalty towards their organization and growth of the organization. The larger ramifications of this kind of culture are that it contributes to the decline of community because it's through the community that we address and attempt to solve many social ills. Without community networks problem solving will be much more difficult.

Flexi-time leads to communication problem

In a flexible work culture where a person is setting his own goals, or seeking projects as per his own requirements, he may actually reduce individual capacity to earn a wage. All may not be motivated enough to perform at their best and due to lack of high standards the total output of the community gets lowered.

More direct interactions help develop interpersonal ties breaking mental blocks and preconceived notions

Flexi-time leads to communication problem due to unavailability of group members rather than lack of understanding. Most of the communication is done through phones or other search modes. Studies have shown that message content is affected, when the communication is not direct or on a one to one basis. A person may be just "to the point" while communicating through the electrical mode. But in a more direct interaction, people tend to discuss more, which helps in thawing of relations, developing interpersonal ties, breaking mental blocks and preconceived notions. The flexible work culture may foster individualistic culture which alienates people from each other. Decision making is seen to be much slower and a number of work hours are wasted due to late decisions (UMIST 2000). Adjustments to new technology, home environment and cost are some related factors. The flexible work culture banks on new technology to a great extent. Computers, cellular phones, pagers, telecommuting etc. are important elements of this culture. What is important is that the employee must feel comfortable with the technology in terms of its suitability to work habits and style, and should be adequate and cost effective for the work to be performed at/from home.

Decision-making is much slower

According to Dr. John Gundry, through the last decade, the response of the organizations to the need for speed, flexibility, globalization and change is for people to work remotely, in distributed, virtual teams. In an article on m-Commerce, he predicted some key characteristics of the new work culture. (1) Goodbye office-whereby the traditional face to face office will speed up, and physical proximity would be less important than connectivity (Gundry 2001).(2) The second characteristic he predicted was goodbye friends whereby the opportunity for relationships would diminish. (3) Goodbye relaxation, where the 'attention economy' would require the person to be available 24x7 hours of the week. Work is fragmented, frenetic, electronic, and anonymous. Flexi-time allows a person to operate from home assuming that it is more convenient. Surveys have shown that at home, people have even lesser time for work as compared to the 8-9 hours spent on work in the office. Resultingly they try to finish work in a lesser amount of time .This may result in cutting corners, reduced efficiency and lowered standards of performance. The costs in a flexible work culture are high, the costs of technology are exorbitant. The organization needs much more of human resource management staff than ever before. The attrition rate is seen to be very high in this culture. Every time an employee leaves, there are innumerable costs incurred-recruitment costs, training costs, outsourcing costs etc.

New technology, such as computers, cellular phones, telecommuting are key elements of flexible work culture

In an European Survey of 400 companies in 17 countries by ISR (published in 1995), the results showed a substantial decline from 1985-1995 in perceived job security with Britain showing the worst decline in perceived job security dropping from 70% in 1985 to 48% in 1995.

In another survey done by Institute of Management (UMIST England) it was seen that contractual work culture lowered morale and resulted in erosion of motivation. 86% people reported damage in relationships with children, 79% reported damage in relationship with spouse and 68% reported reduced productivity.

The costs in a flexible work culture are high

Flexibility arouses anxiety as people do not know what risks will pay off and which paths to pursue. The employers in a contractual work culture do not feel responsible towards the growth and personal welfare of the employees. The employee too sees the job only as one of a series of more or less temporary jobs and feels less loyal towards it. The anxiety provoking flexible culture poses a threat to the health of the employee. Anxiety leads to stress which may lead to stress induced heart ailments, diabetes, chronic ulcers, headaches, skin disorders,



high blood pressure and even total burn-out of the system. To avoid work insecurities, people work harder which may develop into work holism and burnout at a fairly young age (Lardner 1999).

The anxiety provoking flexible culture pose a threat to health of employee

Different cultures are high on collectivism and power distance (Hofstede 1980). According to Hofstede some cultures are high on collectivism and power distance and thus are predisposed towards some particular kind of authority structure. Total flexible culture goes contradictory to such dispositions and may not be facilitative. With increased cultural diversity at the workplace, the management needs to consider the different cultural dispositions and have orientation programs focusing on this subject. Based on the aforesaid factors the design of the present case study has been developed.

Methodology

Design of the Study

This study is focused on IT organization

A structured, open interview was conducted on employees of a leading information technology organization based in Delhi and case studies were developed. The reason for conducting interviews was that we attempted to get some rich qualitative data on the subject which would lend insights for an in-depth psychological analysis.

Sample, Rationale and Field of Study

An attempt was made to develop case studies based on structured interviews of ten managers of an information technology organization. The study focused on IT organization as different types of flexibility are practiced in the IT sector all over the world. In the IT sector, projects may require a high degree of coordination but flexi time practices seem to be counter-productive at this point. Therefore, flexible culture when analyzed from a work design perspective needs to consider many factors. Focus needs to be put also on individual differences in perception of effects of this new trend of flexibility from the point of view of the employees on whom it is being practiced.

Interview Schedule

Questions were asked on different issues like- coordination, loyalty, identity, perception, work climate etc.

The interview schedule is based on review of literature (presented earlier in the paper). Eleven questions related to the different issues like coordination, loyalty, identity, perception, work climate etc were included in the schedule.

A content analysis of the data was done. In the discussion part, a section analysis is presented.

Ten open ended questions (given in appendix I) were asked related to employee perception of flexible culture.

Discussion

Analysis of Results

Majority responded positively towards flexibility in their organizations

The results show that in all the cases studied, the managers agree to the positive aspect of flexibility. Going through the contents of the qualitative data it can be said that by and large people have a positive response towards flexibility in their organizations, but they did have some reservations. To gauge whether the positive response is a deeply entrenched attitude towards the practice of flexibility or just a tendency of flowing with the trend, an attempt was made in this paper to do an in depth study of the perceptions of the employees

In this new work culture, the employees owe loyalty first to his work then to the organization

All the managers were aware of flextime and some even mentioned about flexibility in the nature of work, for example, freedom to set one's own goals, follow one's own ways and pace to achieve them. One respondent even mentioned about dress code flexibility.

4 out of the 10 case studies of the managers considered themselves as both, a professional and a member of an organization. But 6 out of 10 case studies considered themselves as professionals. Studies have shown that flexible work culture may lead to increase productivity and profitability but it also leads to erosion of loyalty (UMIST 2001).



Flexible Organizational Culture: Perception of IT Managers

New age worker is rarely bothered about long-term goals and development of the organization

The traditional bureaucratic organization is yielding its place to the new order. The original psychological contract of the traditional systems was a multifaceted relationship where the employee owed utmost loyalty to the organization and the organization provided it with security. An in depth content analysis of the qualitative responses of the managers pointed to the fact that in the new culture the employee owes loyalty first to his work then the organization. A 'symbiotic' relationship does exist but on no uncertain terms.

Coordination is major handicap in this culture

The new breed worker is focused in his priorities and goals. The responses reflect a certain level of calculation on the part of the employee that is, if the organizational goals would help him achieve his personal goals. The case studies do depict a sad state of the present scenario of this breed of pedigreed new age worker who is rarely bothered about the long-term goals and development of the organization.

This culture does not foster team spirit

Seven out of the 10 case studies agreed to it that coordination is a major handicap of this culture. People have different time tables and getting together may be a Herculean task. The organization did not have a core time when all the employees could be present. People came and went as and when it suited them. A major issue seems to be emerging out of these findings, that this culture does not foster team spirit.

Relationships amongst the managers were not very strong. In 8 out of the 10 cases studied, managers reported that their relationships were not that strong with their colleagues in this culture. Two of them strongly felt that they missed the strong friendships. One of the respondent reported that she missed the smiling faces early in the morning. She said an empty office robs a bit of the verve and excitement. People do not have strong relationships with their colleagues and this can be due to the lesser degree of contact in the new work cultures. This factor can be strongly related to team spirit in an organization. People in the Indian set up are more predisposed towards collectivistic culture and they look for those close knitted relationships in their work settings as well.

No strong relationship with colleagues

The question 8 (see Appendix I) is strongly related to the psychological factor of involvement and identity with the organization. Only 2 out of 10 managers reported that they were enthusiastic about extracurricular events in their organization. Such events reflect the degree of involvement and identity of the employee with the organization. It is really sad to see the old family ties of the organizations breaking down and a certain alienation of the individualistic culture setting in. To foster team spirit organizations need to make extra efforts to get people together from time to time.

The organizations give people the choice to work at home because it could be less stressful as performance would be better, but the million dollar question is 'Is performance better in home surroundings and do people want to work at home because it is better or due to some other reason?'

People prefer to work from home due to ills of commuting rather than benefits of working at home

It was an interesting finding to see 5 out of 10 people considers home more distracting and 2 felt working at home more comfortable. One of the respondents had even hired a room near her house as home was very distracting and office was too far away to be reached everyday. People reported that commuting was the major drawback of working at the office. When given a choice if they stay back it is more because of the ills of commuting than benefits of working at home. One of them even suggested that the organization either hires small branch offices in various areas of the city or pays for the rooms hired by people. The results point towards an interesting facet of flexi-time.

Most of the people found the concept as, 'trendy' and 'with the times'. If we do a psychological analysis we can say that people are generally accepting about a concept-it is only when you prod and go deeper do you find various under currents.

On outer observation people seem to be accepting this culture but there are reservations which is seen when deep analysis is done

Most people found coordinating difficult and the management needs to look into it or else people feel cheated, when they see themselves as more committed and regular. Some even suggested that the management helps them hire small offices near their residence to work to avoid commuting. One of the employees even found the idea of absence of a dress code very disturbing-this can be linked with our link with our colonial past.



These interviews were conducted to collect rich qualitative data as not much research has been done on the demerits of this new culture. People seem to be pleased by the perceived benefits of this culture. It gives them a sense of autonomy which is very satisfying (Herzberg 1969). But the flipside is the marked decrease in security. The psychological contract is very weak and people are working for personal gains and goals. It would be very presumptuous on the part of the organizations to believe that this calculative worker would bother about the growth of the organization or even stay with the organization in the face of better options. They see themselves as professionals selling their expertise to the highest bidder. There is a total corrosion of character. They develop strong dependency on their work alone (Sennet, 1998).

*This culture is turning
people into great worker
less of human qualities*

People find coordinating with the teammates in this alienated culture very difficult. The Indian worker seems to be missing the family culture. He is trying to adopt the new culture without complaining of his personal yearnings for close human relationships. It would not be an overstatement to say that this contractual work culture is gradually churning out humanoids who are great workers but they lack the human qualities of loyalty, altruism, belongingness and commitment.

People reported to be very satisfied with the practice of flexi-time. None of the organizations had a very organized system of flexi-time. There were no clock cards or core time. People could come and go anytime that they wanted and could take an off whenever they wished. The organization seem to be crediting the employees with a very high level of maturity and personal management. One of the respondents confessed that she finds time management very difficult. When given a choice she tends to take time granted and stretches the work along a longer time continuum. Another of the respondents was very expressive about his reservations. According to him the Indian worker should not be credited with the amount of maturity with which the western worker is, and should not be given so much freedom as it tends to be exploited! This can be linked to the legacy of the colonial past of the country and the tendency is to be governed and monitored. According to Brian Towers (1998) at the managerial level ideas about a new psychological contract become more widespread and individuals are expected to be more self reliant in managing their careers rather than rely upon the company to provide the traditional career path. In this context the workers who are belong to the old school of thought and expect a paternalistic role exhibited by the organization would feel lost and out of place. Where as workers who are more resilient, would feel more comfortable but their commitment would be more to their work than the organization. If the organization provides newer development opportunities with challenging work, and have greater career marketability, then the employee commitment to the organization may be increased.

It requires long-term actions and well planned human resource management policies which have a reciprocal nature of commitment, for trust and employee commitment to crystallize into a more permanent feature of the organization (Towers, 1998).

Conclusion

As Senett (1989) comments, “without a bureaucratic system to channel wealth gains throughout a hierarchy, rewards gravitate to the most powerful. In an unfettered situation, those in a position to grab do so. Flexible work force is goaded onward by those who seek power”.

Anthropologist Stud Turklin in his book 'Working' says, “work is about a search for daily meaning as well as daily bread, for recognition as well as cash, for astonishment rather than torpor in short for a sort of life, rather than a Monday to Friday sort of dying.” In this millenium the employers should reflect on where they are going, what that would mean for the employee and society in the future (Corrosion of Character-Sennet 1989) and try to action their often espoused but rarely implemented belief “our most valuable resource is our human index'. The individualistic culture is turning the individual into a self centered isolated machine.

This study had attempted to gauge the perceptions of the employees as regard the flexible work culture. The employee seem to be satisfied with the aspect of, flexibility of time but are not very satisfied with the social aspect of their work life. Most of the people do not see

*This kind of culture is
turning individual into a
self centered isolated
machine*

*Employees not satisfied
with social aspect of life in
this work culture*



themselves as members of their organization and do not see their membership as an extension of their identity. This has serious psychological ramifications which the organization needs to think about.

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Appendix I

- The open ended questions asked in the interview were as follows.
Question (1) How do you categorize flexibility on a three point scale?
Question (2) What are the different kinds of flexibility which are practiced in your organization?
Question (3) How do you see yourself ?
Question (4) If an employee has to take a long break (ex.3-4 months) due to some personal crisis then how much would the organization support?
Question (5) Are you concerned about the long-term goals of your organization?
Question (6) Do you find coordination with your team mates difficult?
Question (7) How strong are your relations with your colleague in this culture?
Question (8) How enthusiastic are you if there is an extracurricular event in your organization?
Question (9) As compared to office how distracting/comfortable do you find working at home?
Question (10) Do you see any demerits in this flexible work culture and what are your suggestions for improvisations?





Management of Refereed Content Generation and Utilization for Formal Higher Education

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Overview of the Kerala Education Grid Project

Several government agencies working to set up countrywide educational service network

Ministry of Human Resources Development, All India Council for Technical Education, University Grants Commission, ERNET India and several other agencies of the Government are working towards setting up a countrywide educational services network through several associated programs, such as National Programme for Technology Enhanced Learning (NPTEL), broadband connectivity for education and ISTE initiatives in developing learning materials. The Kerala Government has taken the major initiative of Kerala Education Grid Project with plans to link the institutions of higher education through a collaborative knowledge network of education servers over the Internet. The Department of Higher Education [DHE] of the Kerala Government and the Indian Institute of Information Technology and Management – Kerala [IIITM-K] took the steps to launch the Kerala Education Grid as a state-level plan initiative. The Governing Council and an Apex Project Coordination Unit [APCU] of the project have been constituted through necessary Government orders. This approach paper is being proposed following the discussions and views of the project member-experts and officials of the Governing Council and APCU.

Kerala education grid project is a major initiative of the Kerala government

In the context of Web-assisted education over a network of academic and research institutions, several issues arise. To appreciate the issues, we briefly describe below the features and approach of the Education Grid Project.

Course specific refereed and recommended content

1. The participating colleges will be linked over a statewide Education Network. Each college will host an Education Server with learning management system (LMS) collaboration tools, groupware, digital library and e-publishing facilities.
2. Premier institutions such as NIT – Calicut, Cochin University of Science and Technology (CUSAT) – Kochi, College of Engineering (CET), Kerala University and IIITM-K – Thriuvananthapuram will each host an Education Grid Resource Centre [EGRC]; IIITM-K will host the Education Grid Operations Centre [EGOC] that coordinates the entire project.
3. The project is steered by an Apex Project Coordination Unit (APCU) of academicians, experts and key officials such as Directors of Technical and Collegiate Education. A Project Governing Council chaired by the Principal Secretary Higher Education will monitor and oversee that policy and monetary inputs to the project are forthcoming.
4. Each course that is taught formally in the various colleges across the universities or different institutions (starting with Engineering and Sciences disciplines) will have course specific refereed and recommended content. There will be specific teacher orientation and assistance for scheduling of course events such as sequence of topics covered, mid-term and end-term examinations, tutorial and practical, assignments and discussions, etc.
5. Each course content and collaboration environment set over an intranet of Course Knowledge and Collaboration Space (CKCS) over internet. These will be supported by digital library and pedagogically effective management. Each CKCS will also manage a portal for interaction with the outside world.



A Pedagogic Framework for Web-enabled Courseware

Richer methodology than the traditional printed methodology

In contrast to the traditional printed, IT facilitated methodology is richer in both the presentation format and ability to incorporating course management processes.

There are several pedagogic frameworks available with considerable overlap in their approach and scope. Our traditional classroom - examination centric approach is one of these. B.F. Skinner's personalized system of instruction is well suited for mentor assisted self-paced learning through self-study. David Merrill [www.id2.usu.edu] describes a few pedagogic models including such ones as the *Problem Based Learning* [PBL] or *Pebble in the Pond* models. In recent years, the *problem based learning* approach appears to be gaining in popularity for Web-assisted learning in formal instruction. It is possible for us to mix the different pedagogic models in a learning situation.

Mix of different pedagogic models can be used

We shall describe how we can structure the different components of content with reference to the pedagogic PBL model. Merrill provides the model shown in Figure 1. to illustrate this. It is assumed that a course syllabus consists of a series of Learning Modules (LM). In a semester long course, we teach typically 10 - 12 modules. A module is covered typically in 2 to 4 lectures, a tutorial for case studies and examples, associated exercises, a test and if needed some practical. The above figure refers to the five pedagogic components that we need to have in a typical learning module. The purpose of each of the 5 components is stated here.

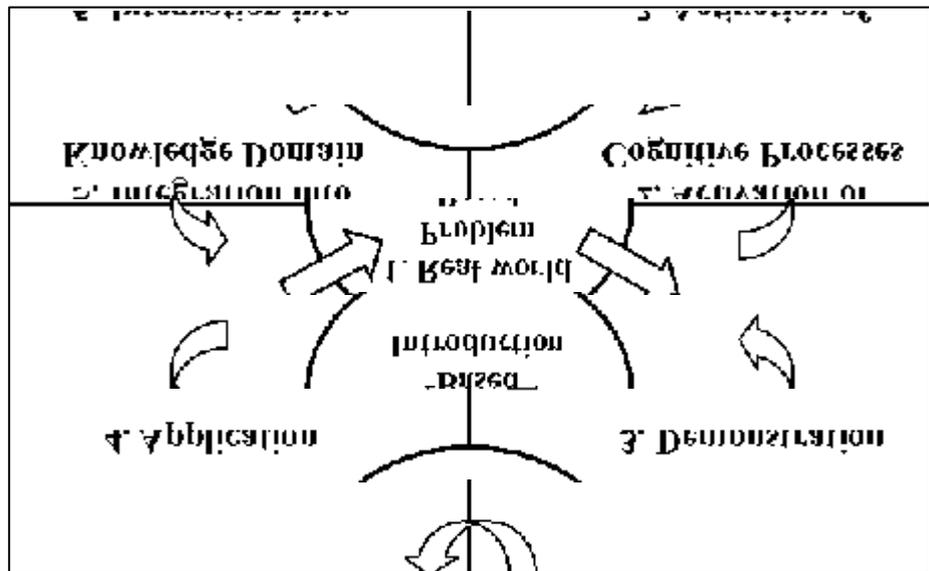


Figure 1 : Merrill's Pedagogic Components in Problem Based Learning

Real-world Problem Based Introduction

Motivate students by problems related to a real-world scenario

The first step is to motivate the students by showing how the problem or topic under discussion is related to a real-world scenario. Thus, for example, if we are teaching the solution of second order linear differential equation, we should show where such equations arise in the real world - as either an exact or as approximate description of some reality.

Here we must state clearly what the instructional objectives of the learning module are. This will help students focus their learning effort in conformity to the instructional objective.

It will be highly motivating if we add anecdotal information relating to the topic, or how historically the problem was taken up and the solution approaches evolved.

Activation of Cognitive Processes

The objective is to trigger the thinking or cognitive processes

The aim of this component is to trigger the thinking or cognitive processes of the learner from the prerequisite or preparatory level of the class and in ways that improve the efficiency and quality of efforts in teaching and learning. The spirit is to communicating effectively the nuances and essential descriptive knowledge components of the topic covered in the module. The key aspects of this are.



Adequate emphasis on communicating the approach to the topic

- (i) Problem description or statement
- (ii) The model and assumptions behind the solution
- (iii) Communicating the approach to the topic: Most students can understand or appreciate the overall approach of solving a problem. But, it requires sincere efforts to master the nitty-gritty of steps that lead of the solution, or gain the insight that is set forth as a concept. Often the lack of association among the model, assumptions and the approach to the solution raises most of the doubts in minds of the students. Hence adequate emphasis needs to be given for this part of the content. If possible we may include a video clip from the best of teachers in the linked content to emphasize this aspect.
- (iv) The descriptive part as we see commonly in the textbooks. This needs to be tempered at the level of preparedness of the class. If this proves to be voluminous, it may be pointed to sections of recommended books or papers.

Demonstration

Demonstration of how theory is applied in practice

Once the specifics of the problem, model and solution approach are communicated and taught, the next logical step is to show how the theory is applied in practice. We do this by examples, case studies, practical, web-based illustrations and demonstrations, through java applets, etc. We also emphasize the different ways in which the concepts that are taught are applied under different problem scenarios.

Application

Application is exercise or homework normally given

The application part is reinforced through exercises or homework. The web as a medium provides useful multimedia and interaction (as in self-test) capabilities to enrich this component of the learning activity. It will be useful if students too are enabled to submit solutions to assignments online and in web-based solutions format if necessary. We may add a Self Test for the module that will assist discovering oneself how well one has understood, and what knowledge gaps exists in one’s understanding.

In practice and to have a head start, it is best we begin posting solutions to the examinations of the recent past, homework and allow for release of solution after a time delay. This will attract the students and help build question banks. Here again referees may screen the quality of questions chosen so that the repetitive grind of questions that do not lead to some insight is kept within bounds. A well-designed computer evaluated objective type self test should help the students to test the understanding of key application or knowledge components pertaining to the learning module. Such test should be aligned with the instructional objectives set for the modules.

Integration into Knowledge Domain

This Model addresses the need of both weak and bright students

Through the components described above, it is ensured that the students have been taught well. We need a part to challenge the students to check themselves how well they have internalized or assimilated the learning objectives. This is best done by challenging the student to apply what has been taught into areas somewhat outside the syllabus and provoke the student to extend the concepts. Challenge Problems (that help discover one’s assimilation and mastery of what is taught) and related examples or problems in other subject areas address such trans-subject learning experience. This part need not be evaluated. But it helps motivated and bright students as a pointer to things outside of the syllabus. It is provided as self or group study material to help measure how well one has internalized the lesson.

The Value of the Five-component Pedagogic Model for Content

A relook at the five components presented above shows that the first Real-world Problem based introduction is targeted at both the teacher and student; the second activation part and the third demonstration part are primarily oriented to the teacher’s efforts, the fourth and fifth components are aimed predominantly towards the students efforts. In all the five we must always keep both parties in mind.

Our traditional education system does not pay special attention to the very weak or the very strong students. The former fail and dropout and latter get bored. The five-component pedagogy model addresses the need of the very weak through Real-world problem based



introduction (with pointer to refresh prerequisite material) and demonstration and very strong through integration into knowledge domain.

Supplementary Content and Course Management Functions

The five components of content briefly stated above provide a well-organized skeletal structure for E-Courseware within a module. When we place this courseware at the colleges, we also need to ensure that the course management and teachers' mentoring processes are in place to help conduct the course efficiently. Typically, these are helped by the following additions to the content.

- (i) Syllabus, prerequisites, target learners group, learning objectives, and formal credit attached to the course.
- (ii) Schedule and sequence of activities (number of lectures, tutorial, practical, group work, self-study, etc. and their sequencing) related to each module.
- (iii) Teacher's material, power point presentations, approach to the topic, highlighting key concepts and their explanations, etc.
- (iv) Online quiz or test for the module.
- (v) Associated Module / Course-specific Portal with Digital Library and links to sites outside, including those related to industry.
- (vi) Links to relevant popular journal articles, and content areas of similar courses in other institutions, historical papers on the subject and information on industry or profession that uses the ideas.

The Content Quality Metric for E-courseware

Having stated the five pedagogic components of content for a given module and the supplementary part of content in earlier sections we develop a refereeing and rating process for E-Courseware. We call this rating as the Content Quality Metric (CQM). This CQM is necessary to provide a periodic health check on the quality of E-Courseware and assess its worth in placing it for the formal education. Secondly, CQM helps build and maintain an active database of the large number of modules with attendant configuration management and version control functions. Thirdly, without a CQM type tracking approach, it is difficult to make E-Courseware a formal part of the university processes.

The approach to CQM is straightforward. We examine each of the five pedagogic components of content as given in earlier section, namely (i) real-world problem based introduction (referred as introduction), (ii) activation of cognitive processes (refer this simply as 'Activation'), (iii) Demonstration, (iv) Application and (v) Integration into knowledge domain (referred as 'integration'). Merrill recommends a star rating for each of the module. A course having all in good condition is given 5 stars. He further suggests that each be given one of 3 types of stars - Gold, Silver or Bronze. Instead of star, we may give each of the 5 components of a module the CQM rating as a single numeral. An example of how such a rating can be assigned is illustrated in Table-1 pertaining to the first component.

It may be noted from Table 1 that it is broadly in conformance with Merrill's model of rating as passable (bronze), good (silver) and excellent (gold). We have put together some explicit details of items that constitute the component. This will help E-Courseware authors, the course expert groups and the referees to know what is expected of them and how to work together in the creation and management of the content.

What is given here is a sketch on how to judge the components. The third column need not be linearly mapped to the second by a referee. The second column is indicative of the details of such content that enhance the learning experience of the student. In ways similar to the first component, we may give a CQM value to the other components as per Tables 2-5.

The term 'bisociation' in the last part of the Integration component refers to the word Arthur Koestler coins to explain the capacity for associating two seemingly different subject areas by the similar underlying paradigm that may have been evolved in the module. It may not be relevant for every kind of module. It is important and interesting to note in all the five components of the module, good to very good rating is achievable without recourse to complex multimedia or expensive simulation type content.

Teacher's mentoring processes to help conduct the course efficiently

Refereeing and rating process of e-courseware called CQM

CQM helps in periodic health check on the quality of e-courseware



Table 1

Component Title	Basis of rating	Value of Metric
1. Real-world problem based introduction	a) Absent	0 (poor)
	b) Inadequate	1 (poor)
	c) Is it textually stated well and does it relate to a real world scenario?	2 (satisfactory)
	d) Above + clear statement of learning objectives.	3 (fair)
	e) Includes quality statement of prerequisites and links to such prerequisite content in the links to the digital library and literature.	4 (good)
	f) Includes refereed pre-diagnostic test.	5 (very good)
	g) Real world scenario is illustrated well using quality visual, flash or applet material.	6 (high quality)
	h) Includes anecdotal and historical information with links to classic papers in the area.	7 (excellent)

Table 2

Component Title	Basis of rating	Value of Metric
2. Activation of cognitive processes	a) Absent	0 (poor)
	b) Inadequate descriptive content	1 (poor)
	c) Plain description of the model, problem to be solved or method.	2 (satisfactory)
	d) Clear statement of assumptions, and how it is related to the model or method.	3 (fair)
	e) Communicating the approach: How the solution or method is evolved, why the approach is taken.	4 (good)
	f) Quality notes (in printable form or with pointers to relevant textbook sections) and rich illustrations on the approach to the problem and the method.	5 (very good)
	g) Summary video lecture by eminent faculty on the module.	6 (high quality)
	h) Quality graphic and multimedia illustrations that add value to understanding the method and its corollaries.	7 (excellent)

Table 3

Component Title	Basis of rating	Value of Metric
3. Demonstration	a) Absent	0 (poor)
	b) Weak illustrations, examples.	1 (poor)
	c) Fairly worked out examples.	2 (satisfactory)
	d) Examples worked out in close relation to 'Activation' content.	3 (fair)
	e) The worked out solutions explicitly articulate the underlying assumptions and the difference between the assumption and reality.	4 (good)
	f) Case studies added.	5 (very good)
	g) Interactive examples for practice	6 (high quality)
	h) Multimedia / simulated content and links to sites on how the ideas are used in industry or in the field concerned.	7 (excellent)



Table 4

Component Title	Basis of rating	Value of Metric
4. Application	a) Absent	0 (poor)
	b) Weak, problem set.	1 (poor)
	c) Acceptable problem set with worked out solutions.	2 (satisfactory)
	d) Quality problem set in close relation to 'Activation' content.	3 (fair)
	e) Worked out solutions with explanation for crucial steps.	4 (good)
	f) Self-test that helps assess one's knowledge gaps in understanding.	5 (very good)
	g) Group and simulation exercises, improve cooperative problem solving among small groups of learners and/or practical/lab exercises.	6 (high quality)
	h) Java applets based interactive or simulation exercises.	7 (excellent)

Table 5

Component Title	Basis of rating	Value of Metric
5. Integration (to test how well the learner has internalized and can apply to real life situations in related areas).	a) Absent	0 (poor)
	b) Weak statements of application in real life situations.	1 (poor)
	c) Real life problem situations in the field or related area where the idea is applied.	2 (satisfactory)
	d) Links to industries, sites with brief description on how the concepts are applied.	3 (fair)
	e) Interpreted real life examples on how well the model or method taught helps address the problem.	4 (good)
	f) How extending the concepts are made possible by relaxing the assumptions to address better real life problems.	5 (very good)
	g) Pointers to advanced courses in the area and links to certification courses and other such areas that help the learner in making a career in the area.	6 (high quality)
	h) Pointers to current journal papers in the area; a flavour of 'bisociation' as to how when the idea here applied in an alternative subject context leads to solutions.	7 (excellent)

Fair assessment by CQM vector rating

As an example of how the CQM helps, let us say a learning module has the rating 2 - 4 - 3 - 5 - 2. In one stroke the metric tells the following: the LM has (i) satisfactory or usable problem based introduction; (ii) good descriptive part that communicates effectively the approach to the problem; (iii) better demonstration, case studies, etc.; (iv) very good home work and self-test to help check learner's understanding; and (v) satisfactory integration part that challenges the learner's capacity to apply what has been taught. Thus CQM allows for a fair assessment of the different dimensions that constitute the codifiable parts of learning processes.

Role of Course Expert Group

Course expert group (CEG) of three faculty from best available in the subject

Education Grid envisages the setting up of Resource Centres in premier institutions that have good faculty. In each subject area at a given level (say UG core, UG elective, UG senior and PG) the project will identify a Course Expert Group (CEG) of three faculty (from the best available in the subject) and associate a Resource Centre (EGRC) for the content development. The CEG will identify the courses to be taken up for content development and come up with the syllabus broken appropriately into modules. This is submitted as a proposal for funding by the project for content development.

Once a Course Development Proposal is received, it is scrutinised and funds for its development will be given from the project. The CEG will be rooted in one of the EGRCs and may co-opt experts and eminent faculty from anywhere in the country to help develop the course. EGRC will be adequately equipped with the tools for content development and web-hosting servers.

Financial Viability of Education Grid

Price for courses with good content rating

In the long run we propose to the APCU that a course with minimum good content rating in at least 70% of the modules will be placed in the colleges for a price. For each student taking such a course, the user college will be asked to support the Education Grid activity through a levy of INR 200 per student per course. Economies of scale show the following. Suppose we address 5 lakh students, each talking 10 courses in a year. Let us say 10% of the courses are mature enough within one or two years for service charges. The collection at INR 200 per course amounts to INR 10 Million per year. Over time as more courses mature, the collection will be several times higher. This is for Kerala alone. At national level, the collection will be at least ten times higher. Out of this collection, a part, say 25%, will fund the college's IT infrastructure servicing and teacher's training. The remaining will be ploughed back to support content development, maintenance activities and network services under the Grid. This will ensure that the Education Grid becomes self-sustaining in the long run.

What is the Course Knowledge and Collaboration Space?

Maintaining CKCS consistently, a major challenge to the Education Grid Project

The way the diverse component activities are proposed to be maintained across geographically distributed institutions is to establish and maintain Course Knowledge and Collaboration Space (CKCS) for each course. A major challenge of the Education Grid Project is to establish and maintain this CKCS consistently in the respective Education Servers of the participating colleges. This space is figuratively shown in figure 2. What the figure implies is that such a well maintained information and collaborative space with refereed content as explained in earlier section and supported through processes by the CEGs as stated in earlier section for each applicable course will be made available through the college Education Server under the Education Grid.

Two key assumptions in the approach to content creation and management are that (a) there is a reasonable quality of Internet connectivity across the colleges (this may be solved by requesting ERNET to install and maintain the network) and (b) each college is endowed

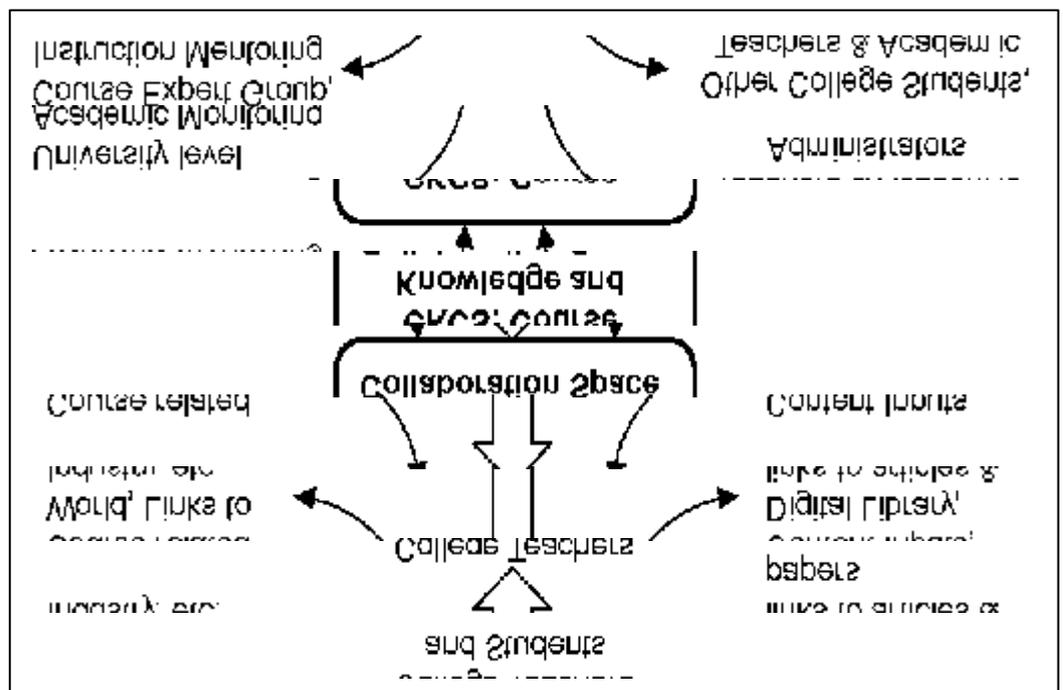


Figure 2 : Course Space as the Meeting Ground of Different Stakeholders

with quality Education Servers and LAN based access. The servers should have (i) Learning Management System and (ii) Groupware with Collaboration tools to provide distributed Intranet support for the course experts, mentors, referees and teachers across the colleges. The servers should also support adequate digital library and e-publishing facilities in the colleges.

Choice of Suitable Platform for the Education Grid

Till date a few institutions such as some IITs and IIMs have installed some popular Course Tools packages such as WebCT, Blackboard, Virtual Manhattan (Free Software) or similar ones (almost all from North America). A good comparison of several such tools in the market is available in the site www.edutools.info and in the comparisons therein by Bruce Landon of the University of British Columbia. As standalone web-enabled course servers, these are quite satisfactory. From the education grid point of view we are looking for the following features in the server platform.

- i) Learning Management System
- ii) Groupware and collaboration tools with group specific documents library, workflow support for e-publishing, published documents, directory services, informal knowledge repository, etc.
- iii) Support for recorded multimedia streaming services
- iv) Master Digital Library with personalized library view through links and bookmarks
- v) Grid transport framework that maintains consistency in relevant group spaces and LMS areas across geographically distributed servers
- vi) Low life cycle cost of ownership.

The ready available servers mostly from North America are best suited for expert teachers to establish support their own courses. Except for the Virtual Manhattan, the packages cost (INR 0.5-1 million per year as license fee) makes them expensive for the Indian colleges. Their inadequacy in supporting several of the functions stated above coherently make them inadequate for the Education Grid. In addition, we also look for efficient web-enabled administration of components services, and API type interfaces for custom functions to help develop new components functions by the owners.

It was in the above context a major thrust in developing a new technology class Education Servers was initiated at IIT Kanpur in 1999-2000. The group of IITK developers shifted to IIITM-K at Thiruvananthapuram in May 2001. Augmented by local engineers the group completed the early version of this server by December 2001. By that time IIITM-K became the first fully Web-enabled institute using this package with server farm supporting the diverse kind of services from behind. The new technology class Education Servers are now fully supported by the original developers moving over and forming the first company to be incubated in IIITM-K and now established in Technopark, Thiruvananthapuram.

This new company is called Transversal E Networks (P) Ltd., or TeN for short. TeN has already delivered whole new generation of servers and portals for Education, Enterprise Knowledge Portals and Digital Libraries. The users include IIT Madras, IISc, IIM Ahmedabad, IIITM-K, Indian School of Business-Hyderabad, TCS Corporate, Ashok Leyland, Cochin University of Science and technology, Technopark - Thiruvananthapuram, Aeronautical Development Agency, Regional Research Laboratory - Thiruvananthapuram, Medical Council - Thiruvananthapuram, ER&DCI and several others. The server is being developed further to include the functionalities needed for the management of Education Grid. For details one may visit www.iiitm.ac.in and www.transversalnet.com.

The CKCS over this network of servers is best visualized as one among several such course intranets (or as we call it a transversal network) across the servers in the multiple college and EGRCs and the EGOC. This is shown in Figure 3 below. Each course has three 'Intranets' of services. The first is the Learning Management System (LMS) that is used by the registered students of the class and the instructor(s) in the respective colleges. Common content including the refereed content as approved by the CEG and permitted by the university, threaded discussions boards, FAQs, linked libraries, etc.

Stand alone web enabled course servers such as webCT, blackboard are satisfactory

All functions of education grid are not covered by stand alone servers and they are more expensive as well

New technology class education server was initiated at IIT Kanpur

The group from IIITM-K that created server formed the company Transversal e-Networks (P) Ltd. or TeN

The list of users includes
 IIT Madras, IISc,
 IIM Ahmedabad,
 IIITM-Kerala, Aeronotical
 Development Agency
 and others

The second is the Content Development and Collaboration space. This is like the shadow space behind the LMS part. This is an area for collaboration driven by the respective CEGs and used for refereed content generation, teachers' training and orientation, supplementary informal content exchange and the back-office work for the portal management of the course. The third is the Digital Library and other resources that are accessible and common to all the courses. This can be made very rich by including professional and popular journals in the different subjects, linked libraries, etc.

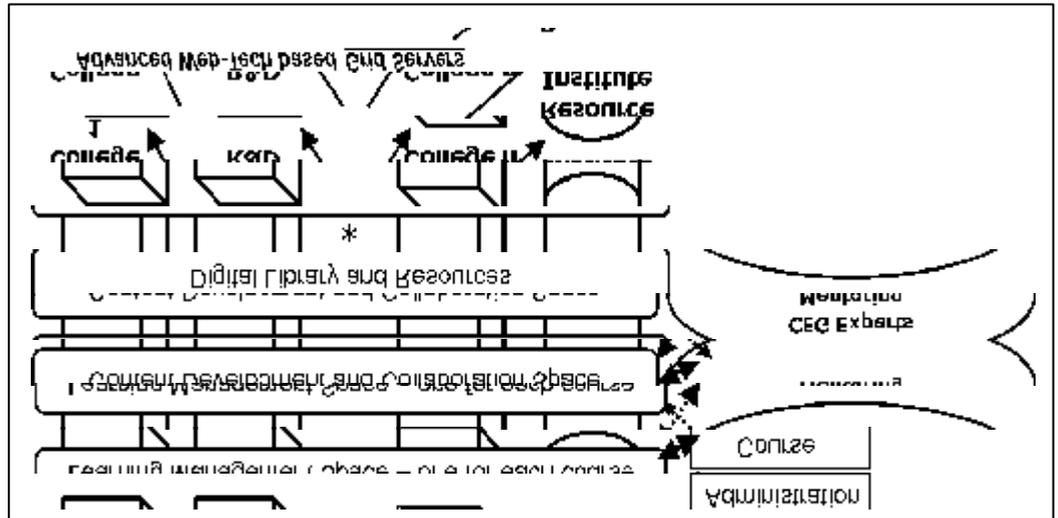


Figure 3 : Course Knowledge and Collaboration Spaces over Education Grid

Place and Role of Education Grid in Formal Higher Education

Access to digital library
 and other resources

The present administrative discipline of the university and colleges system has three layers : (i) Program administration, monitoring and accreditation; (ii) College level curriculum, instruction planning, scheduling and evaluation processes, and (iii) lectures, tutorials, practical and related work. We need a 4th layer in this education hierarchy, viz , the Facilitation Layer with Learning Environment and Content Management processes built into it. In this, the 'across' functions of the colleges under the Education Grid are invoked. These Education Grid functions are fundamental in ensuring the effective use and management of the learning processes and learning environment of the colleges. This four-layer model is illustrated in Figure 4.

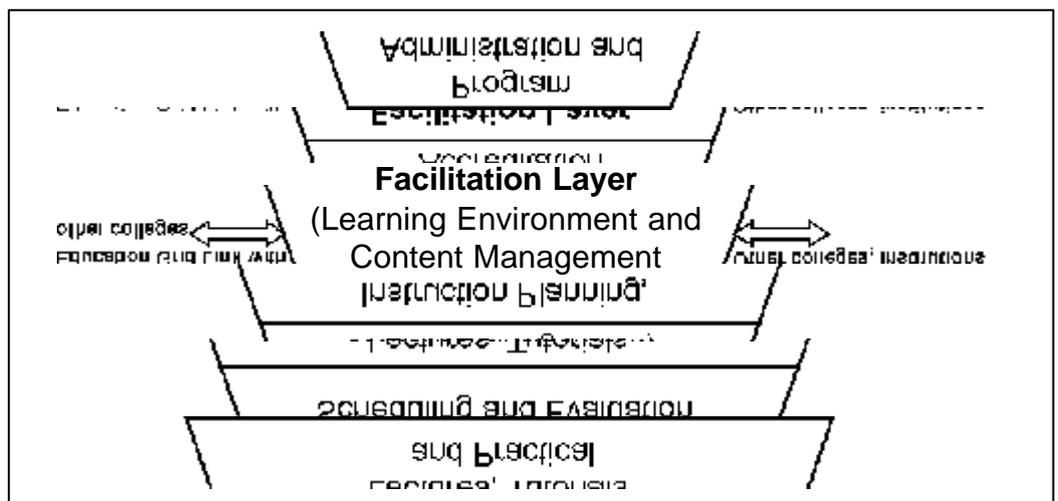


Figure 4 : Layered View of Learning Processes and their Management in Formal Higher Education

We call the Education Grid support services for the Learning Environment and Content Management as the Online Assisted Learning Environment, or, OALE for short. With the rapid expansion and reach of IT and Internet in the colleges, Education Grid has the potential of becoming an indispensable component in the formal education.

However, in the Indian context, the shortage of dedicated quality teachers is severely acute. Hence, we recommend the Education Grid approach for addressing quality education.

Education Grid as Unifying Infrastructure for Higher Education

*Education grid approach
for quality education*

Today, marginal use of web-enabled content in the few institutions that use them is informal and maintained by a few interested faculty by themselves. To give adequate weight to the whole process, the universities, institutions and colleges need to give formal recognition to establishing and maintaining the following processes under the facilitation layer of Figure 4 supported by the Education Grid. This function presupposes that there exists an Education Grid (or equivalently, an Educational Services Centre of an Institute) with formal processes to establish and sustain the OALE functions. The different aspects of the OALE functions are summarised below.

- i) Recognition of Course Knowledge and Collaboration Space that have content of sufficient quality and worth in improving the standard of instruction in the course. This is done by a due approval process through formal sub-committee of Academic Councils in the university/institutional system.
- ii) The above presupposes that adequate content is available through an initial thrust under the Education Grid project. The EGRC's are funded and empowered to develop and maintain the content organized as a set of Learning Modules with refereed CQM rating as outlined earlier. Recently MHRD has launched a major thrust to develop and supply quality content to all the engineering colleges developed by all the IITs and IISc. Education grid complements this effort and ensures that the colleges and teachers are equipped to use this content effectively to enhance the quality of education. This is called the National Program on Technology Enhanced Learning, or NPTEL (see www.nptel.iitm.ernet.in). In the Kerala Education Grid case, the Department of Higher Education has formalized the roles of EGRCs and the administration and coordination role of EGOE hosted at IITM-K. Effective management and policy groups for the Education Grid have been constituted through necessary government orders.
- iii) A set of approved printable materials - notes, homework, case studies, and textbooks, etc. made available for teachers and students to take home and practice with.
- iv) A process of formally registering, assigning, administering and modifying the list of students accessing and using the CKCS by the concerned colleges.
- v) Recommended schedule and calendar of events to be managed over the CKCS. This schedule will help improved synchronisation of the diverse functions associated with management and conduct of the course.
- vi) Recognition and liaisoning with the experts and mentoring team - Course Expert Group, or, CEG - associated with the course by the Education Grid. This group will be a standing body actively involved in assisting the teachers of the different colleges who conduct the course.
- vii) Approved teachers' material, references, classroom assistance, and mentoring network access.
- viii) Course specific teachers training and orientation programs, teachers' evaluation and certification processes.
- ix) Development and deployment of course-specific online assisted examination and evaluation systems.
- x) Course portal management and authoring assistance by EGOE and EGRCs.
- xi) Maintenance of course-specific Digital Library and reference collections maintenance; monitoring of IPR and copyright concerns in the course materials.
- xii) Role and orientation of librarians and academic administrators of member colleges as Knowledge Officers/Managers and administrators of relevant OALE components in their respective colleges.

*Approved notes,
case studies made
available to teachers
and students*

*Course specific teachers
training and
orientation programme*



Role of the Education Grid Resource Centres and Operations Centre

The Kerala Education Grid plans to set up the EGRCs in a few premier institutions as already stated. The roles of the EGRC and course development and maintenance activities are explained below:

1. The EGRCs will be funded and equipped with necessary servers, systems, tools and Internet for carrying out courses development and maintenance.
2. EGRC will develop and maintain content in those subjects identified and assigned to them by the APCU.
3. Each course will be supported through funds and resources in one of the EGRCs. This helps avoid duplication of efforts.
4. Each course will have a three member course expert group (CEG) drawn from the best of faculty and experts in the subject from anywhere in the state. The CEG will be approved by the APCU. We expect at least one of the expert in the CEG will be from the host institution of the associated EGRC.
5. The CEG will draw up the syllabus and the set of proposed modules to be developed, and get it whetted by the APCU. This syllabus will act as the reference curriculum for the course.
6. To encourage wider participation of enthusiastic faculty anywhere in the state, APCU will welcome proposals for the development of a course or specific learning modules. Once APCU (or a committee constituted by it) approves, the faculty concerned may use the services of one of the EGRCs or the EGOC to develop the module.
7. EGRC will maintain the course-specific library and conduct teacher training programmes.

Course specific library will be created

The objective is that the EGRCs will be the nodal centers for supporting all course -related activities. All EGRCs will be monitored and assisted by the EGOC. EGOC is effectively the central project coordination office that supports the APCU and Governing Council meetings and channel the funds to approved activities. EGOC will also monitor and actively assist the EGRCs, CEGs and other programmes of the Education Grid. EGOC will play the central administrative, core technology development, project monitoring and coordination role required to support the several activities related to infrastructure and IT related processes as stated below:

EGOC role will be central administration, development, monitoring and coordination

- i) Planning, configuration, installation, commissioning and management of a number of systems and underlying technologies that support the Education Grid and its services.
- ii) R&D and referral center for technology development, system integration and maintenance
- iii) Managing the large higher education network across Kerala. This is not addressed effectively by the ISPs in India. ERNET India does this for academic and research institutions. ERNET will function through the EGOC to install and maintain the network.
- iv) Maintenance of the Education Grid and course-specific portals.
- v) Courseware related configuration management, version control, consistency and integrity maintenance.
- vi) Support for the EGRCs, authors and referees for content development.
- vii) Overall project planning, facilitation, coordination and monitoring.
- viii) Support services for the Governing Council and APCU.

Education Grid and the Colleges

Today most of the colleges lack basic academic resources such as good library, quality teaching faculty, support for interdisciplinary and flexible curriculam for the students, etc. Through its facilitation Layer, the Education Grid will provide dynamic support in all these areas. Good and experienced teachers of the colleges will be able to directly contribute to the Education Grid processes. Online assisted teacher training, opportunity for teaching quality assessment with associated incentives will act as major booster for motivating the teachers. Students are motivated already in becoming demanding users of Internet in education. It gives them



flexibility and self-pacing in learning. Makeup courses for students lagging behind are easy to conduct. Alternative channels to take special elective courses from other institutions and industry give them opportunity for interdisciplinary education. Colleges will be able to modernize quickly by sharing best practices from other colleges and institutions. New funding for Digital Library and information resources for curricula support are best funded through the Education Grid processes. Education Grid makes possible applications of Knowledge Management practices at all levels within and across the colleges.

Proposal for a National Initiative

Sharing of best practices among colleges and institutions

The project aim is to deploy quality e-courseware that has value in the Educational Process. The goal is to improve substantially the standard and quality of instruction and efforts by both the teachers and the students. The approach is to use state-of-the art IT facilitated information systems and methods that are in tune with the emerging knowledge era. The paper is being submitted for the readers to study critically the document holistically and send their constructive inputs (by email to director@iiitmk.ac.in) so that an acceptable national consensus is evolved. The approach suggested will strengthen and complement the current initiatives of bodies such as the Indian Society for Technical Education, UGC, MHRD, AICTE, Infnlibnet, etc. and help modernizing their activities. It will also promote e-publishing industry and making it relevant to the future of higher education system and R&D. We propose to the Government of India to accord highest priority and make Education Grid a national thrust and initiative and thereby address the national concern for quality education.

Constructive inputs can be sent at director@iiitmk.ac.in

The size and complexity of the task of referred Web-enabled courses, their deployment and usage are not as daunting as they may appear. We are dealing with a few hundred courses with a total of about 5000 modules. To begin with, in at least a hundred standard courses there is much content available on the Internet from leading universities, industry and the publishing industry. There is also a huge collection of paper based notes and assignments from eminent faculty across the country. Furthermore, it does not take more than a reliable 2 Mbps bandwidth per college connected to an IP-VPN backbone over a typical MPLS network of today. If we cost a module development of INR 1,00,000 we are looking for an effort of INR 500 million in content development and perhaps an equal amount in support programmes at the starting level. This is well within the means of MHRD and AICTE. The infrastructure issues are already being addressed by MHRD, AICTE and ERNET. Education programs in Health, Agriculture, Social Welfare, Administration, Law, etc. under other Government departments may commence similar education grid activities in parallel. The challenge is to create a national movement and swiftly create quality content and put in place processes as outline here for realizing the value proposition and promise expected from IT facilitation in higher education.

The challenge is to create a national movement and create quality content

The Global Revolution in Education

The only irreplaceable capital an organization possesses is the knowledge and the ability of its people. The productivity of that capital depends upon how effectively people share their competence with those who can use it

There is a revolution on particularly in the developed world where in education is undergoing a sea change with disciplined and free participation of very large number of teachers, students, industry, with the governments actively involved in its promotion. Gordon Moore, the founder of Intel and originator of the famous Moore's Law in Electronics in his parting address on the day of his retirement in April 2001 said, "Education is our Achilles heel". More than a century ago Andrew Carnegie stated that, "The only irreplaceable capital an organization possesses is the knowledge and the ability of its people. The productivity of that capital depends upon how effectively people share their competence with those who can use it." Christopher Galvin, the chief of Motorola says, "Motorola no longer wants hire people with a four year degree; one issue: attend to quality education. Make the university/colleges and institutions system participate in the continuing education needs for industry, government, education, organizations and individuals. Do not compromise on quality. Progress and results will follow. Realizing the importance of the Internet and Web in Education, the then President of the United States appointed a Web-based Education Commission in 1999 to come up with national action plan (see www.webcommission.org) for its use in Education. One of its findings show that the dropout rate of the weaker students in higher education reduced by at least 35%. Several



Higher education system as engine of growth

national bodies of USA such as the National Science Foundation have funded major web-based content developments in different subjects.

The progress of our country, its due position in the coming era of knowledge economy and society depends upon how efficiently we empower our higher education system to become the engine of growth in this increasingly inter-dependent and globalized world. Coming years will see increasing emphasis on creation of wealth through knowledge. This depends upon the capacity to apply knowledge to create value. This capacity is best created through quality and holistic higher education with built-in development of the learner's values, ethics and character. It appears that the approach of the Education Grid as envisaged is the best natural way to leverage upon IT and catapult India in to the Knowledge Era of the 21st century.

Acknowledgements

This document was prompted by the need to address the critical issues of how to identify, imbed and exploit the IT facilitated processes and make them accountable in the formal higher education through the Education Grid. It is also needed to effectively manage the Education Grid Project itself. Management and accountability of such large finance deliverables against the expenditure. The approach described here was encouraged by the discussions in the Kerala Education Grid Apex Project Coordination Unit, Education Grid Governing Council and one-on-one interactions with their members. Specific interactions with Prof. S.S. Prabhu, Shri Arvind Mohan and Ms B.V. Laxmi of IIITM-K, Prof. K.B.M. Namboodiripad of NIT- Calicut, Dr Mangalasundar Krishnan of IIT Madras, Prof. R. Sharan of IIT Kanpur, Prof. P.N. Murthy and R. Narayana of TCS, Shri K. Mohandas, Principle Secretary, Higher Education and several others are gratefully acknowledged.

