



Revitalizing the Organization

Organizational vitality gets clouded if not consciously nurtured

Is our organization lacking in vitality? Is it becoming stale? Does it have a lot of inertia? Are the people in the organization not motivated and inspired? Do we see a deadend? These are some of the vital questions that every organization faces at some or other time. An organization being an organismic and living system keeps moving till it has a vital force. Like an individual, the organizational vitality also gets subdued and clouded if it is not consciously nurtured.

An organization requires continuous treatment for revitalizing it

If we as individuals do not give attention to either physical/operational, intellectual, emotional or spiritual domains, we would experience that our vitality is clouded or draining out. We may be caught by some ailment or disease and find no fun or inspiration in life. In that situation we require a proper holistic treatment to revitalize our all the interrelated domains. Similarly, the organizational individual may also keep losing its vitality over time due to neglect, carelessness or too much involvement in the external issues rather than nurturing the internal processes. The day to day rut and quest for growth, market forces, etc may build a lot of inertia in the organization. Thus, an organization would require continuous treatment for revitalizing it so as to get best possible performance.

The processes of prevention are usually much better than that of correction

In holistic development of vitality, the processes of prevention are usually much better than that of correction. Thus, it is proposed to revitalize the organization in terms of regular ongoing meta processes. A similar approach is advocated in case of individual human beings in terms of diet, life style, physical and mental exercise, emotional support and spiritual advancement.

Operational and intellectual vitality relate to smooth and agile functioning

The operational and intellectual vitality relate to smooth and agile functioning of the organization in its day to day activities as well as evolving into innovative and challenging areas with minimum time and efforts. This is the vitality which is akin to physical and mental fitness/vitality for an individual human being.

Emotional and spiritual vitality would result into an enlightened organization

The emotional and spiritual vitality relate to maturity of the organization, which may constantly inspire the individuals working in it. It would be fulfilling the self-actualization needs of employees and would ultimately result into an enlightened organization.

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Information Technology in the Caribbean Manufacturing Firms: An Industrial Survey

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Abstract

Manufacturing organizations have undergone rapid changes within their structure, due to which, more and more manufacturing facilities and products are becoming information enhanced. Information systems can tightly integrate various supply chain components with manufacturing process, allowing the enterprise to smoothly and quickly make the transition from design to build at a known level of risk associated with cost and time. This paper presents an industrial survey that was conducted to study the current status/usage of information technology for manufacture (ITM) in the Trinidad and Tobago (TT) firms. From the results of the survey, it can be seen that considerable scope exists for the introduction of information technology (IT) systems in the Caribbean manufacturing industry.

Keywords: caribbean region, industrial survey, information technology for manufacture (ITM), IT tools, LAN

Introduction

Manufacturing organizations have undergone rapid changes within their structure. These organizations are now required to adapt to new trends in social and economic environments such as globalization of manufacturing activities, green manufacturing and product life-cycle management. However, more and more manufacturing facilities and products are becoming information enhanced. Many machines and equipment in factories can now be numerically controlled and they are now getting more adjustable to information processing and communication with high performance computers (Lee and Noh, 1997).

Over the past few years in communication technology, we have seen remarkable changes in the evolution of microcomputers. With the price reductions in computer accessories coupled with processor speeds in the giga hertz range, wireless networks that are capable to communicate over miles of free space and internet speeds in excess of 10 mbps and exponential growth and readily availability of wide variety of software tools, it is not surprising today that more businesses are looking towards the usage of information technology (IT) tools to solve their problems. Current advances in IT and, in particular, computer aided design and manufacturing (CAD/CAM) and flexible manufacturing system (FMS), have attracted organizations to undertake significant investments in these systems. Now, increasing computing power and the falling cost of computer hardware and software, mean manufacturing enterprises can strive to attain the basic goals of profitability, growth and survival (Mohanty, 1993).

The real challenge for today's manufacturers will be transforming the whole of their businesses into a digital enterprise, in which e-commerce is deeply integrated with e-production. This means finding and implementing strategies

to incorporate all of the three dimensions of business (product, process and delivery agent) into IT architecture. The National Research Council's Board of USA on Manufacturing and Engineering Design has highlighted in one of their studies termed "Visionary Manufacturing Challenges for 2020" that the nature of manufacturing enterprises will evolve in response to changes in the technological, political and economic climate and also that information and knowledge is seen as a extremely important factor towards the development of manufacturing operations. IT systems can tightly integrate various supply chain components with manufacturing process, allowing the enterprise to smoothly and quickly make the transition from design to build at a known level of risk associated with cost and time (Carabine, 1998).

IT in the Caribbean Manufacturing Firms

The Caribbean is mostly known for its large Tourism and Agriculture industry. The income from these sectors contributes considerably to the development of the various islands in the Caribbean (The Industrialist, 1998). Only few islands have strong manufacturing bases, such as Barbados, Jamaica, Trinidad and Tobago (TT), which are major contenders in the plastic, metal and food products (Harris, 2000). In TT alone there are over 350 registered manufacturing companies. Most of these companies own a website and can be contacted electronically. Though no known research work has been published in the areas of manufacturing and IT within TT, there is evidence that manufacturing firms use some components of IT in their day-to-day activities. Most of the franchised firms in TT such as the Energy and Food sectors rely heavily on several IT systems to carry out monitoring services of plants, job sites and also to communicate with their supply chain partners and so on. These companies normally establish their own



links, which are done via satellite or by the use of wireless communication (radio, microwaves and so on), for security and reliability reasons (Trinidad and Tobago at a Glance, 2003).

The role of IT in the TT manufacturing firms can be categorized as: (1) knowledge management, (2) e-business, (3) enterprise resource planning and (4) enterprise maintenance and asset management. A majority of manufacturing firms in Trinidad and Tobago employ one or a combination of the IT tools for addressing the areas mentioned above. Some routine IT tools employed are: (1) Electronic mail (e-mail), (2) Internet access, (3) Intranet and (4) collaboration and web-enabled applications.

In the Caribbean region, with the increase in Internet speeds and the number of Internet service providers (ISP), one can predict an increase in the number of firms that will switch to IT packages to handle their flow of information. Hence there is a need to investigate the application of IT tools and its status in the Caribbean manufacturing firms that can help organizations to improve their agility and competitiveness in the global markets.

Information Technology for Manufacture

In this paper, ITM is defined as application of various computer based software packages and strategies to perform various product design and manufacturing activities. ITM takes many forms. It may include Local or Wide Area Networks (LAN or WAN), which are frequently used for on-line design and manufacturing services and e-business. The ever-changing world of technology and communications has made it difficult for some companies to keep abreast of new methods of business but they give businesses the ability to provide more efficient service that is of high quality. Technology does not only provide benefits to the customer but it gives the companies more solutions to their everyday manufacturing problems and can help employers provide distance learning and on-line training to their employees. In addition, greater communicative ability allows businesses to interact with others via simple tools such as email or advanced tools such as video conferencing. The onus is now on manufacturers to utilize these IT related technologies to provide better products to customers and provide solutions to their business.

Employing computer-based systems such as CAD, CAM, FMS, MRP I, MRP II, JIT, FLA, and so on would reduce the lead-time and improve the quality and productivity of manufacturing operations to a considerable extent. However, the ultimate benefits can only be achieved if certain challenges are met and the right computer network environment is created. The important ITM constructs/computer integrated technologies that were considered in the study are addressed in the next section and the operational definitions are presented in the Appendix.

Background

For the purposes of this project, various computer softwares/technologies were considered. These technologies are: CAD/CAM, FMS, MRP, JIT and FLA. By implementing computer integrated manufacturing (CIM) systems, SMEs have achieved significant performance enhancements in several areas, e.g. improved quality, responsiveness, effective sales and marketing information, increased operational productivity, lower overhead costs, reduced WIP, reduced lead time, less floor space and reduced set-up costs. Reduction in WIP and lead times is a result of lean manufacturing (Albert, 2005), which includes JIT. Improvement in shop floor operation is a hindrance in some of the SMEs (Marri et al., 2000).

A detailed study on product design and development is an appropriate starting point for implementation of IT in any manufacturing enterprise due to the following reasons (Rehg and Kraebber, 2001):

- reduction in many tedious manual tasks present in the design and documentation of product systems.
- generation of design drawings for a new product is one of the first activities in the design area.

Design of new products is a complicated and information intensive process. Only a few companies are successful more than half the time. These odds present a challenge for a product design team (Ulrich and Eppinger, 2000). Otherwise, the benefit for the enterprise was negative for several reasons. Time will be wasted entering redundant data, separate images of the same product have to be maintained, the number of drawing errors for the product will be increased, product quality will suffer due to the drawing errors and production costs will be increased due to more part list errors and obsolete parts.

A major CIM axiom states, "create data once and use it many times". The CAD/CAM hardware and software must support file formats that permit the part geometry and specification data attached to the drawing to be used by (1) manufacturing engineering for CNC code generation, engineering change orders, routing, process planning and quality analysis; and (2) production planning and control for product structure and part specification.

Effective implementation of CAD systems offers manufacturers a number of benefits such as cutting design costs, reducing cycle time and improving information flow. Implementation issues that need to pay attention for improving the business are customization of CAD systems and high level integration of various functional areas of manufacturing setting such as product design, design automation, testing, simulation, manufacturing and assembly operations.

The present CAD systems transfer the geometric models

of design objects. Design process starts in general by the input of the product specifications. They are decomposed to the detailed ones. The design process is progressed by imagination, remembrance, reference, calculation and so on in the designers' heads. Designers may explain the reasons/ideas for decomposition, development, modeling and other decisions.

The design process enriches the product by adding basic geometric detail and reshapes the product by applying design for manufacture and assembly (DFMA) guidelines and constraints. The DFMA process answers the question, 'is the design optimum for manufacturing and assembly'? DFMA is a holistic approach to design analysis because both the manufacture and assembly of the finished product are considered simultaneously (Boothroyd et al., 2002). This consideration of manufacturing and assembly during design results in lower total product costs. The part geometry created with CAD in the design process area must be compatible to CAM software to create machine code capable of machining the part on almost any CNC machine of the shop.

The introduction of CNC machines drastically changed the manufacturing industry. Curves were as simple to cut as straight lines, complex 3-D structures were relatively easy to produce and the number of machining steps that required human interactions went way down. In a production environment, all of these machines may be combined into one station to allow the continuous creation of a part involving several operations. This type of system is analogous to an FMS layout. CNC machines are nowadays driven directly from files created by CAD/CAM software packages, so that an assembly or part can go from design to production without any intermediate paper drawing work being required. In one sense, CNC machines may be said to represent special industrial robot systems, as they are programmable to perform any kind of machining operation.

Apart from CAD/CAM tools, the improvement of the productivity in manufacturing operations can be obtained through the application of concurrent engineering (CE) approach (Vernadat, 1999). CE aims at integrating all upstream and downstream activities related to product and process development. In this regard, CE environments could be significantly improved if advanced solutions are devised for enhanced integrated information system design, which is a critical aspect, not only in terms of well-structured information such as CAD files, parts lists and process plans exchanged using standard data formats such as data exchange format (DXF), initial graphics exchange specification (IGES), product data exchange specification (PDES) and so on, but also in terms of non-structured information (e.g. e-mails, memos, messages hypermedia data, and so on) to facilitate cooperation among integrated teams.

Flow line automation (FLA) includes several automated machines that are linked by automated parts transfer and handling machines. The individual machines on the line use

automated raw material feeders and automatically carry out their operations without the need for human interactions. As each machine completes its operations, partially completed parts are automatically transferred to the next machine on the line in a fixed sequence. These machines can be equipped with quality control sensors and also they can be controlled remotely via a LAN.

However, the format for creation and storage of the design must be consistent with a basic CIM philosophy that demands the establishment of a single enterprise database with a single image of all product information. The implementation of a central database for all products requires an enterprise information centered LAN, where employees use computer technology to access and share product data electronically.

The current industrial survey focuses on computer based product design and manufacturing techniques and principles, along with a look at the information systems that support network oriented manufacturing operations in the enterprise, which make the study very unique. The objective of this paper is to present an industrial survey conducted in Trinidad and Tobago (TT) with the main intention to study the current status/usage of information technology for manufacturing (ITM) in local firms. It is expected that the study findings can help local manufacturers to explore the gaps and define the scope for the introduction of IT in the TT manufacturing firms.

It is not surprising today that more business are looking towards the usage of information technology (IT) tools to solve their problems.

Research Methodology

To conduct the survey in TT manufacturing firms, two types of questionnaires were developed. The questionnaire labeled as the "Preliminary Questionnaire" gathered general information from the companies, pertaining to their current usage of ITM and the level of assistance they expected from the outside agencies in terms of design and development of IT systems within their firms. The questionnaire labeled as the "Main Questionnaire" gathered technology-specific information from the companies. This questionnaire includes much more detailed questions pertaining to ITM and a few questions on the organizational structure of the company.

This survey targeted on the manufacturing firms that are currently involved in designing, fabricating and manufacturing of products for both the local and international markets. The main questionnaire sought to gather information regarding the status of ITM especially on:

- how much TT manufacturers know about it?
- how many are currently in use and the degree to which they are employed?
- what plans or expectations does the management of such companies have for their organizations?

Preliminary Questionnaire Design and Analysis of Data

This questionnaire was designed to be as short as possible in order to obtain immediate response from the survey

participants. The estimated completion time for the preliminary questionnaire is in the range of 5-10 minutes.

The questionnaire contained two sections: Section 1 covered various questions on the usage of ITM and their plans of implementing them or not. Section 2 focused on various questions pertaining to the type of information or training that the firm might need for implementation of ITM within their company. Information gathered from this questionnaire used in constructing the main questionnaire.

Based on the data gathered from the preliminary questionnaire, it was clear that CAD is the most used IT component amongst the firms in Trinidad. FLA, Robotics and FMS technology are quite similar in nature. These all share the bases of automation and the reduction of human interface within the process line. In fact, the responses from the preliminary questionnaire played a major role in the development of the main questionnaire since from the pilot study we are able to pinpoint those firms that are:

- using some form of IT
- have plans of using IT in the future
- have no intentions of using IT
- the line of study does not fit their company objectives.

Main Questionnaire Design

The main questionnaire comprised four sections and thirty-two questions. These sections were labeled in the following manner:

- General questions on IT tools: implementation issues and evaluation of currently used systems
- Detailed questions on the individual technologies: perceived/expected outcomes of implementing IT tools and also experiences gained from these systems
- Organization related questions: like the product range and company type
- Feedback: recommendations made and assistance needed by the firms in order to improve or implement IT tools.

Data Collection

The questionnaires were targeted at manufacturers that were using or had potential for using ITM. A search at the TT Manufacturers' Association's (TTMA) website provided the names of such companies. Both questionnaires were sent to 71 different organizations. Forty two questionnaires were returned. Of those returned, 11 of them were considered not relevant to the study. This resulted in 31 usable responses. The criteria used to decide the usable responses are based on 'whether a questionnaire is completely filled in or not' and on its content to meet the objective of the study. The overall response rate was therefore $(42/70) = 60$ per cent

and the effective response rate was $(31/70) = 44.29$ per cent. The targeted firms for this survey were thought to have a high probability of having some form or attribute of ITM already installed within their company's structure. The profiles of the individuals responsible for filling in and returning the questionnaires ranged from CEO, middle level managers and engineers to shop floor technicians. Three methods were used to deliver the questionnaires: e-mail, personal delivery and on-site interviews. The majority of the preliminary questionnaires were delivered by e-mail but most of the main questionnaires were performed by the on site interviews.

IT systems can tightly integrate various supply chain components with manufacturing process, allowing the enterprise to smoothly and quickly make the transition from design to build at a known level of risk associated with cost and time.

Results and Analysis

For analysis of the data, various graphic representation tools were used to give straightforward views on the status of ITM in TT. From the results, it can be seen that surprisingly a low fraction of firms constituting only 18 per cent of the sample (as shown in Figure1) use ITM. However, later through field visits it was observed that many of those who responded in the negative, were using some of the other individual IT tools. The least used of these technologies was Computer Numerical Control (CNC) at 10 per cent, while Computer Aided Process Planning (CAPP) and Computer Aided Design (CAD) were the most used technologies at 44 per cent. The other technologies that fell within these extremes were Computer Aided Manufacturing (CAM) (22 per cent), Just-in-Time (JIT) systems (25 per cent) and Materials Resource Planning (MRP II) (25 per cent).

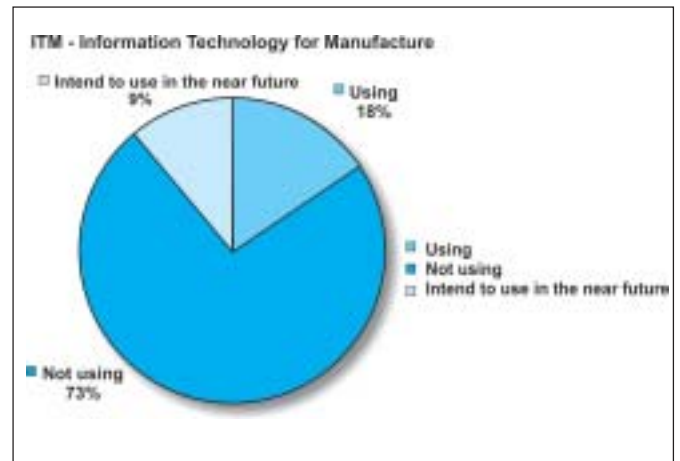


Figure 1 : Status of ITM in TT Firms

Questions were also asked on areas where help might be required by the respondents in order to better facilitate the use of the aforementioned technologies. From the results, we see that the majority of respondents require assistance in the installation of CAD software and the training of professionals for use of the IT related software over 60 per cent and 50 per cent respectively (refer Figure 2).

The graph of the usage of IT shows some very interesting statistics, which is depicted in Figure 3. The graph showing

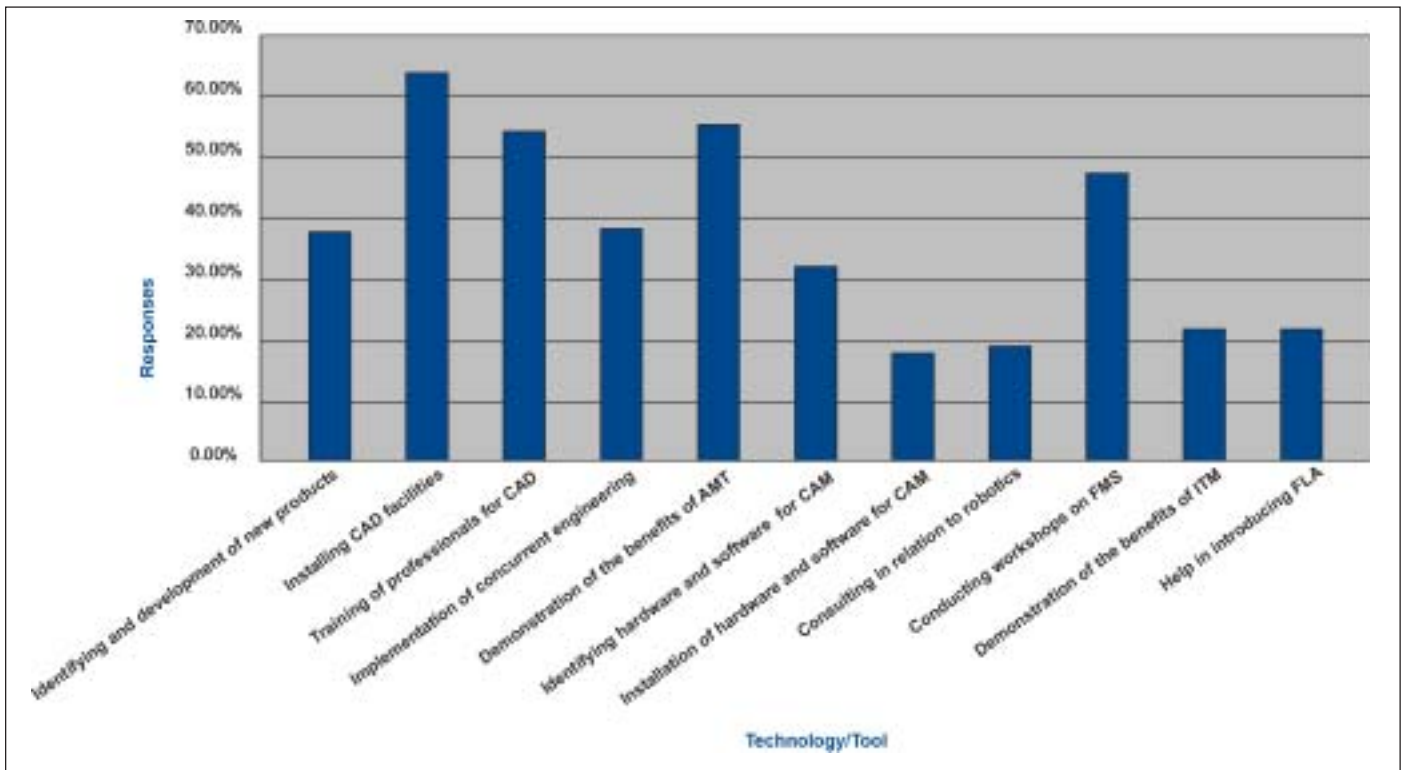


Figure 2: Assistance Required in Implementation of IT Related Tools in TT Manufacturing Firms

the use of IT for distance learning is of particular importance. It appears that less than 40 per cent are either using or plan to use distance learning for the training of employees. Some of the respondents suggested the need for a consultant in their field to gain hands-on experience and the ability to ask questions in real-time.

The role of IT in the TT manufacturing firms can be categorized as: (1) knowledge management, (2) e-business, (3) enterprise resource planning and (4) enterprise maintenance and asset management.

Figure 3 depicts a detail outline of the various commonly used IT tools that are being employed in Trinidad, these range

from personal computer on the job floor to conducting distance-learning training via the Internet. From Figure 3, one will notice that most of the companies that were studied in this survey use the Internet to send information to suppliers and clients. We see that all the manufacturing companies (100 per cent) use personal computer to manage the shop floor information. The same can be said when it comes to the usage of Internet services. A slight decrease (6.3 per cent) in the number of

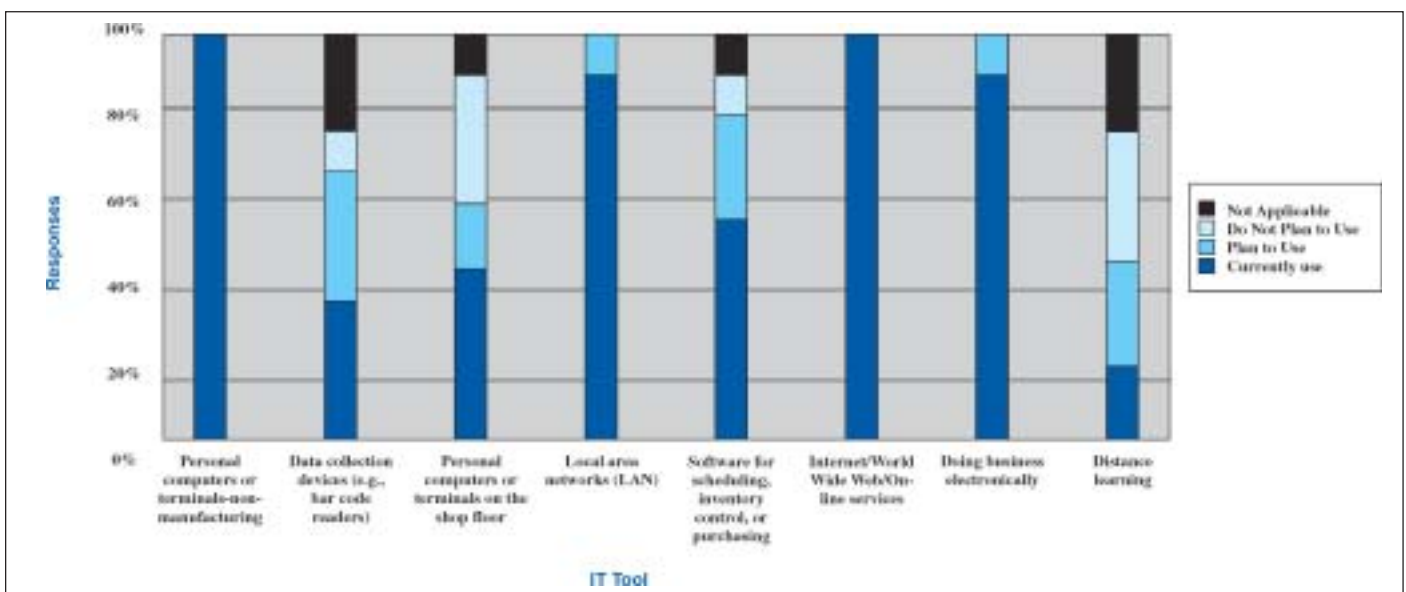


Figure 3: Summary of IT Usage in TT Manufacturing Firms

companies that conduct business electronically can be seen. More than 90 per cent of the sample population has LAN installation within their facilities.

Data collection devices, personal computers on the job floor and conducting distance-learning programmes all displayed low percentages, 36, 40 and 22 respectively. Where distance learning had the largest response was, when it came to finding the component “irrelevant” and having “no plans of using in the future”. Figure 4 shows that manufacturers in TT believe the actual benefits of ITM are very close to the perceived benefits.

Data Validation

For validation of the data, Box and Whisker plot was used since it is an invaluable tool for gaining a quick overview of the extent of a numeric data set. It takes the form of a box that spans the distance between two quartiles surrounding the median, typically the 25 per cent quartile to the 75 per cent quartile. Commonly, “whiskers,” lines that extend to span either the full data set or the data set excluding outliers, are added. Outliers are defined as points beyond 3/2 the interquartile range from the edge of the box; far outliers are points beyond three times the interquartile range. However, the following basics on Box and Whisker plot are worth to note in understanding the Figures 5 - 6.

ITM is defined as application of various computer based software packages and strategies to perform various product design and manufacturing activities.

The box and whisker plot has several graphic elements: The lower and upper lines of the “box” are the 25th and

75th percentiles of the sample. The distance between the top and bottom of the box is the interquartile range. The line in the middle of the box is the sample median. If the median is not centered in the box, that is an indication of skewness. The “whiskers” are lines extending above and below the box. They show the extent of the rest of the sample (unless there are outliers). Assuming no outliers, the maximum of the sample is the top of the upper whisker. The minimum of the sample is the bottom of the lower whisker. By default, an outlier is a value that is more than 1.5 times the interquartile range away from the top or bottom of the box. The plus sign at the top of the plot is an indication of an outlier in the data. This point may be the result of a data entry error, a

poor measurement or a change in the system that generated the data. The notches in the box are a graphic confidence interval about the median of a sample

(refer Figure 5). Box plots do not have notches by default. Some important definitions on box and whiskers plot are given below:

Quartiles: The lower and upper quartiles are the 25th and 75th percentiles of the distribution (respectively). The 25th percentile of a variable is a value such that 25 per cent of the values of the variable fall below that value. Similarly, the 75th percentile is a value such that 75 per cent of the values of the variable fall below that value and is calculated accordingly.

Quartile Range: The quartile range of a variable is calculated as the value of the 75th percentile minus the value of the

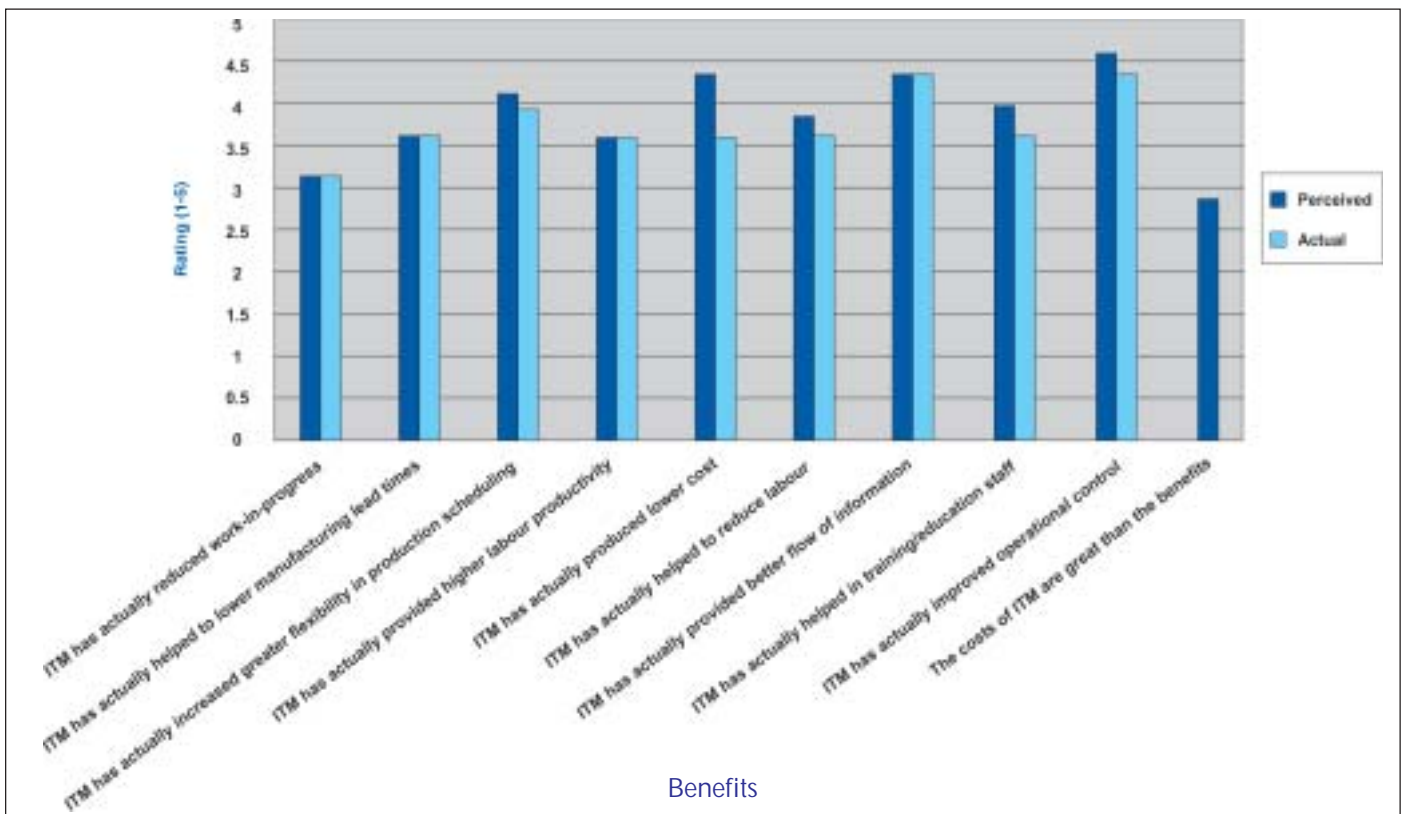


Figure 4: Perceived versus Actual Benefits from ITM

25th percentile. Thus it is the width of the range about the median that includes 50 per cent of the cases.

Outliers: Values that are “far” from the middle of the distribution are referred to as outliers and extreme values if they meet certain conditions.

Time will be wasted entering redundant data, separate images of the same product have to be maintained, the number of drawing errors for the product will be increased, product quality will be suffered due to more part list errors and obsolete parts. A major CIM axiom states, "create data once and use it many times".

Table 1 displays the data gathered on the perception of ITM in TT. On looking at the average expectation scores column it is clear that all average opinion responses are positive lying between 3-5 on the scale of 1-5. One thing note worthy here is the decrease in the score when switching from expectations to outcomes. Though the majority of the outcomes are lower than the

expectations, none of them fall below the spread of the expectation values, which means that the actual values are tight and close to the reality when compared to the expectations.

Figure 5 shows the box and whisker plot for ITM based on expectations on examining the plot, we see that the distribution falls

between the agree and the strongly agree region. In addition, it can be seen that the median is symmetrical, where there is a slight shift to the positive (upper) side, generally the

Table 1: Perception of ITM in Trinidad and Tobago Firms

Perception of ITM	Average Expectation Score(1-5)	Per cent Difference from outcomes	Standard Deviation based on expectation	Standard Deviation based on outcomes
We hoped ITM would help to reduce work in-progress	3.19	6.67	1.38	0.74
We hoped ITM would help to lower manufacturing lead times (faster customer deliveries)	3.56	-0.82	1.31	0.83
We hoped ITM would give greater flexibility in production scheduling (Improve product variety)	3.76	-2.60	1.35	0.72
We hoped ITM would provide higher labour productivity	3.65	-3.12	1.22	0.74
We hoped ITM would produce lower cost	3.81	-10.82	1.17	0.74
We hoped ITM would help to reduce labour	3.69	-5.99	1.40	0.74
We hoped ITM would provide better flow of information	4.13	-3.03	0.96	0.85
We hoped ITM would aid in training/educating staff	3.94	-5.19	1.34	0.88
We hoped ITM would help to improve operational control	3.85	0.00	1.72	0.69

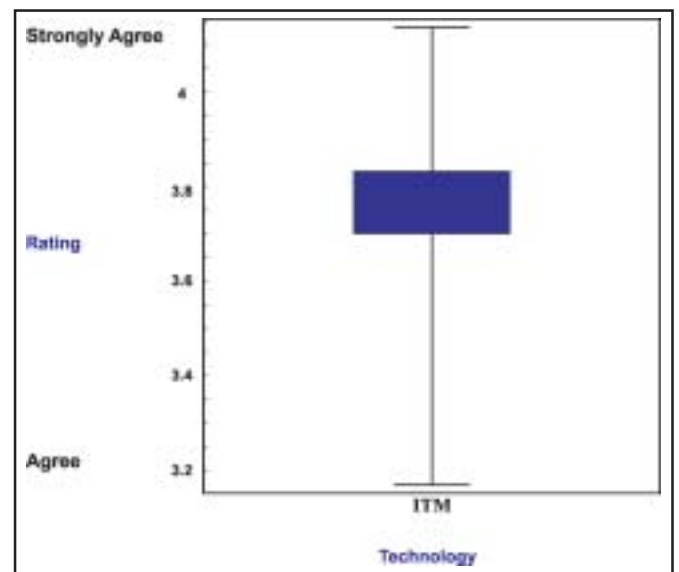


Figure 5: Box and Whisker Plot for ITM Based on Expectations

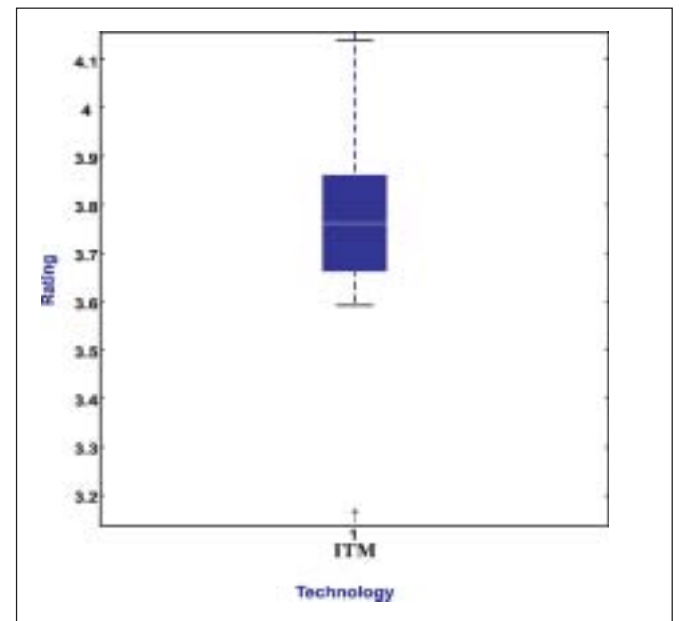


Figure 6: Box and Whisker Plot for ITM Expectations (Outliers distance is assumed to be 1.5 Inter Quartile Range)

expectations for the views are compact, though outliers lie at 3.19 where “ITM would help to reduce WIP” was the outlier. This is depicted in Figure 6.

Conclusions

Serious thought should be given for the implementation of IT in the Caribbean-manufacturing firms. This paper comes up with an industrial survey to explore the application of IT tools in the TT manufacturing firms. The following inferences can be drawn from the results of the survey: (i) considerable scope exists for the introduction of IT in the local manufacturing industry, (ii) only a small proportion of manufacturing industries in TT employ IT systems and (iii) majority of respondents require assistance in the installation of various software tools and the training to professionals for use of the same.

From the survey, it can be seen that a low fraction of firms use ITM. However, through our field surveys later we found that many of those who responded negative are using some or the other individual IT tools. The study also indicates at use of IT for distance learning is of particular importance. It appears that less than 40 per cent are either using or plan to use distance learning for the training of employees.

However, there is evidence of strong positive trends in that all respondents use personal computers and the Internet, while over 90 per cent use LAN to do business electronically. It is also seen that approximately half of the respondents indicated the use of software for scheduling, inventory control and purchasing. Further the study shows that manufacturers in TT believe the actual benefits of ITM are very close to the perceived benefits.

It can be seen that manufacturing sector in Caribbean is a major contributor to employment opportunities while petroleum and gas is the smallest contributor. To begin an upgrade in the manufacturing sector will require manpower training. The knowledge gained by engineers in this area will enable the industry to grow into a globally competitive sector providing high quality products. Hence, application of ITM in TT is of great importance. The challenge for the future is to identify appropriate IT systems and application strategies that help to build more flexible, reconfigurable and proactive manufacturing systems with capabilities for

managing the change and innovation to be able to adapt to market evolution and prosper in the face of global competition. The results of this study will serve as the basis for further research into specific IT needs and applications.

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References

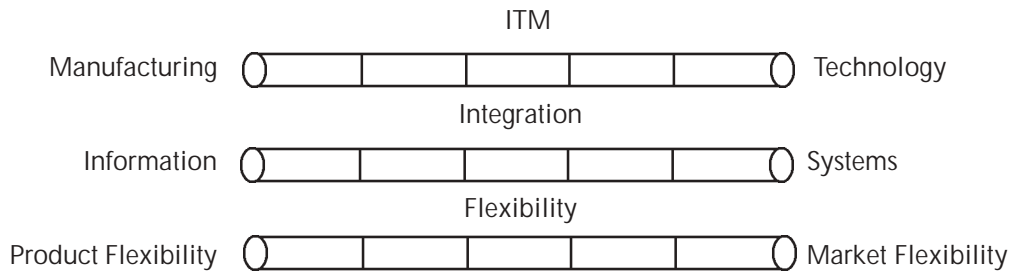
- Albert M. (2005) Setup Reduction: At the Heart of Lean Manufacturing, Modern Machine Shop feature article, (Retrieved on December 9, 2005 from <http://www.mmsonline.com>)
- Boothroyd G., Dewhurst P. and Knight W. (2002) *Product Design for Manufacture and Assembly*, Marcel and Dekker Inc., New York.
- Carabine L. (1998) Merging Cad with IT, *Mechanical Engineering Magazine*, July, 56-58.
- Harris M. (2000) *The Current Situation of Small and Medium-sized Industrial Enterprises in Trinidad & Tobago*, Barbados and St. Lucia, United Nations Publication.
- Lee K.I. and Noh S.D. (1997) Virtual Manufacturing System-A Test-Bed of Engineering Activities, *Annals of the CIRP*, 46, 347-350.
- Marri H.B., Gunasekaran A. and Grieve R.J. (2000) Performance Measurements in the Implementation of CIM in Small and Medium Enterprises: An Empirical Analysis, *International Journal of Production Research*, 38(17), 4403 – 4411.
- Mohanty R.P. (1993) Analysis of Justification Problems in CIMS: Review and Projection, *Production Planning and Control*, 4(3), 260-272.
- Rehg J.A. and Kraebber H.W. (2001) *Computer Integrated Manufacturing*, 2nd edition, Prentice Hall, New Jersey.
- The Industrialist (1998) *Preparing for the Challenges of the 21 Century*, Barbados Manufacturers' Association.
- Trinidad and Tobago at a Glance (2003) *Tourism and Industrial Development Company of Trinidad and Tobago (TIDCO) Publications*, Phillips Street, Port of Spain, Trinidad, West Indies.
- Ulrich K.T. and Eppinger S.D. (2000) *Product Design and Development*, 3rd Edition, McGraw Hill, Irwin.
- Vermadat F.B. (1999) Research Agenda for Agile Manufacturing, *International Journal of Agile Manufacturing Systems*, 1(1), 37-40.
- Trinidad and Tobago Manufacturers' Association (TTMA) (Retrieved on December 9, 2005 from <http://www.ttma.com>)
- Visionary Manufacturing Challenges for 2020 (Retrieved on December 9, 2005 from <http://www.books.nap.edu/catalog/6314.html>)

APPENDIX:
Important Constructs/Computer Integrated Technologies and Operational Definitions of the Study

Acronym		Meaning	Operational Definition and Examples
AMT	:	Advanced Manufacturing Technologies	Includes various computer based technologies such as NC, CNC, CAD, CAM, and so on
CAD	:	Computer Aided Design	The use of computers to interactively design products and prepare engineering documentation. CAD software allows designers to improve productivity and save time by shortening development cycles for virtually all products.
CAM	:	Computer Aided Manufacture	Refers to the use of specialized computer programs to direct and control manufacturing equipment.
DFMA	:	Design for Manufacture and Assembly	Design of products considering implications to manufacturing and assembly
MRP	:	Materials Requirement Planning	A system that allows inventory data to be augmented by other resource variables
CAPP	:	Computer Aided Process Planning	Integration of CAD and CAM through computer aided process planning
FMS	:	Flexible Manufacturing System	A system using an automated work cell controlled by electronic signals from a common centralized computer facility. The central computer provides instructions to each workstation and to the material-handling equipment using numerical control (NC).
JIT	:	Just In Time	Production and inventory control system based on small lot sizes, stable level production schedules and pull system of production. It is based on a philosophy of continuous and forced problems solving that drives out waste (E.g. Kanban, Poka-Yoke, Zero Inventory Systems, and so on).
ROBOTICS	:		A flexible machine with the ability to hold, move, or grab items
CNC	:	Computer Numerical Control	Machines that are able to be programmed by computers to perform a cycle of operations repeatedly
ITM	:	Information Technology for Manufacture	In this paper ITM is defined as application of various computer based software packages and strategies to perform product design and manufacturing related activities.
FLA	:	Flow Line Automation	e.g. Bottling plants, Automated Assembly lines, and so on

Flexibility Mapping : Practitioner's Perspective

1. What types of flexibilities you see in the practical situation of "Information Technology in the Caribbean Manufacturing Firms" 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 due to Information Technology in the Caribbean Manufacturing Firms 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 of issues related to usage of various categories of application software (Please tick mark in the appropriate box(es))



Key Questions Reflecting the Applicability in Real Life:

1. What are the various drivers for Information Technology in the Caribbean Manufacturing Firms?
2. What are the Key Information Technology in the Caribbean Manufacturing Firms?
3. How the Information Technology in the Caribbean Manufacturing Firms in Commercial operations is taking place?



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Assessing Impact of Mobile Communications on Organizations: A Flexibility Analysis

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Abstract

The paper presents a framework to assess the impact of Mobile Communications on the flexibility of the organizations. Following the digital revolution Mobile space is offering opportunity to make business functions effective. The most obvious impact is the flexibility gained in business operation. A framework is suggested to assess the organization's flexibility gained due to mobile applications. It takes into the consideration the various business applications that are possible using mobile phones and suggest a flexibility index. This is illustrated with a case study of a multinational organization. The flexibility index is subsequently compared with other Indian organizations. The results suggest that though the Flexibility imparted due to mobile communications is very low, with uptake of new business applications, it would increase manifold making the organizations more agile and competitive.

Keywords: flexibility, mobile commerce, mobile communications

Introduction

Digital revolution is generally identified with E-commerce but, in today's context, any further reference on this would be incomplete if it does not include the vast opportunity opened up by the emerging technologies in mobile space. Although still a relatively new capability, M-commerce has the potential to create a whole new service sector, new business models and new avenues for customer service. Unlike E-commerce, mobile space is much more pervasive. However, their true potential and challenge lies in combining the two.

Explosive growth of the mobile telephone population, combined with the development of wireless technologies, offers new type of opportunity to make businesses effective. According to Wireless Week (2004), there were 94.9 million Mobile users in 2003 worldwide and the segment is expected to grow to 1.67 billion by 2008. Some more interesting data is presented in the box below:

Indian mobile industry is playing its role in delivering sizeable economic benefits to the Indian economy and the nation. The mobile industry is estimated to be generating about 1 per cent of the GDP, which is Rs. 31,300 crores per year and it is estimated also that approximately 3.6 million jobs in India depend now on the mobile industry, directly and indirectly. The industry also provides, on a conservative basis, about Rs. 15000 crores per annum to the Government by way of revenues through over half a dozen

Global Mobile Users	1.52 billion
Analogue Users	34m
US Mobile users	140m
Global GSM users	1.25 billion
Global CDMA Users	202m
Global TDMA users	120m
Total European users	342.43
Total African users	53m
Total 3G users	130m
Total South African users	19m
#1 Mobile Country	China (300m) [India 42.1 m]
#1 GSM Country	China (282m)
#1 in Handsets 2Q04	Nokia(35.5%)
#1 Network In Africa	Vodacom(11m)
#1 Network In Asia	Unicom (153m)
#1 Network In Japan	DoCoMo
#1 Network In Europe	T-Mobil (28m)
#1 In Infrastructure	Ericsson
Global monthly SMS	36/user
SMS Sent Global 1Q04	135 billion
SMS sent in UK 3/2004	2.1 billion

Source: EMC World Cellular Database

<http://www.gsmworld.com/news/statistics/substats.shtml>

streams. All the above are over and above the very substantial productivity gains provided to Indian businesses, large and small, as well as to individual users. Today, mobile telephony

is recognized in India as an essential communication tool for the common man and is being used by all alike-whether trader, a vegetable vendor, a barber, a plumber or a pundit and so on.

Having crossed the historic milestone of total mobiles exceeding fixed phones in October 2004, the GSM sector has also, in April 2005, driven past the next milestone of GSM mobiles (total GSM Subscribers in April 2005 – 42.1 Million) themselves exceeding the total number of fixed wireline connections (estimated 41.8 Million). Sharing of infrastructure to reduce costs, a more viable interconnection and ADC regime, removal of unreasonable obstacles to prepaid subscriber acquisition, earliest introduction of 3G services harmonized with the world and so on, are urgently needed to catalyze the services. Further at global level, mobile industry is set to break through the 2 billion subscriber mark as soon as July 2006 and reach 2.45 billion mobile subscriptions by the end of 2009, according to the latest forecasts from EMC.

In this paper, an attempt is made to identify various possible business functions that find immediate application of mobile technologies. Impact of these applications can be seen on several dimensions that may include effective marketing efforts, increased serviceability, customer retention, sales, market share, revenue, cost reduction, profit and many more. Moreover, there could be some qualitative change in the work environment. One of the critical variables that stands to be positively influenced by these developments is the overall flexibility experienced at organizational level. It is worthwhile to assess the degree of flexibility on a qualitative scale. Before discussing the flexibility assessment, it is contextually relevant to have a look at the latest evolution of researches on this new subject so that an organized understanding is developed.

Latest Research

We can identify a variety of mobile equipment over a wireless telecommunication network in a wireless environment (Barnes 2002, Coursaris and Hassanein 2002, Gunsakaran and Ngai 2003) (Table 1). Currently, these wireless devices include (Table 2) two-way pagers/SMS (short message systems), wireless application protocol (WAP)-equipped cellular phones, personal digital assistants (PDA), Internet-enabled laptop computer with wireless access capacity and consumer premise IEEE 802.11(a/b) wireless network devices (Leung and Antypas, 2001).

The immediate business function that can attract application of mobile equipments is marketing. Mobile media offers major marketing opportunities and innovation as it transcends the traditional communication and supports one-to one, many-to-many and mass communication

Phones and personal digital assistants increase the

Following the digital revolution Mobile space is offering opportunity to make business functions effective. The most obvious impact is the flexibility gained in business operation.

Table 1: Key Mobile Network Technologies

Standard	Description	Speed ^a
GSM (GlobalSystem for Mobile Communication)	The prevailing mobile standard in Europe and most of the Asia-Pacific region around half of the world's mobile phone users.	14.4 kbit/s
PCS (Personal Communications Services)	A standard based on Time Division Multiple Access (TDMA), which divides a frequency into time slots and gives users access to a time slot at regular intervals. TDMA is used in the US, central/south America and many other countries.	14.4 kbit/s
PDC (PersonalDigital Cellular)	A standard used in Japan. Uses packet-data overlay on second-generation networks to achieve 'always-on' data communication and a higher speed	28.8 kbit/s
HSCSD (High Speed Circuit Switched Data)	A circuit switched protocol based on GSM. It is able to transmit data at around four times the speed of GSM by using four radio channels simultaneously. Some services were launched in late 1999 and early 2000.	57.6 kbit/s
GPRS (General Packet Radio Service)	A packet switched wireless protocol as defined in the GSM standard offering instant, 'always on' access to data networks. The speed will initially be less than the maximum burst: at first 43.2 kbit/s upstream and 14.4 kbit/s downstream rising to 56 kbit/s shortly afterwards.	115kbit/s (burst)
EDGE (Enhanced Data rates for Global Evolution)	This is a higher bandwidth version of GPRS and an evolution of GSM. The high speeds will enable bandwidth-hungry multimedia applications. EDGE conveniently provides a migration path to UMTS by implementing necessary modulation changes. Planned service availability is for 2002.	384 kbit/s
IMT2000 (International Mobile Telecommunications)	This is a third generation (3G) standard. Three rival protocols have been developed: Universal Mobile Telephone System (UMTS) in Europe, Code Division Multiple Access (CDMA) 2000 in the US and Wideband-CDMA in Japan. The development of the standard requires significant investment in infrastructure. Commercial availability of most services is predicted for 2002-3.	384 kbit/-2 Mbit/s

(Source: S.J. Barnes / International Journal of Information Management 22 (2002) 91-108)

availability, frequency and speed of communication. Yet the technology associated with these devices, which let marketers personally communicate with consumers, continues to evolve (Scharl et al, 2005).

There are some recent publications that discuss various marketing issues related to Mobile commerce technologies and applications (Balasubramanian et al. 2002, Barnes 2002,

Coursaris and Hassanein 2002, Leung and Antypas 2001, Kumar and Zahn 2003) but only a few scholars have attempted to explain factors influencing their adoption (Coursaris and Hassanein 2002, NG-Kruele et al. 2002). There is specific application of the Technology Acceptance Model (TAM) to examine factors affecting emerging mobile technology and applications in Singapore (Yang 2005) and Taiwan (Wu & Wang, 2005).

At present, the mobile communication is driven by different factors (Figure-1). Buellingen and Woerter (2004) have explored the driving forces of M-commerce, to analyze the institutional and functional change of the 3G mobile communication value chain and to isolate critical factors and essential characteristics of mobile applications for economic success of 3G M-commerce. They identified three major drivers. Social development related factors that account the possibility to be able to communicate privately or for business anytime and anywhere. Transmission technology-related driving factors that are about mobile access to Internet and to other Internet Protocol (IP)-based

Though the Flexibility imparted due to mobile communications is very low, with uptake of new business applications, it would increase many fold making the organizations more agile and competitive.



Figure 1: Drivers for Mobile Communication (Source: Buellingen and Woerter 2004)

services and applications. Economic drivers refer to positive network externalities, attractive content, low costs and reasonable prices of the mobile services, substitution possibilities and other factors are contributing substantially to the market growth.

Scharl et al. (2005) have reviewed the mobile marketing and then investigated the most successful form of mobile communication, short message services (SMS), via a quantitative content analysis of the Fortune Global 500 Web sites and qualitative interviews with European experts. There are some interesting predictions in this paper. Short Message Service (SMS) in most other countries, attracted 580 million users who sent 431 billion messages in 2002. In the First quarter of 2004, users sent 135 billion SMS messages

(Cellular Online 2004) and predictions are that 94.9 million mobile commerce users in 2003 will grow to 1.67 billion users by 2008. SMS will account for the bulk of mobile telephone companies' revenues from data services until 2006. This high diffusion of SMS facilitates analyzing usage behaviour and hints at the commercial potential of future communication services. Multimedia Messaging Services (MMS), for example, will build on the success of SMS but allow for richer content based on similar asynchronous, digital and interactive communication (M2 Presswire 2004).

The question arises how to make best forms of applications. This would require an understanding of the variety of roles that people could play in the busy lifestyles and work styles of today. Dholakia and Dholakia (2004) have analyzed the complex combinations that result from a person's location (work, home, other), his or her prescribed or self-ascribed role (professional and on duty, or private and off duty) and the stance (in terms of time commitment and busyness). The emergence of mobile space has a number of differentiating characteristics which offers opportunities for reaching customers at multiple (targeted) locations, for configuring services and offerings in novel (pinpointed) ways and enabling new types of shopping and service consumption experiences (Table 3 and Figure 2).

Table 3: Complex Interactions of Locations, Roles and Stances

Location	Stance	Role	
		Professional (on duty)	Private (off duty)
Work	Busy Time on hand, Waiting	Productivity Productivity or Entertainment	Entertainment or Productivity
Home	Busy Open to diversion	Convenience Entertainment	
Other	Busy Time on hand, Waiting	Efficiency Efficiency or Entertainment	Entertainment or Convenience or Efficiency

cell entries indicate primary benefit sought in that setting. (Source: Dholakia and Dholakia, 2004).



Figure 2: Key Dimensions of the Emergent M-business Space. (Source: Dholakia and Dholakia, 2004).

Today's workforce is increasingly mobile. Yet the speed at which business operates demands that mobile workers stay in constant communication with their customers and colleagues. To provide them with instant access to enterprise, personal and Internet information, many corporations are designing and deploying wireless data solutions. These wireless solutions allow corporations to reap a significant return on investment by increasing worker productivity, eliminating task duplication, improving customer service, providing point of service revenue opportunities.

There are many mobile communications applications, important from the purpose of the business operations, business professionals and the consumers. An assessment made by Durlacher consulting (2003) is shown in Figure 3. There are various mobile services that are showing a positive trend of use in India, but the major services that showed tremendous increase by 2004 are intranet accessing, financial services and location services. Future applications will use graphics and video conferencing.

Implementing a wireless solution represents a significant challenge for most businesses because they have not yet

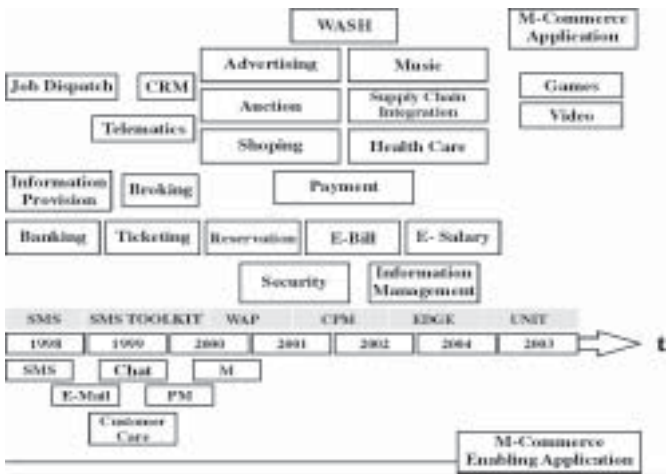


Figure 3: Mobile Applications in Commercial Operation (Source: Durlacher 2003)

acquired the knowledge and necessary to understand the challenges at hand or have the technology available to overcome those challenges. Developing a wireless application that will succeed in the field requires more than simply putting a desktop application on a mobile computer a wireless solution needs to contend with the harshest of environments-from varying coverage conditions to extreme weather conditions to narrower bandwidth to higher latencies-making designing a good solution challenging. Wireless solutions also need to address the unique needs of mobile workers. On the road, mobile workers only want access to specific information and they do not want to surf for it or take a long time booting up a computer. Mobile

According to Wireless Week (2004), there were 94.4 million Mobile users in 2003 worldwide and the segment is expected to grow to 1.67 billion by 2008. Some more interesting data is presented in the box below.

users also want to use different devices and have information formatted appropriately for each. However, they do need data to be synchronized between devices so they do not have to spend Arthur D Little (2000), the wireless applications for business purposes can be divided into three categories, using this approach various business applications are classified Mobile Work Force, Business Entities, and Business Processes (Figure 4).

According to Arthur D Little (2000), the wireless applications for business purposes can be divided into three categories, using this approach various business applications are classified Mobile Work Force, Business Entities, Business Processes (Figure 4).

Business Process <i>Offices enabled to interact with remote or mobile branches, people, and customers on their own (virtual) network</i>	<ul style="list-style-type: none"> Remote branch connectivity Business-to-Business integration (customers and suppliers) Corporate data streams
Business Entities <i>Transmitting the result of measurements of a distant station to the home base and interpreting/using the data that is obtained</i>	<ul style="list-style-type: none"> Connect vending machines (ATMs) Fleet management (trucks/cars) Household appliance connectivity Bluetooth applications
Mobile Workforce <i>Employees enabled to work in their normal office any time, any place, anywhere</i>	<ul style="list-style-type: none"> Access to intra- and extranets Job dispatch Synchronization (files, agendas) Software updates Information management

Figure 4: Various Business Applications

Flexibility has long been recognized as the organization's capability that has the potential to impact the competitive position and the business performance of the organization. Webster's dictionary believes that flexibility is "characterized by a ready capability for modification or change, by plasticity, pliancy, variability and often by consequent adaptability to new situations". In general, the term "flexibility" has a positive connotation: flexible organizations are better ones (Leeuw and Volberda 1996). Flexibility has been historically used to refer the blend of capabilities and attributes that facilitates adjustments to change according to the situational context (Evans 1991). Upton (1994) defines flexibility as "the ability to change or react with little penalty in time, effort

cost or performance". Flexible Systems Management uses the concept of continuum (options) to build systemic flexibility in management (Sushil,

2000).

Mobile business applications make business functions flexible and high performing entities. Figure-5 presents results of a study conducted by Forrester Research (2001) among 50 European E-commerce executives revealed the benefits anticipated from offering Mobile Internet. These are ofcourse

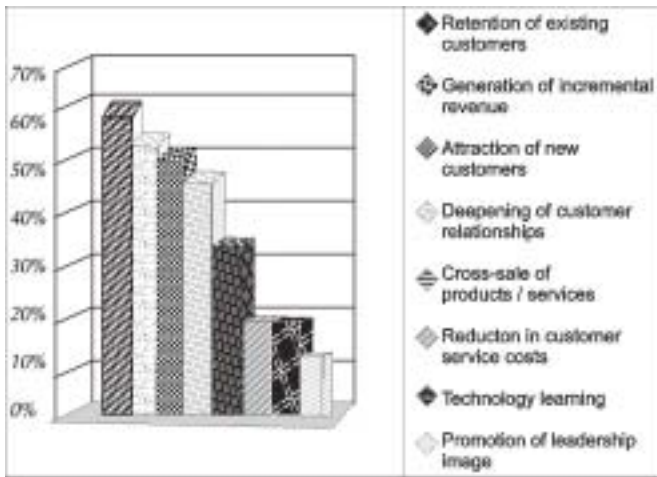


Figure 5: Benefits to the Organization
(Source: Forrester Research)

opinion based projections and not actual measured benefit.

The graph clearly indicates that there is nearly 70 per cent increase in Customer Retention due to Mobile Internet Services. This could be because of faster service to the customers, listening to the customer problems leading to more satisfied customer. Another aspect of this is that due to greater usage of technology, most of the organizations are becoming semi-virtual organization, including all the manufacturing organizations, and are hence regarded as flexible and high performing stable enterprises. They have increased their competence levels by improving upon their supporting technologies. Mobile Communication is one of the very important support technologies that is helping the organizations to be more flexible and competitive. According to Sushil (2000), Sectoral and functional flexibility leads to more tangible benefits in the organizations. With the increasing competition, customer demand and quality, there was a need for speed, which led to meeting tight deadlines, technology up-gradation and product Innovation. The functional areas that various units recommend introducing flexibility for tangible organizational benefits are:

- After Sales Service
- Marketing and Engineering Job Rotation
- Decision Making
- Customer Handling with Adequate Autonomy
- R&D
- Operational Areas, Customers Interaction and Choice of Research Projects

Several guidelines dictate how to get business. A reduction and elimination of such guidelines would generate freedom and creativity to operating managers. Technological

upgradation enhances organizational flexibility which might be reflected if:

- Number of options generated in a given situation of decision making has increased
- Ability of organization to absorb changes has enhanced
- Degree of freedom to decision makers for actions is increasing.

In a competitive environment, organizations are more found to be keen on introducing changes and absorbing their impact in order to be high on the competence levels. Technological upgradations are one of the strategies to increase in competence levels.

Flexibility also imparts freedom to the actors and actions are taken that are providing this kind of freedom. With mobile communication, employees will be more mobile and hence increase in degree of freedom; moreover, access to important data also imparts lot of freedom to the actors in the process. Flexibility may be one overall qualitative variable that implicitly encompasses the all-round performance achieved due to mobile applications. These are reflected in three aspects, which are, flexibility in terms of number of different

Indian mobile industry is playing its role in delivering sizeable economic benefits to the Indian economic and the nation. The mobile industry is estimated to be generating about 1% of the GDP i.e. Rs. 31300 crores per year and is estimated also that approximately 3.6 million jobs in India depend now on the mobile industry, directly and indirectly.

options available in a decision making situation, flexibility in terms of freedom of choice to actors or the empowerment for decision making to the various actors (it symbolizes decentralization in the system) and the ability of the system to manoeuvre

as per the changes in internal and external environment.

We need to identify the main organizational functions where mobile application leads to the introduction of the above three flexibility attributes. The organizations have various important functions and each function has various activities, which are applicable in terms of usage of mobile communications. We propose a Mobile Business Applications Model to classify the organization into relevant functions and the function into the activities that are potential candidate for the mobile business applications (Figure 6). The model is developed on the basis of opinion given by the experts in the field of mobile communication and application providers. The model is the first step towards understanding the implications of mobile communication on the organizations. This is used for assessing the flexibility as introduced by mobile applications. The three major identifiable functions where mobile applications are dominant for achieving higher performance are:

- Sales /Marketing
- Operations and Maintenance
- General Management

These are further subdivided based on the activities that

are going to pick up in the near future. General Management was chosen as one of the classifications since many employees use mobile phones for general business purposes and not necessarily for a particular function.

The above functions are described below in detail.

Sales Force Applications

- **Contact Management:** Mobile Phones are being used in nearly all the organizations to manage their contacts, though right now in India major contact management is done through voice, but with time other applications will be needed to do contact management through data.
- **Route Scheduling:** In sales mobile communication can very effectively be used for planning your route, moreover with coming up of technologies like GPS, route for a particular location could be easily scheduled. More over regular updates about the route are obtained on mobile phones, either through the content provider or through the company databases. There has been lot of work done by mobile portals and content providers to bring about the maps on the mobile phones.
- **Catalogues and Price Lists:** A list of prices as well as various catalogues are made available to the workforce, when they go for sales call, so that they do not have to return back to office to get catalogues and so on. This saves a lot of precious time of the sales force to increase the effectiveness of the organization.
- **Call Scheduling:** Scheduling your daily sales call can be easy and time saving by using a Mobile phone, as a sales person has a particular number to be contacted.
- **Order Status/Order Entry Tracking:** In order to maintain a real time data communication, order status needs to be fed in as soon as possible, as a result lot of inventory costs could be saved. Moreover a sales person does not duplicate a call if he/ she has the correct order status, this also results in effective supply of order.
- **Customer Account Records:** Customer accounts are updated using mobile phones and giving customer a better service. More over with mobile CRM, effective marketing can also be done to the customers.
- **Corporate Phone Directories:** This is a very important function where mobile phones are being used, as a lot of time is wasted in searching the numbers, any person in the field can now easily access the corporate phone directories using the mobile phones and make his call scheduling while on the move, moreover it helps in contacting the various important persons at times.
- **Onsite Claims:** This is applicable mainly for the insurance sectors, but other sales persons are also using these for making onsite claims.

Increase in Mobile Communication will make Employees totally mobile and as a result their interaction with their co employees would decrease, this is going to bring a lot of change in the Management Styles.

Operations and Maintenance

- **Dispatch Updates:** Operations and Maintenance mobile force are using these for making necessary updates of the dispatched products, helps in maintaining the real time communication.
- **Financial Statements:** Not much has been done to make financial settlements through a mobile phone on an organization level basis, but corporate persone are doing it for personnel purposes, there are various security issues concerned with it.
- **Inventory Status:** Real time updating of orders helps reducing inventory costs, more over warehouses and dispatch handling person can update the Inventory Status.
- **Fleet Management:** Mobile Communication is very effectively used for managing the fleet for delivery ,maintenance and collection teams ,as they could easily be updated on their mobile devices about their next place of action.
 - **Tracking of Batches of Product:** Tracking of the product can be done through mobile phones and the status of the order obtained on the mobile phones itself by the customer.

General Management

- **B2B Integration:** Various organizations can Integrate their extranets and intranets to have a standard mode of communication with their partners through mobile phones.
- **Real time Data Query:** In general, all the employees can make real time data queries, whenever that is required. Whether it is the order status or the dispatch updates this could easily be done through the mobile devices.
- **Synchronizing Data and Files:** While going for an important meeting, employees can synchronize their data and files, so that they know the exact status. This helps in gaining advantage in important decisions.
- **Access to Intranets/ Extranets:** Accessing the intranets and extranets can make a person more flexible as he/ she can devote more time to his work and update himself about this organization's partners through mobiles.
- **Business Intelligence:** Not much has been done in this, but an organization can use this tool to get critical information using datawarehousing and datamining application on the mobile phones.
- **Bluetooth:** This is used by organizations to enable the intercommunication of just about any piece of apparatus with any other (where this is appropriate of course!) .One of the main constraints on the design is the cost,

is that can also be done with various PCs and mobile phones.

- **Remote Branch Connectivity:** This can be done through Wireless LANS and VSATS, but using mobile communication for wireless LANS as discussed above can help a lot.

A mobile business application model around the above activities is shown in Figure-6, which can be further used to analyze the degree of flexibility accrued in the organization due to mobile applications. Each of the functions and the activities associated with these functions are assigned weightage of importance with respect to their role in organizational flexibility. Analytical Hierarchy Process (AHP) could be an appropriate technique to assign the weightage. Subsequently a flexibility index can be calculated as weighted average of the users opinion on the enhanced performance due to mobile applications. We also define the M-flexibility matrix, which can be utilized to find the growth of flexibility in the organization with time.

With the increase in mobile communication employee will be working from their homes, hence the particular definition of work culture and working environment would change to a great extent



Figure 6 : Mobile Business Applications and Organizational Flexibility

Flexibility Index

Each Function has a particular weightage towards imparting flexibility in the organization. The above model (Figure 6) describes it amply. Further, based on this a flexibility Index

is suggested which can be used to compare organizations and find out how far use of mobile communications have been helpful in achieving organizational flexibility. This can also be utilized to judge the organizations’ flexibility over the years.

While calculating the flexibility index a bottom up approach is followed. It has to be a participative process of the domain experts who are identified to assign weightage to each function and subsequently to each activity. In order to maintain the consistency, it is important to review the weights (namely, every six months). Further, performance of mobile projects used for each of the activities and functions is assessed as rating on a 1-9 scale (which is, level of mobile communications usage is 1, which is, hardly or 9, which is, extensively). Next step is to multiply the weights with the respective ratings assigned by respondents to various projects to find out a final project wise score (Figure-7).

This score at each level of the mobile business applications results in overall flexibility achieved by the organization.

AHP requires a pair wise comparison of each of the activities and the function and obtain the Priority Weights

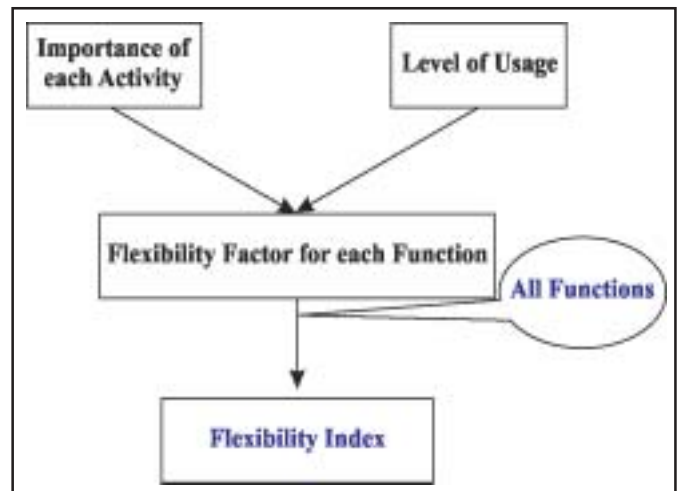


Figure 7: Basic Model For Calculating the Flexibility Index

for them. The attribute preference matrix is prepared using the help of business experts. Here we have chosen three experts results of which are shown in Figure 6. Flexibility index through AHP results between the range of 1 and 9.

Flexibility Mapping

Flexibility Mapping is done to find out the impact of mobile communication on the flexibility of the organizations. Flexibility Mapping is done between a range of 1-9, which is, from very very low to very very high. In the flexibility mapping, 1 stands for the very very low and 9 for the very very high. Rest of the numbers are placed between them showing the continuum over which Flexibility Mapping can be done as explained in Figure 8. This mapping could also

be used to compare two organizations.

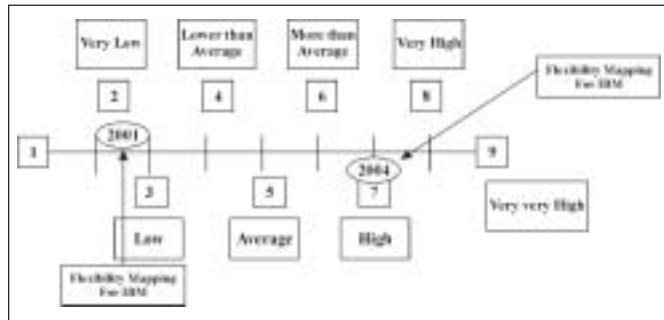


Figure 8 : IBM Flexibility Mapping for IBM for year 2001 and 2004

M-Flexibility Matrix

It is also possible to compare various organizations for their gaining flexibility due to mobile communication with the help of flexibility index. This will help in understanding how much flexibility has altered over the years and which organization is able to adopt new avenues faster. This index can effectively be used to find out the extent of change in flexibility during a fixed period of time. In order to do this, *M-Flexibility Matrix* was defined. It takes into consideration two important variables: one is the Flexibility Index and other is the time, all these taking into consideration the various drivers and inhibitors of mobile communication. The M-Flexibility Matrix also portrays a growth curve that the organization takes during a particular period of time (Figure 9).

With Increase in Mobile communication various standards and technologies will be changing, organizations must adapt to these changes in order to improve the flexibility.

The growth curve shown is an indication of how the flexibility increases from one year to another over a timeline.

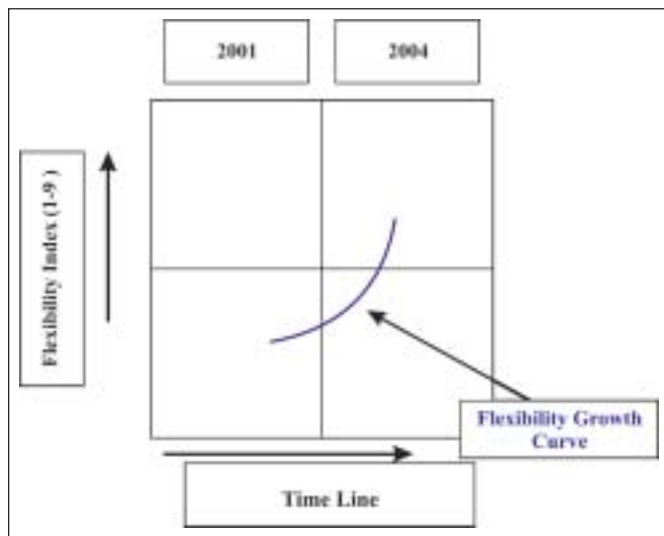


Figure 9: M-Flexibility Matrix

In order to find out exactly what has been the growth path, the organizations must plot their flexibility indexes every six months on the matrix. The ideal growth curve is depicted in the matrix.

A Case Study of IBM

The above model is illustrated by a case study in order to analyze the impact of mobile communications in International Business Machines Corporation (IBM). The impact is judged by finding out the flexibility index for IBM, which is subsequently compared with that of other Indian organizations.

IBM was incorporated in 1911, uses advanced information technology to provide customer solutions. The Company operates using several segments that create value by offering a variety of solutions, including, either singularly or in some combination, technologies, systems, products, services, software and financing. Organizationally, the Company's three hardware product segments are comprised of Technology, Personal Systems and Enterprise Systems. IBM's other major operations consist of a Global Services segment, a Software segment, a Global Financing segment and an Enterprise Investments segment.

The Technology segment produces peripheral equipment for use in general-purpose computer systems, including storage devices, networking components, advanced-function printers and display devices. In addition, the segment provides components, such as semiconductors and HDDs, for use in the Company's products and for sale to original equipment manufacturers (OEMs). Major business units include Microelectronics, Storage Technology and Printing Systems.

IBM is the creator of the original PC in 1981. The Personal Systems segment produces general-purpose computer systems, including some system and consumer software that operate applications for use by one user at a time (personal computer clients) or as servers. Major brands include the Aptiva home personal computers, IntelliStation workstations, IBM xSeries servers, NetVista and ThinkPad mobile systems. In the first quarter of 2000, the Company transferred the Retail Store Solutions (RSS) business, a provider of point-of-sale solutions, to the Personal Systems segment, from the Enterprise Investments segment. The Company also reorganized the Server segment and renamed it the Enterprise Systems segment. Since January 2005, IBM has now sold its computer business to Chinese assembler Lenovo, formerly the Legend Group. Lenovo will pay Big Blue \$1.25bn, with \$650m in cash and IBM will retain an 18.9 per cent stake in the joint venture. Lenovo will be IBM's preferred supplier and retains the right to use the brand for five years. The deal excludes IBM's eServer x86 PC servers.

The Global Services segment is an information technology (I/T) services provider, supporting computer hardware and software products and providing professional services to help customers of all sizes realize the full value of information technology. The segment provides value through three primary lines of business, Strategic Outsourcing Services, Business Innovation Services and Integrated Technology

Services.

Strategic outsourcing services creates business value through long-term strategic partnerships with customers by taking on responsibility for their processes and systems. Business innovation services provides business/industry consulting and end-to-end E-business implementation of such offerings as supply chain management, customer relationship management, enterprise resource planning and business intelligence. Integrated technology services offers customers a single i/t partner to manage multi-vendor i/t systems' complexity in an E-business environment, including such traditional offerings as product support, business recovery services, site and connectivity services and systems management and networking services. Learning services supports the three primary lines of business and helps customers design, develop and deploy curricula to educate their employees. The global services segment is suited to integrate the full range of the company's and key industry participants' capabilities, including hardware, software, services and research.

The Software segment delivers operating systems for the company's servers and e-business-enabling software (middleware) for IBM and non-IBM platforms. The segment's business offerings align with key customer opportunity areas, transformation and integration, leveraging information, organizational effectiveness and managing technology. In addition to its own development, product and marketing effort, the segment supports more than 35,000 independent software vendors to ensure that the company's software and hardware offerings are included in those partners' solutions.

The Global Financing segment is a provider of financing services for I/T. The segment provides lease and loan financing that enables the Company's customers to acquire complete I/T and e-business solutions (hardware, software and services) provided by the Company and its business partners. Global Financing, as a reliable source of capital for the distribution channel, also provides the Company's business partners with customized commercial financing for inventory, accounts receivable and term loans, helping them manage their cash flow, invest in infrastructure and grow their business.

IBM offers its products through its global sales and distribution organizations. The sales and distribution organizations have both a geographic focus (in the Americas, Europe/Middle East/Africa and Asia Pacific) and a specialized and global industry focus. In addition, these organizations include a global sales and distribution effort devoted exclusively to small and medium businesses. IBM also offers its products and services through a variety of third-party

business partners, including distributors and resellers, as well as through its online channels.

An Overview of IBM Mobile Connect

IBM mobile connect is a flexible and adaptable data management solution. It enables corporate IT managers to harness the power of handheld computing devices by remotely linking them directly to their corporate applications. This enables the mobile workforce to access and update corporate information from any location, which can streamline business processes and accelerate corporate decision-making.

Some main features of the system are:

- ❑ Supports Windows® CE, the Palm Computing Platform and Symbian's EPOC operating systems.
- ❑ Mobile users can easily synchronize data with Microsoft Exchange, Lotus Notes, or with any ODBC-compliant database, such as DB2™, Oracle, Sybase and Extended System's Advantage Database Server.
- ❑ The mobile can synchronize using modem, cellular phone, Internet, Wireless, Intranet, local area network (LAN), wide area network (WAN) and so on.
 - ❑ Intuitive interface and wizards reduce the time it takes to set up the system.
 - ❑ The mobile users can be authenticated through the existing user details held by Microsoft Exchange or Lotus Notes, which minimizes administration and initial set-up time.
- ❑ Centralized control for effective management.
- ❑ Automatic backup/restore of mobile devices, remote installation of apps and detailed reporting of each mobile's status, making managing mobile devices easier.
- ❑ Encrypted communications assures the secure transfer of corporate data to and from mobile devices.
- ❑ Remote monitoring through Microsoft's Management Console, enabling support staff to easily monitor and conduct diagnostics on mobile devices.

The limitations in disk space, resident memory, and battery capacity exert considerable restrictions on the mobile applications development process. Yet, perhaps the most significant factor that differentiates handhelds from desktops is the intermittent connectivity to backend business systems and the maze of connectivity options- wireless, LAN, dial-up docking and Internet.

Flexibility in IBM

Based on the Study Conducted in IBM India, flexibility Index for IBM was calculated for year 2001 and 2004 (Figure 6). Further using the Flexibility Indexes for both the years the M-Flexibility Matrix was prepared

It is clear from the above table that the flexibility in IBM due to Mobile communications was **low** during 2001 but has drastically improved to a higher level during 2004. Figure 8 depicts the impact of mobile communication on the flexibility of IBM mapped on the flexibility continuum.

During 2004, a trend of increase in flexibility becomes clear as the organization starts taking new strategic technology decisions, in order to enhance its competence levels. M-Flexibility Matrix as plotted in Figure 10 shows the Flexibility growth curve, which shows that the organization is on the path of achieving high flexibility by the year 2004.

From Figure 10, it is clear that with increase in the mobile services and technological standards, the flexibility in the

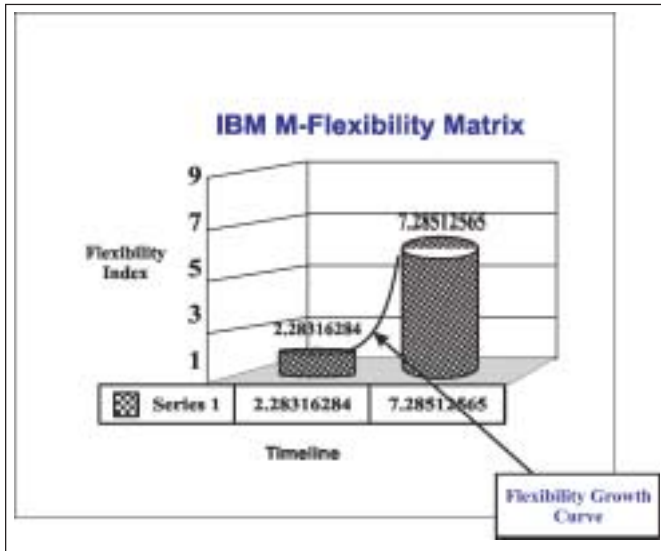


Figure 10: IBM M-Flexibility Matrix Using AHP

organization increases as more and more applications are being made for Mobile Communications. Use of corporate Phone directories and catalogues and Price Lists is extensive. In operations and Maintenance, at present IBM is using Dispatch Updates, Inventory Status Fleet Management, as well as tracking of products. This is reflected in flexibility index and improved performance of IBM with the use of Mobile Applications. IBM has benefited from the most in terms of Time Saving and Speed and Responsiveness. The performances are judged based on the increase in the year 2004. The figure also indicates that beyond time saving and speed the company has also benefited through increased customer satisfaction and improved efficiency. All these are indicative of an improved flexibility in the organization.

These market drivers, combined with regulatory stipulations on 3G licenses to open up network access, are leading to a drastic restructuring of the telecommunications industry. The previously vertically integrated service and access providers are being driven towards more horizontal structures by the segmentation of the content providers along vertically integrated industry lines.

Flexibility Index of select Indian organizations is also measured from the perspective of their role as Application Providers. These organization are Bharti Telesoft, Phoney Tunes, Asia cyber net, Cell next, Netvantage, EHPT, Velocient and Hughes. A comparison is made between the flexibility attained in general by the chosen organizations vis-à-vis IBM and result is shown in Figure 11.

As seen in the Figure, the Indian organizations are also

showing a trend of increasing Flexibility Using Mobile Communication.

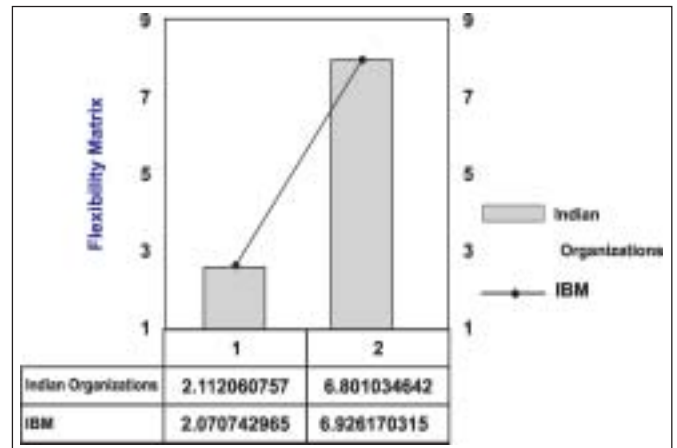


Figure 11: Comparison of IBM and Other Indian Organization

Comparing the IBM case study with other Indian organizations we find that the flexibility index for both is very close and almost at the same level for each. The main theme that comes out is that mobile communications is going to increase the flexibility index of organizations tremendously, as more and more applications are being made for business application, organizations are going to use these applications for their benefits and to increase their performances.

There are various issues concerned with flexibility, as it can be seen that increase in flexibility during a period of time is due to various reasons. As far as the IBM case and Indian organizations are concerned, one marked difference between them is that IBM has incorporated less number of applications, but they are extensively using these applications. Whether it's accessing the intranets/ extranets or b2b integration, for that matter dispatch updates or tracking of products they are extensively using these for their functions. Where as other Indian organizations are using applications in various functions, the extent of usage is limited, the basic reason that comes out is mainly because of lack of content. This is the basic inhibitor in faster adoption of mobile communication in India. Since standards have already set in various other countries, as well as are available in India and with coming up of new technologies the basic reason for slow take up of mobile data applications, is the cost of data transfer.

Discussion

The above results reveal that increase in usage of mobile communications is going to bring about a series of change in the organizations. Currently the organizations are using mobile tools mostly for voice communication and little data

and multimedia content. However, with development in network technologies, the organizations are going to change the way they use these tools and are being managed. Some of the change management issues are:

- ❑ Increase in mobile communication will make employees totally mobile and as a result their interaction with their co employees would decrease, this is going to bring a lot of change in the management styles.
- ❑ Employees will be working from their homes also hence the particular definition of work culture and working environment would change.
- ❑ An employee using a company's mobile device can be using it for other purposes and hence company policies need to be changed.
- ❑ Increasing mobility of workforce would have exhaustiveness and tiredness feeling creeping in, moreover the work would become at times monotonous, hence this change needs to be taken care of.
- ❑ With Increase in mobile communication various standards and technologies will be changing, organizations must adapt to these changes in order to improve the flexibility.
- ❑ Attitude and working criteria of your partners will change and this needs to be monitored in order to bring about the flexibility.

Apart from the above, computing in a mobile environment poses significant challenges in four distinct areas: devices, users, applications and infrastructure. Mobile devices vary dramatically from desktop and laptop computers. Handhelds and mobile devices appear in a variety of form factors and processor types. Screen sizes are quite different, input methods range from stylus and touch screen to barcode. The limitations in disk space, resident memory and battery capacity exert considerable restrictions on the mobile applications development process. Yet, perhaps the most significant factor that differentiates handhelds from desktops is the intermittent connectivity to back-end business systems and the maze of connectivity options-wireless, LAN, dial-up, docking and Internet. When moving to mobile, all of these factors make the mobile and handheld platform a considerable challenge.

The mobile workforce represents an entirely new class of enterprise users. The mobile user is accustomed to rugged or isolated environments where weather conditions or connectivity coverage vary greatly. Furthermore, mobile workers are often technologically challenged and unwilling or unable to perform local systems administration. Features such as instant on and highly tuned, task-specific applications are critical business requirements when deploying to mobile users.

Compared to commercially available applications, mobile applications are unique in a number of ways. Developers designing and building mobile applications cannot make any assumptions about connection types or how often users will connect. In addition, individual job roles and responsibilities, along with the appropriate mobile computing platform to perform the job, dictate how application software is designed and built. Finally, mobile applications must process only the essential subsets of mission-critical information and data from multiple back-end sources. The blending of data, device and application functionality presents considerable challenges for the developer of mobile applications.

The challenge of building an infrastructure to manage mobile devices, users and applications is more multi-layered than the desktop. Dealing with operational issues such as device connectivity, connection optimization, data and application versioning, tight security profiles, data modelling and management and applications development in today's environments requires highly specialized personnel with expensive skill sets. Centralized administration and control of the mobile infrastructure is essential in this heterogeneous environment. Administrators and end users to dynamically and quickly adjust to field

feedback, business requirements and emerging. Further, newer technology and innovative applications may demand a review of the above framework. This might impact the flexibility index.

To be able to address the above, some care is essential such as:

- ❑ The main focus of the mobile value chain members in India and all over the world should be on changing network technologies and they should align their services and products with these technologies.
- ❑ The application provider and the content provider should be customer centric and make applications that are useful for the customer, whether it is business, professional or a student.
- ❑ In order to overpower the inhibitors mobile operators and application providers should make applications that are secure enough to prevent data from being hacked. Handset availability can be increased by new technological development and innovation.
- ❑ Mobile operators should get prepared to offer various mobile services, either through using SMS, or WAP. More over it is recommended that application providers should make more of location services and financial trading applications.
- ❑ Organizations should take into consideration various change management issues while changing their way of working.

Since the study clearly forecasts an increase in flexibility

in the organizations, with uptake of mobile communication, survey could be done to find out the content that each one is looking for. The implications of the above recommendations are

- ❑ The mobile value chain members will focus more on the technologies and how to get their product and solutions in line with new up-gradations.
- ❑ The application provider and the content provider will have more focus on the consumer and would be making those applications which the customer is ready to pay as Indian market is quite price sensitive.
- ❑ The area of focus will now be making applications that could use the mobile internet most effectively.

Conclusion

Mobile space offers huge opportunity of achieving greater work flexibility and higher performance in organizations. Further, success will be driven by content, service and access providers who are able to deploy solutions that leverage the unique qualities of the mobile platform, as value will not be generated by simply exporting the lessons learned from the internet space to mobile devices. These market drivers, combined with regulatory stipulations on 3G licenses to open up network access, are leading to a drastic restructuring of the telecommunications industry. The previously vertically integrated service and access providers are being driven towards more horizontal structures by the segmentation of the content providers along vertically integrated industry lines. The new value chain is giving rise to the emergence of new services and new revenue opportunities as well as development of new applications for the enterprises. All these applications made needs to be so designed that they are useful for the mobile professional so that they are ready to pay for the applications. Increase in mobile applications is bringing about the change in the organizations. The IBM case study clearly presents the picture about the flexibility levels in the organization, the M-Flexibility matrix shows the growth curve and it explains how uptake of mobile applications is going to enhance flexibility in the organizations. Performances of various Indian organizations have shown a trend towards an increase, all this is possible because of flexibility incorporated in the organizations. While going in for technological innovations various human values/ ethics and work culture issues must also be taken care. The study was confined to the city of Delhi as a result the perspective of only the

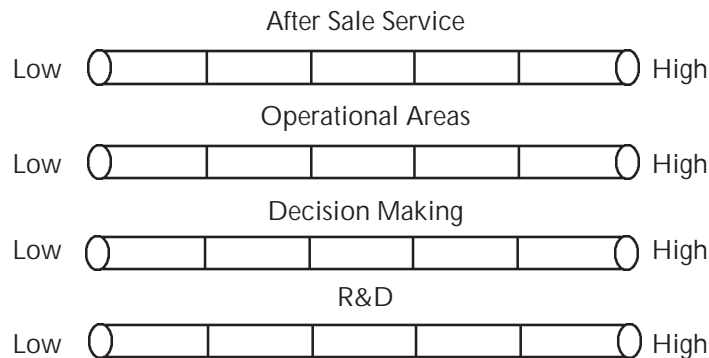
application providers in Delhi could be conducted. A future study could encompass larger audience spread across whole country. More over the study can easily be extended to figure out the various applications, which the organizations are looking for and they are willing to pay.

References

- Balasubramanian S., Peterson R.A. and Jarvenpaa S.L. (2002) Exploring the Implications of M-commerce for Markets and Marketing, *Journal of the Academy of Marketing Science* 30(4), 348–361.
- Barnes S.J. (2002) The Mobile Commerce Value Chain: Analysis and Future Developments, *International Journal of Information Management*, 22, 91–110.
- Cellular Online (2004) Latest Mobile, GSM, Global, Handset, Base Station and Regional Cellular Statistics. Available from: <www.cellular.co.za/stats/stats-main.htm>.
- Coursaris C. and Hassanein K. (2002) Understanding M-commerce a Consumer-centric Model, *Quarterly Journal of Electronic Commerce*, 3(3), 247–271.
- De L.A. and Volberda H. (1996) On the Concept of Flexibility: A Dual Control Perspective, *Omega*, 24(2), 121-139.
- Dholakia R.R. and Dholakia N. (2004) Mobility and Markets: Emerging Outlines of M-commerce, *Journal of Business Research*, 57(12), 1391-1396.
- Evans C. (1991) Linking Information Technology with Organizational Change, *Organizational Dynamics*, Summer, 30-47.
- Gunsaekaran A. and Ngai E. (2003) Special Issue on Mobile Commerce: Strategies, Technologies and Applications, *Decision Support Systems*, 35, 187–188.
- Kumar S. and Zahn C. (2003) Mobile Communications: Evolution and Impact on Business Operations, *Technovation* 23, 515–520.
- Leung K. and Antypas J. (2001) Improving Returns on M-commerce Investment, *Journal of Business Strategy*, 22(5), 12–14.
- M2 Presswire (2004) Arthur D. Little and Exane Report Predicts Continued Revenue Growth for European Mobile Operators, February 18, 2004. Available from: <www.presswire.net/>.
- NG-Kruelle C., Swatman P.A. and Rebne D.S. (2002) The Price of Convenience: Privacy and Mobile Commerce, *Quarterly Journal of Electronic Commerce*, 3(3), 273–285.
- Scharl A., Dickinger A. and Murphy J. (2005) Diffusion and Success Factors of Mobile Marketing, *Electronic Commerce Research and Applications*, 4, 159–173.
- Sushil (2000) SAP-LAP Models of Enquiry, *Management Decision*, 38(5), 347-353.
- Upton D.M. (1994) The Management of Manufacturing Flexibility, *California Management Review*, 36(2), Winter, 72-89.
- Wireless Week (2004) Buying Numbers, 30.
- Yang K.C.C. (2005) Exploring Factors Affecting the Adoption of Mobile Commerce in Singapore, *Telematics and Informatics*, 22, 257–277

Flexibility Mapping : Practitioner's Perspective

1. What types of flexibilities you see in the practical situation of "Mobile Communications" 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 due to Mobile Communications 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 of issues related to usage of various categories of application software (Please tick mark in the appropriate box(es))



4. Develop a SAP-LAP (Situation Actor Process-Learning Action performance) model for "Mobile Applications" relevant to your organization.

Key Questions Reflecting the Applicability in Real Life:

1. What are the various drivers for Mobile Communication?
2. What are the Key Mobile Network and Service Technologies?
3. How the mobile Applications in Commercial operations is taking place?



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Status of Socio-technical Change in Indian Automobile Industry – A Longitudinal Study

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Abstract

Management of change has assumed a great deal of importance in Indian automobile industry. Managing change is posing a big challenge to Indian firms in the wake of globalization and liberalization. Successful change demands that all major areas of an organization are kept in focus concurrently. These areas are technology, structure, systems, people and culture. It is seen that all these areas are interwoven and cannot be emphasized upon in isolation. This paper presents the current status of socio-technical change in Indian automobile industry, strategies used for management of change and results there of. The study has been made through survey in Indian automobile companies using a specially designed questionnaire. Many aspects of socio-technical change like change in various areas of change management, i.e. technology, systems, structure, people and culture, resistance offered to change efforts, change agents, extent of change and results of change efforts have been considered. Effect of socio-technical change on competitiveness of the organizations has also been determined.

Keywords: change management, Socio-technical change, strategies

Introduction

The study of change and its development has been one of the greatest themes in the social sciences. Many social science disciplines have developed theoretical literature and empirical findings about the birth, development, transformation, decay and decline of human and natural systems. A recent tradition of research in the various fields of the organizational science has grappled with organizational change and developments (Woodman 1989, Van de Ven and Poole 1995, Quinn 1995). The development theories of change in the organization studies have been faced with the hurdle of scholarly quality and practical relevance (Pettigrew, 1987). In this paper, it is emphasized that for successful organizational change, changes in various areas like technology, structure, systems, people and culture are needed. The paper also contains findings of a survey of managing socio-technical change in Indian automobile industry.

Change Management

Change management is defined as the effective management of a business-change. Executive leaders, managers and front line employees have to work in team to successfully implement the needed processes and technology for the organizational change. According to Prosci (2000), "change management represents the processes, tools and techniques to manage the people-side of business change to achieve the required business outcomes and also to realize that business changes can be met effectively within the social infrastructure of the workplace". This definition has been commonly used among practitioners and end-users.

Literature Review

Organizational change has been associated with the visible changes in the organization. Efforts are made in various areas like technology, structure, system, strategy, culture, etc. On the other hand, individual change represents the change in attitude, vision and target of an individual in the organization. Change management is defined as the effective management of a business-change. Executive leaders, managers and front line employees have to work in team to successfully implement the needed processes and required technology for the organizational change.

Descriptive research by Tichy and Devanna (1990) suggests that transformation of an organization follows a process, which includes a sequence of phases: recognizing the need for change, creating a new vision and then institutionalizing the change. Saeed et al (1993) have recommended a "focused manufacturing knowledge" in manufacturing area than making many engineering changes. The engineering changes have been the primary means for most mid- to high-volume product-oriented organizations to modify existing product designs in a controllable, coordinated and methodical manner.

In recent years, researchers have been concerned with understanding why some organizations perform better than others. According to the resource-based perspective, successful organizations have unique capabilities or resources that give them an advantage over their competitors. Gersick (1994), has found that these resources are valuable when they are rare, inimitable and non-substitutable. Consistent with

resource-based view, the author maintains that the development of social capital within an organization is the source of competitive advantage for a firm. Winning in business today demands innovative culture. According to Kanter (1999), the need of the companies is to serve the social sector and gain competitive advantage. For the success of a business, social acceptance of innovations a especially technological changes, is a must. He further states that companies should view community needs as opportunities to develop ideas, serve new markets and solve long-standing business problems. The best way to ensure full commitment is to make parity between corporate and the community.

Literature on various aspects of socio-technical change management is briefly covered below.

Technological Change

Managing a technological change pro-actively has always been a big challenge for any firm. Hayes (1991), Langowitz (1992) and Katz et al (1996) have studied the technology transfer in a multinational cooperative joint venture and concluded that technology change depends upon type of technologies, methods used to transfer them, their degree of success and the organizational, national and cultural differences.

Malthus (1978), Marx (1987) and Ricardo (1995) have expressed concern about the effects of innovation, especially in the form of new technology machinery, on the displacement of labor.

According to them, new technology is concerned with labor saving and quality-enhancing innovations, such as computer-aided design/computer-aided manufacturing systems, computer numerically controlled machines, just-in-time inventory systems, flexible manufacturing systems and robotics. Technology change has been derived as a two-stage process. In the first stage, the firm is found to make a decision to adopt a new advanced manufacturing technology. This is followed by adjustment of the labor force in the second stage.

Structural Change

Organizations have various structures based on the optimal coordination of interactions amongst various activities. Many structures are designed in the organizations based on number of levels, authorities and responsibilities of individuals. Changing structure in a company includes alteration in any authority relationships, coordination mechanisms, degree of centralization, job design, or similar other structural variables. Process reengineering, restructuring, downsizing and empowering have resulted in more decentralization, wider spans of control, reduced work specialization and cross functional teams. These structural components have given employees the authoritative flexibility and ease to implement process improvements (Robbins, 2001).

The need of structural change of a high technology firm is reflected directly from the environment of the firm and

the characteristics of the technology (Moharman et al, 1990). He has expressed that the strategic and structural changes are being manifested in large multinational corporations (MNCs) to locate more and more value-added activities outside the home country. Further, 'subsidiary development' initiative is an important driver of the process of structural change, through which the subsidiaries expand their scope of activities and responsibilities within MNCs.

Pattanayak (2000) has advocated downsizing and delayering for reengineering in the companies. He has emphasized that successful reengineering requires a change in the company's whole structure.

Systemic Change

Mumford (1983) and Pava (1983) developed socio-technical systems design approach for process redesign. They have stated that performance of the organizations is dependent upon technical and social dimensions. They further considered that technology dimension is concerned with its technology and procedures and social dimension denotes people who work for the organization and focuses on their psychological needs for fulfilling and satisfying work. They have concluded that socio-technical systems involve the joint design of the technical subsystem (optimized for efficiency) and the social subsystem (optimized for job satisfaction and motivation) in such a way that they support each other.

To accomplish change in an organization, traditional measures need to be changed with an empowered workforce that is more self-directed, self-managed and self-controlled

French (2000) has found the impact of the new processes on the survival of the organization. Further, he has demanded new processes to be developed for cost reduction through value engineering activities, also reduction in product-life cycle through research and development and improving confidence of its vendors through revitalization of the company. Carr and Gabriel (2001) have considered the systemic change responsible for competitiveness of an organization. They have demanded a shift from crisis management to long-term process of stabilizing the organization, sustaining progress and ensuring the success of the company in a rapidly changing environment.

Chaudron (2002) studied the impact of various change efforts in various organizations. Based on this study, he determined several causes to organization's change efforts to stumble or stagnate. One of the important causes has been lack of systemic changes. He has stressed that management must focus on customer satisfaction and should promote teamwork in the entire organization. Profit sharing may be introduced; individual performance appraisals may be radically changed or eliminated; organizational structure may be realigned away from functions (production, quality, engineering) to a customer-, process- or geograph-based; information may be disseminated to all the employees than to reserve it for senior management. Significantly, more authority must also be extended to the line employees. If management does not align these systems, the effect will be like "Dr. Doolittle's Pushme-Pullyou" animal (a horse with

two heads, each pulling in the opposite direction).

Kampas (2003) has found that it is the necessity of the present industry to orchestrate transition from product-innovation culture to process-innovation culture, which focuses on systems change like product development, procurement, manufacturing, sales, distribution and marketing.

People Change

Change in people refers to changes in employee attitudes, expectations, perceptions, or behavior. The human dimension of change requires a workplace committed to the organization's objectives, targets and vision. This dimension has necessitated proper education and training for the manpower. It has also demanded a performance evaluation and reward system that supports and encourages continuous improvements.

According to Beatty and Ulrich (1996), the greatest effort involved in making the change in an organization is to change the mindset of employees at all levels. The mindset represents a shared way of thinking and behaving within an organization. Further, they added that mindset is institutionalized in vision, value and mission. As an organization becomes mature, it has a relatively fixed mindset and becomes a liability. With time, its intensity may hinder the ability to change.

Friedman (2002) has studied the role of individual in organizational change.

Organization learning occurs when individuals within an organization experience a problematic situation and enquire about it on organization's behalf. Further, involvement of people results in change of individuals' mindsets as well as organization culture. He has further stated that programmes like TQM and reengineering transform people at all levels into agents of organization change.

Bogley and Boyd (2003) have felt the importance of developing a global mindset requiring changes of organizational structure, process and systems. It requires a balanced formalization with flexibility through modular networks and communities of practice, balancing standardization with customerization through disruptive management, centers of excellence and corporate vision.

Cultural Change

Organizational culture denotes a system of shared meaning within an organization that determines to a large degree how employees behave. New systems or patterns of values, symbols, rituals, myths and practices have evolved over time in the industry. Organizations around the world are experiencing changes in the culture and the trend is towards even more changes as countries continue to undergo changes in the cultural composition of their general populations (Erez and Somech 1996, Hambrick et al 1998, Wenting and Palma 2000).

There are basically two types of approaches for cultural change in an organization, i.e. the team approach (Heavens,

1993) and the committee approach (Quinn, 1995). Participation on committees means to bring people together to share ideas on a particular project. The committee approach has been superseded by the concept of shared management. Teams have been encouraged to work collaboratively using team problem-solving techniques. Teams tend to have more responsibility, more authority and the team approach tends to be more proactive than the committee approach.

Morrison and Phelps (1999) have studied factors to motivate employees for cultural change. They have found an important factor called "taking charge" which in turn effects organization functions. As reported by coworkers, taking charge is related to feel responsibility, self-efficacy and perceptions of top management. It entails voluntary and constructive efforts, by individual employees, to effect change with respect to how work is executed within the context of their jobs, work units, or organizations. They have concluded that employees can be motivated to go beyond the boundaries of their jobs for cultural change. Also, the employees are likely to be motivated when they perceive top management as open to employee.

Entrepreneurial Aspects

Lee and Peterson (2000) have evolved a cultural model of entrepreneurship. They have proposed that a society's prosperity to generate autonomous, risk taking, innovative, competitively aggressive and proactive entrepreneurs depend on its cultured foundation. Role of economic, political/legal and social factors are moderators in the relationship between culture and entrepreneurial orientation. Finally they have concluded that a strong entrepreneurial orientation will ultimately lead to increased competitiveness.

Michael et al (2001) have defined entrepreneurship as the process of storytelling that mediates between extant stocks of entrepreneurial resources and subsequent capital acquisition and wealth creation. The authors have proposed a framework that focuses on how entrepreneurial stories facilitate the crafting of a new venture identity that serves as a touchstone upon which legitimacy may be conferred by investors, competitors and consumers, opening up access to new capital and market opportunities.

Flexibility

A flexible system is one that is able to respond to changes and flexibility is the ability of the system to respond effectively to change. The ability of the organization to cope with the internal changes requires a degree of redundancy in the system, whereas the ability to cope with the external change requires that the systems be versatile and capable of producing wide variety of parts with minimal change over time and costs (Buzacott 1982 and Chung and chen 1990).

The concept of systemic flexibility was introduced by Sushil (1994). Systemic flexibility is the exercise of free will or freedom of choice on the continuum to synthesize the

Managing change has comprised of various interconnected and interdependent areas.

dynamic interplay of thesis and antithesis in an interactive and innovative manner, capturing the ambiguity in systems and expanding the continuum with little penalty in time and effort. Such a systemic concept of flexibility will have major attributes of spectral, integrative, interactive, innovative and fuzziness character and lead success to the organization.

Dixon (1997) feels that there is a linkage between flexibility and competitiveness of an organization. With respect to avoiding product changes, the ultimate level of flexibility is achieved when the need for change itself has been eliminated. Three strategies have been evolved for improving flexibility-choosing flexible technologies, lower the cost of change and product architectural choices that allow the product to easily accommodate change.

Areas of change

Areas of organizational change have been related to its dynamics and effects of time, process, discontinuity and context. From the detailed literature review, it is clear that change management cannot be merely limited to technological aspects like replacement of machines, equipments, instruments and practicing new manufacturing processes. However, it has been commonly aimed to make the processes and products more effective in an organization. Managing change is comprised of various interconnected and interdependent areas (Garg and Singh, 2002). These areas need to be recognized both individually and also in terms of their multilateral linkages with other areas.

Considering the detailed literature review, status of socio-technical change in Indian automobile industry needs to be assessed considering the following aspects:

- Technological change
- Systemic change
- Structural change
- People change
- Cultural change
- Flexibilities
- Innovations
- Continuous improvement
- Drivers of change and change agents
- Organizational learning
- Inhibitors to change
- Reengineering and strategic change
- Need of change

Survey on Socio-technical Change and its Management

A survey has been performed to assess the current status of socio-technical change management in Indian automobile industry. Survey has been conducted using a specially designed questionnaire containing multiple-choice questions.

The steps involved in the survey are:

- a. Design of a suitable questionnaire
- b. Standardization of the questionnaire by pretesting and incorporating the suggestions of the experts from industry and academicians
- c. Conducting survey by mail and personal visits
- d. Entering the data in EXCEL 2000 as a file in the form of various fields for various considerations
- e. Analyzing the response of the survey

Design of Questionnaire

A questionnaire comprising of simple and relevant questions relating to various aspects of change management was designed. The questionnaire has been divided into two broad sections.

Section A has been designed to obtain general information of the responding organization, e.g. type of company, details of collaborations, products manufactured, organizational objectives like market leadership, percentage of market share, profitability, volume and quality of output and also the extent of accomplishment of the objectives.

Section B seeks detailed information related to change management. The overall process of change management has been divided into various segments, namely need of change, selection of driver of change, choosing a change agent, visualizing inhibitors to change process, technological changes, systemic changes, changes in organizational structure, change in mindset of people, cultural change, impact of organizational learning and knowledge management, need of flexibility, impact of reengineering, achievements of benchmarking, changes by innovations, continuous improvement and strategic change. Mostly close-ended multiple-answer type questions have been framed and four alternatives have been provided for giving response. Response has also been used to find extent of change by comparing the status of companies before and after the change process.

Pre-testing and Validation of Questionnaire

To ensure its relevance and effectiveness, the questionnaire has been pretested on a representative sample of industry. Feedback and suggestions by senior executives and academicians were sought and the questionnaire suitably modified before conducting the survey. The questionnaire was validated in terms of face validity and content validity before using it for survey.

Industry Surveyed

Automobile industry in the northern region of India covering the states of Punjab, Haryana, Himachal Pradesh, Uttar Pradesh, Delhi and Union Territory of Chandigarh has been surveyed. Units covered are manufacturing one or more types

A poorly managed organization results in a resisting force that slows down, or in some cases even stops the change process

of vehicles like cars, light commercial vehicles (LCVs), tractors, farm machinery, scooters, motorcycles, mopeds etc. or are engaged in manufacturing of auto-components, e.g. steering systems, axles, filters, brake drums, shock absorbers, casting of engine housings, sheet metal components etc. A total of 252 industrial enterprises were selected for the survey.

Conducting the Survey

Initially, the questionnaires were mailed to all 252 organizations along with a covering letter stating the objective of the study with a request to send an early reply. After about 15 days, reminders were sent to expedite the matter. Information from some of the organizations was received in this way. Personal visits were made to many organizations to collect the response in an interactive manner.

Change in mindset of people is possible by involmment and commitment of top management, sharing their views and vision with the people of the organization

Table 1: Response to the Survey

Type of organization	Number of organizations		Response ratio in percent (%)
	Questionnaire sent to	Response given by	
Total selected organizations	252	83	33%
Automobile manufacturers	52	18	35%
Component manufacturers	200	65	33%

Response Obtained

A total of 83 firms out of selected 252 responded to the questionnaire. Out of them, 18 responses belong to the automotive manufacturing units and remaining 65 to component manufacturing units. Out of 18 responses received from the automotive manufacturing units, 03 are manufacturing passenger cars, 08 tractors and farming machinery, 01 LCV, 05 two-wheelers and 01 MUV. The response to the survey has been presented in Table 1. Analyzing it scale-wise, the maximum response received is from automobile manufacturers (35%) followed by component manufacturers (33%).

Scoring

In section A of the questionnaire, most of the questions seek information in the form of ‘Yes’ or ‘No’. This information has not been used quantitatively. Some questions in section A and almost all questions in section B have a scale of 1-4. The score of 4 was assigned to the best choice, 3 to the second best, 2 to the next in order and 1 to the lowest choice. The score of all the companies were fed to the computer and were analyzed to derive useful findings.

Findings of the Survey

Findings from the survey have been categorized into three

categories:

- i. Determining the status of various aspects of change management
- ii. Categorization of companies into various classes such as very good, good, fair and poor from change management point of view
- iii. Establishing the coefficients of correlation between various aspects of change management and extent of change

Status of Various Aspects

Using the score obtained from the response of questionnaires from 83 companies, average values of the major aspects of change management have been calculated and categorized as shown in Table 2. For categorization, mean value and standard deviation (SD) of the scores of major aspects have been used as described below.

Table 2: Status of Major Aspects of Change in Indian Automobile Industry

S. No	Major aspects of change management	Mean value of average score of various aspects	Mean value in terms of percentage = 100* Mean value/ 4	Category
1	Technological change	3.21	80.25%	Good
2	Flexibilities	3.117	77.92%	Good
3	Innovations	3.078	76.95%	Good
4	Need of change	3.066	76.65%	Good
5	Continuous improvement	3.018	75.45%	Good
6	Driver of change	3.007	75.17%	Good
7	Structural changes	2.948	73.70%	Good
8	Benchmarking	2.867	71.67%	Good
9	Change agent	2.846	71.15%	Fair
10	Systemic changes	2.8	70.00%	Fair
11	Cultural change	2.77	69.25%	Fair
12	Organizational learning	2.766	69.15%	Fair
13	Inhibitors to change	2.542	63.55%	Fair
14	Reengineering	-	51.8%	Poor
15	Strategic change	1.251	31.27%	Poor
		Mean value	71.20%	
		Standard deviation (S D)	0.123	

Very good: Score above (mean+SD) : 83.5% and above
 Good: Score between (mean) and (mean+SD) : 71.2 to 83.4%
 Fair: Score between mean and (mean-SD) : 58.9 to 71.1%
 Poor: Score below (mean-SD) : Below 58.9%

- iii. Structural change
- iv. People change
- v. Cultural change
- vi. Flexibility
- vii. Reengineering
- viii. Innovativeness
- ix. Entrepreneurship
- x. Organizational learning

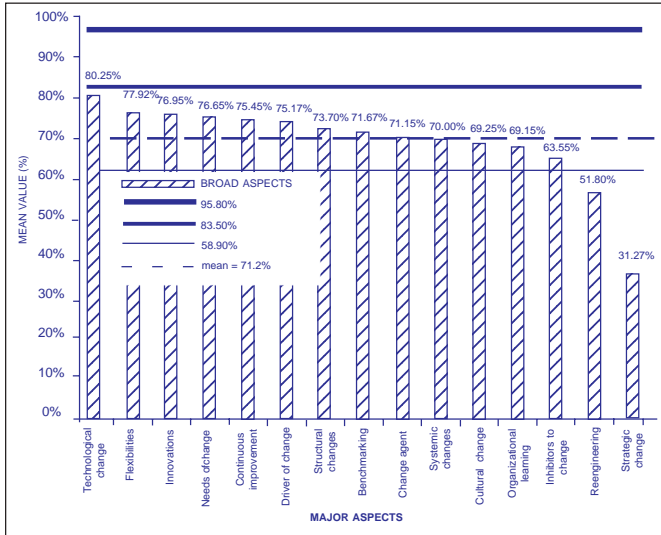


Figure 1: Status of Broad Aspects of Change Management

No one amongst major aspects has fallen in ‘very good’ category as shown in Table 2. With a score of 3.21 (80.25%) on a scale of 4, technological change has the highest score among all major aspects and falls in the ‘good’ range. This has been followed by status of flexibilities (3.117), achievements of innovations (3.078) and feeling of need of change (3.066), continuous improvement (3.018), selection of driver of change (3.007), status of structural change (2.948) and role of benchmarking (2.867) in good range. Appointment of change agent (2.846), status of systemic change (2.8), status of cultural change (2.77), organizational learning (2.766) and inhibitors to change (2.542) occupy ‘fair’ category. Status of reengineering (51.8%) and strategic change (1.251) have been ‘poor’ and worth attention.

Indian automobile industry has felt a need of change and initiated the change process, mostly in a systemic way.

From the above scores, it can be concluded that automobile industry has felt a need of change and has initiated the change process, mostly in a systemic way. Figure 1 gives an at-a-glance picture of the comparative standing of each major aspect.

Classification of Companies

To classify the companies based upon the status of major areas of change, the relevant questions have been separately listed and tabulated from the whole questionnaire and their scores have been compiled under the following heads:

- i. Technological change
- ii. Systemic change

Total score of each company in each head has been calculated from the data of total score of various related questions. The total score of each head is divided by the maximum possible score to calculate the percentage score of each head. From the calculated values for these heads (major areas), a grand average value has been calculated which has been taken as a measure of overall change management. Based on the above criteria, companies have been classified into various categories as shown in Table 3.

Table 3: Status of Organizations in Change Management

S. No.	Major Areas of Change Management	%Organizations in various categories			
		V.Good	Good	Fair	Poor
1	Technological change	16%	37%	33%	14%
2	Systemic change	18%	34%	31%	17%
3	Structural change	14%	34%	41%	11%
4	People change	16%	34%	37%	13%
5	Culture change	20%	22%	43%	14%
6	Flexibility	17%	27%	42%	14%
7	Reengineering	19%	53%	9%	19%
8	Innovativeness	23%	33%	33%	12%
9	Entrepreneurship	17%	33%	31%	19%
10	Organizational learning	18%	37%	28%	17%
11	Overall change management	01%	16%	81%	2%

For categorization of companies, the following method was used. Regarding the ‘choice’ carrying highest marks in each question, the levels achieved by Indian automobile industry have been taken into consideration. Based on the scores in various major areas for all 83 companies, the average value ‘x’ and standard deviation ‘a’ have been calculated. With the help of these values, the comparative performance of the company has been categorized as described below:

- > x+a V. Good
- x to x+a Good
- x-a to x Fair
- < x-a Poor

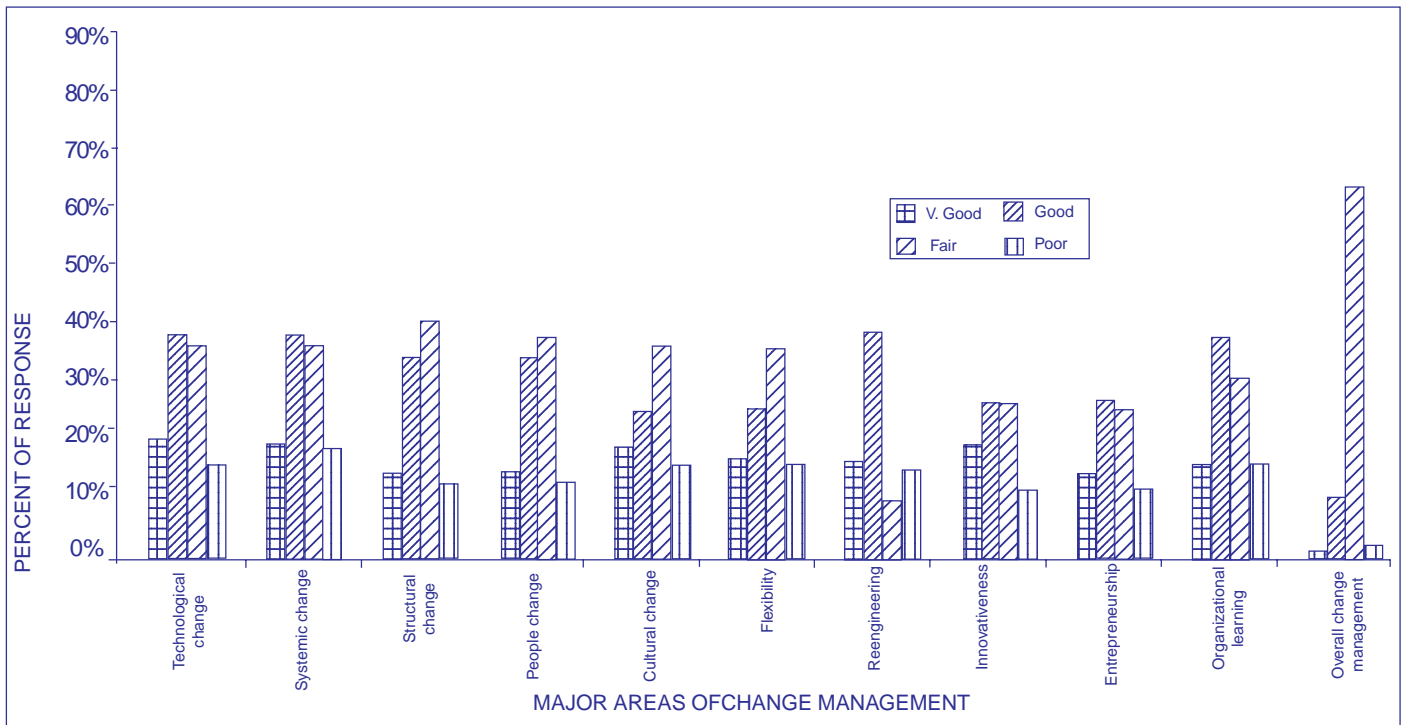


Figure 2: Status of Organizations in Change Management Extent of Change in Each Aspect

Table 3 shows the percentage of companies falling into various categories of change management in various heads (major areas). From this table, it is clear that status of technological change is comparatively good and very good in 53% firms whereas only 33% lie in fair range. Similarly, status of all other major areas of change management in various ranges is depicted in Table 3 and also illustrated in Figure 2.

Extent of Change

Response of the organizations has been used to find out the extent of change (EXTN) by ascertaining the status of relevant features and indicators of the organizations. For assessing the extent of change as a result of the efforts made, information on the following measures/parameters was sought from the respondents on a scale of one to four regarding before and after the change scenario in their organizations:

Technology

- Extent of use of computers in office
- Extent of use of computers in MIS
- Extent of use of CAD/ CAM
- Extent of use of CNC Machines
- Use of Information technology

Systems

- Extent of use of computers in office
- Customer focus
- Extent of use of computers in MIS
- Accountability
- Definition and documentation of individual's

authority & responsibilities

- Transparency
- Extent of use of quality circles
- Team work
- Reactive and proactive improvement
- Participation of all cadres in decision making
- Voluntary participation of employees for education and training
- Government rules and regulations

Structure

- Layers of management
- Team work
- Organizational setup
- Participation of all cadres in decision making

People and Culture

- Team work
- Sense of belongingness at all levels
- Voluntary participation of employees for education and training

The difference of the central tendencies or average values of various indicators before and after the change process are taken as a measure of extent of change (Table 4). Further, the analysis of extent of change has been carried out from two viewpoints:

- Extent of change achieved in each of the aspects, as listed in Table 4, by finding out difference of average scores measured before and after the change

The results of efforts made by the Indian organizations for management of change, although not substantial are still encouraging.

Table 4: Extent of Change (EXTN) in various Aspects

S. No.	Indicators of change	Calculated average value of change on 4-point scale		Extent of change: $EXTN = \frac{C2-C1}{4}$
		Before change process	During or after change process	
		C1	C2	
1	Extent of use of computers in office	2.096	3.410	0.33
2	Customer focus	2.446	3.578	0.28
3	Extent of use of computers in MIS	1.904	3.012	0.28
4	Extent of use of CAD/ CAM	1.831	2.940	0.28
5	Layers of management	1.735	2.819	0.27
6	Accountability	2.036	3.024	0.25
7	Definition and documentation of individual's authority & responsibilities	1.952	2.952	0.25
8	Transparency	2.048	3.024	0.24
9	Extent of use of quality circles	1.964	2.880	0.23
10	Extent of use of CNC Machines	1.904	2.819	0.23
11	Team work	2.313	3.205	0.22
12	Reactive and proactive improvement	1.807	2.699	0.22
13	Use of information technology	1.771	2.651	0.22
14	Organizational setup	2.205	2.988	0.20
15	Participation of all cadres in decision making	2.000	2.771	0.19
16	Sense of belongingness at all levels	2.205	2.855	0.16
17	Voluntary participation of employees for education and training	2.000	2.602	0.15
18	Government rules and regulations	2.398	2.916	0.13

process in all the organizations taken together.

- ii. Extent of change achieved by each organization by working out the before and after difference of the scores of each company in all aspects taken together and then categorizing the companies based on these scores.

Table 4 shows the extent of change achieved by all the

companies taken together in each of the 18 aspects listed in the first column. For each aspect, number of responses to various choices have been multiplied with the corresponding score of the choice and summed up to arrive at the cumulative score. This has been done for both, before and after the

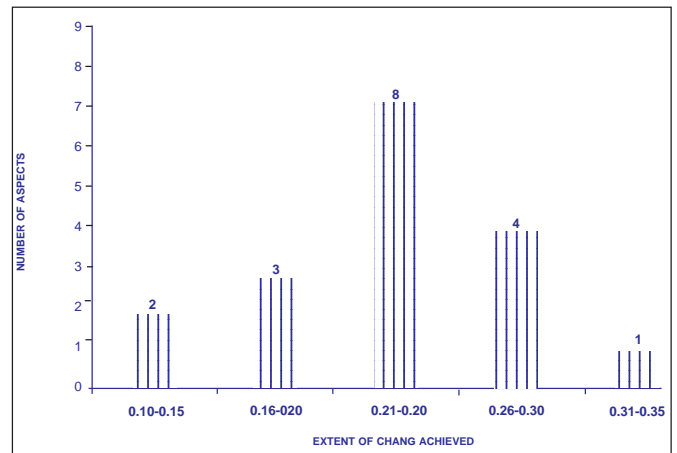


Figure 3: Level of Extent of Change Achieved (EXTN)

change process. Then the difference has been worked out to find out the extent of change on a scale of 0-1. These differences have been put into various ranges or classes for pictorial representation and discussion.

Figure 3 shows the number of aspects achieving a specific range of extent of change. Maximum number of aspects (8) achieved an extent of change of 21-25%. These aspects are shown in Table 4. The results reflect that as a result of the efforts made, there has been 21% to 25% improvement in the areas of accountability of each individual, definition and documentation of responsibility and authority, transparency, use of small group activity, use of computerized machines, information technology, team work and continuous improvement. There has been 25% to 30% improvement in another, 4 aspects. Customer focus, use of computers in

Table 5: Classification of Companies based upon Extent of Change

S. No	Range of extent of change	No of companies
1	0.56-0.60	01
2	0.51-0.55	02
3	0.46-0.50	04
4	0.41-0.45	00
5	0.36-0.40	06
6	0.31-0.35	07
7	0.26-0.30	07
8	0.21-0.25	27
9	0.16-0.20	10
10	0.11-0.15	08
11	0.06-0.10	06
12	0.00-0.05	05

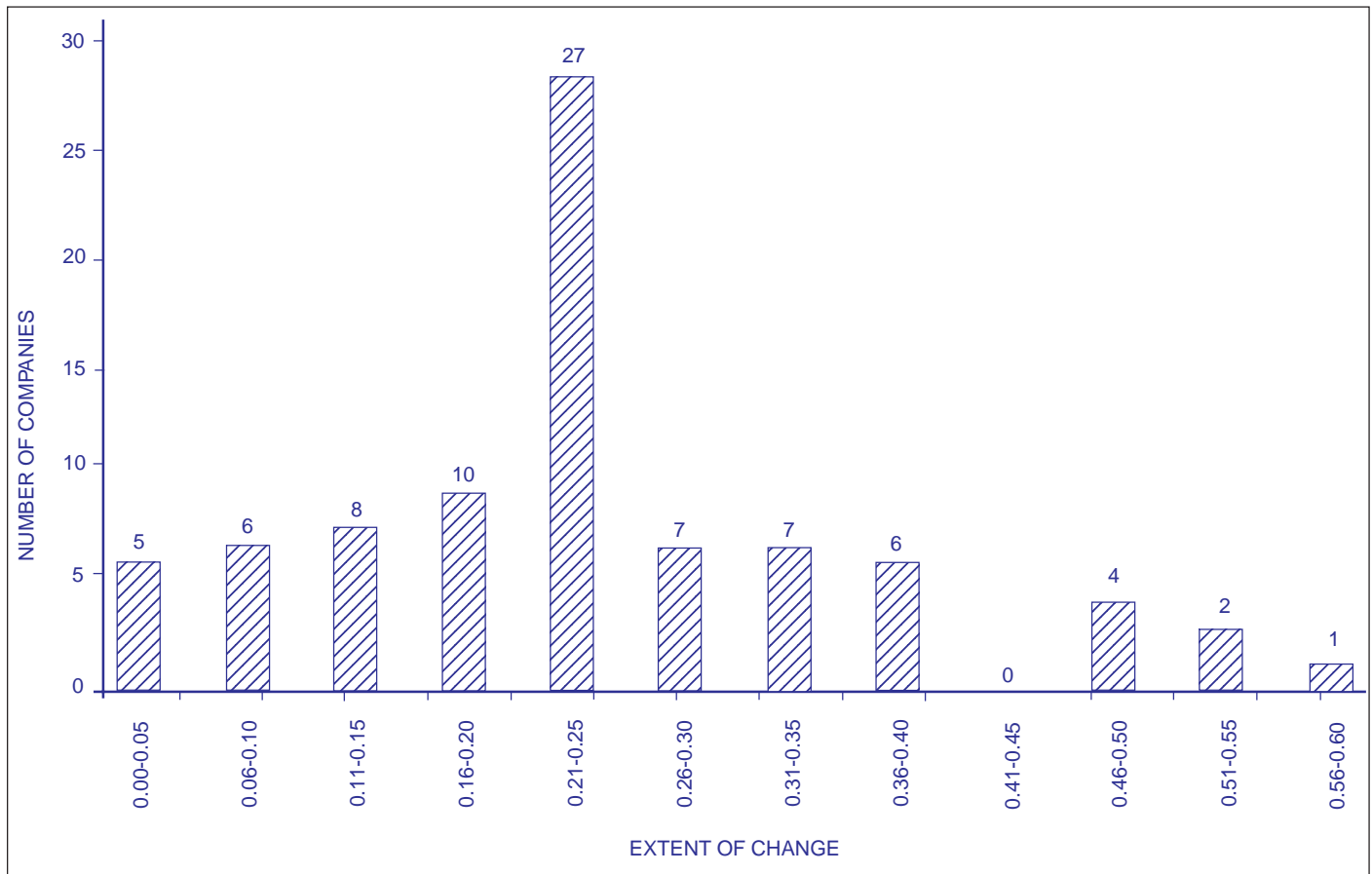


Figure 4: Classification of Organizations based upon Extent of Change (EXTN)

management information systems, design and manufacturing and reduction in layers of management fall in this category. Three vital aspects like organizational structure and set up, participation of people at all levels in decision making and sense of belongingness have achieved only 16% to 20% change over the pre-efforts periods. Two aspects, namely, voluntary participation of employees in education and training and government rules and regulations have changed only to the extent of 10% to 15%. The highest extent of change has been achieved in use of computers in office work (33%).

From the above discussion, it is concluded that the results of efforts made by the organizations for management of change, although not substantial are still encouraging. There is, however, a need to sustain these efforts.

Extent of Change Achieved in Aspects Taken Together

To categorize the companies based upon the extent of change, the scores for various indicators of change before and after change process as responded by the companies have been calculated. The difference of these scores (score after change – score before change) has been taken as extent of change for a company. Extent of change has been classified into 12 categories (ranges) as shown in Table 5 and number of companies in each category has also been found. The categorization of companies based on extent of change has

been depicted in Figure 4.

Organizations proceed to higher levels of change as the demand of competition increases.

Figure 4 shows 27 companies (32%) making 21%-25% change after change process, whereas 29 companies have observed change from 0 to 20% and 27 companies from 26% to 60%. For the response obtained from 83 companies, average score of extent of change has been calculated as 0.24 and standard deviation as 0.12. The average score of 24% is really very low while standard deviation of 0.12 indicates a large variability between the companies. Some companies have visualized quite large changes while others have changes comparatively less. 42 companies (51%) are falling below the average score of 0.24, which is a matter of great concern for Indian automobile industry. Highest value of extent of change achieved has been 0.57 by only one company. From the above discussion, it is concluded that the average extent of change achieved in Indian companies is quite low and has a large variability. There is a need to put more efforts on various aspects of change management.

From the response, further it is found that maximum extent of change has been observed in technology (mean value=0.26) followed by systems (mean value=0.23), structure (mean value=0.22) and people and culture (mean value=0.18), taken in order.

Organizational Competitiveness

Competitiveness is a useful indicator of the success and prosperity of an organization (Porter, 1998). Competitive advantage of the firms is based upon the simple principle, “the more in-time and aware of market a company is, the more competitive it can be (through lower prices and increased market share)” (Porter, 1980). Further, Porter advocated the use of a ‘value chain’ analysis of a company’s internal processes. Value chain of an organization is composed of nine generic activities. The activities can be divided into two broad types: primary activities which involve the physical creation of the product, its sale and transfer to the customers; and support activities which support the primary activities by providing material inputs, technology, human resources and other firmwide functions. Everything that a firm does must be captured in a primary or support activity through a process that requires some ‘judgment’ (Porter, 1985). In short, a firm derives its internal competitiveness from these activities.

Socio-technical systems are made up of technical and social subsystems. To optimize the entire work system, the interaction of both subsystems must be jointly optimized.

According to Momaya (2000), the asset-process-performance framework (APP framework) can be used to capture importance of different factors of competitiveness in an organization. In APP framework, ‘competitive performance’ of a company is obtained through its ‘competitive processes’ using ‘competitive assets’. Competitive performance of a firm can be measured by many criteria such as market leadership, market share, return on investment, profitability, growth of organization, productivity, quality standard, etc. Similarly, competitive processes can be

assessed by various criteria such as processes for value addition, product type, volume of production, product mix, financial management, etc.; and competitive assets by criteria like machines and equipments, technology, human resources, competitors, etc.

In an organization, the activities are to be planned so that its performance remains good on short term as well as long term basis. According to Porter (1980), “primary and support activities decide the approach of the organization towards short-term and long-term performance respectively”. For short term performance, ‘primary activities’ have been considered in Section-B of the questionnaire whereas for long term performance, ‘support activities’ have been considered in Section A in the form of objectives set by the organization and their level of accomplishment. A relative weightage has been assigned to the objectives while assessing their long-term fulfillment. The measure of short-term and long term performance indicators depict

‘competitive performance’ and ‘competitive processes’ respectively (Momaya, 2000) and have been considered as a measure of ‘overall competitiveness’ of the organization as indicated below (Garg, 2005):

Competitiveness score = $\sum Si * Wi + \sum Pi$, where Si is the score of a company in accomplishing competitive processes, Wi the weightage of the objectives and Pi is the performance measure.

From the response of the organizations, the competitiveness score of all 83 organizations, their mean score and the standard deviation have been worked out as

Table 6: Correlations between Overall Change Management, Change Strategies and Competitiveness

	TECH	SYS	STR	PPL	CULT	FLEX	RENG	INNV	ENTR	LRNG	CM	COMP	EXTN
TECH	1												
SYS	0.375**	1											
STR	0.395**	0.385**	1										
PPL	0.449**	0.629**	0.558**	1									
CULT	0.449**	0.564**	0.642**	0.753**	1								
FLEX	0.206	0.317**	0.292**	0.368**	0.318**	1							
RENG	-0.21	0.155	0.262	0.0556	0.054	0.268	1						
INNV	0.388**	0.513**	0.476**	0.487**	0.541**	0.346**	0.142	1					
ENTR	0.338**	0.424**	0.483**	0.596**	0.481**	0.14	0.2017	0.429**	1				
LRNG	0.372**	0.533**	0.381**	0.53**	0.475**	0.256**	0.1621	0.397**	0.451**	1			
CM	0.532**	0.725**	0.723**	0.784**	0.778**	0.539**	0.524**	0.709**	0.651**	0.681**	1		
COMP	0.068	0.204	0.046	0.298**	0.269*	0.172	0.1073	0.394**	0.2058	0.276*	0.317**	1	
EXTN	0.225*	0.126	0.374**	0.46**	0.43**	0.053	0.178	0.070	0.296**	0.265**	0.366**	-0.175	1

** - Correlation is significant at 0.01 level, * - Correlation is significant at 0.05 level.

(SYS- Systems, STR- Structure, PPL- People, CULT- Culture, FLEX- Flexibility, RENG- Reengineering, INNV- Innovation, ENTR- Entrepreneurship, LRNG- Organizational Learning, CM- Overall change management, COMP- Competitiveness, EXTN- Extent of change)



0.35 (where 1.00 can be the highest) and 0.194 respectively. Both statistics depict a low score in general and wide variation among the scores of various companies.

Relationship of Strategies Adopted with Change Management

Table 6 shows the values of coefficients of correlation between various areas and strategies of change management and the extent of change achieved and competitiveness. The values of coefficients of correlation show that there are significant relationships (at confidence level=0.01) between various major areas of change management like technology, structure, systems, people and culture. This depicts the complementary nature of changes in one area with the changes in other areas. Flexibility has a significant relationship at 0.01 level with all these areas except with technology with which the relationship, although positive, is not significant. Reengineering has not emerged to be a strategy, which is complementary with other strategies. It does not have significant relationships with any other strategy or major areas of change management. Innovations have significant relationships at 0.01 level with all the major areas of change and strategies except with reengineering. Entrepreneurship has significant relationships with all other areas and strategies at 0.01 level except with flexibility and reengineering. Organizational learning has come out to be a strategy, which has a bearing on all other areas and strategies. It has significant relationships at 0.01 level with all except reengineering.

As far as overall change management is concerned, it is seen that all major areas and strategies have significant relationships with it at 0.01 level. People change with coefficients of correlation $r = 0.784$ has the strongest relationship with overall change management, followed in order by culture ($r=0.778$), systems ($r=0.725$), structure ($r=0.723$), innovations ($r=0.709$), organizational learning and knowledge management ($r=0.681$), entrepreneurship ($r=0.651$), flexibility ($r=0.539$), technology ($r=0.532$) and reengineering ($r=0.524$).

Conclusion

From the survey, it is clear that Indian automobile has made efforts to manage socio-technical change. Changes have been made in various areas of change management like technology, systems, structure, people and culture. As a result, various notable changes have been made in various organizations. But still there is wide scope for further change. The industry has to strive hard to be innovative, technologically superior as well as working-culture conscious. The continuous pace with world-class technology, supportive systems, restructuring and cultural modifications will help the organizations to change successfully.

References

Beatty R.W. and Ulrich D.O. (1996) Re-engineering the Mature Organization,

IEEE Engineering Management Review, Fall, 60-69.

Bogley and Boyd (2003) The Need for a Corporate Global Mindset, *MIT Sloan Management Review*, 44(2), 25-32.

Buzacott J.A. (1982) The Fundamental Principles of Flexibility in Manufacturing Systems, *Proceedings of the First International Conference on FMS*, Brighton, UK, 23-30.

Carr and Gabriel (2001) The Psychodynamics of Organizational Change Management, *Journal of Organizational Change Management*, 14(5), 415-421.

Chaudron (2002) Nine Pitfalls of Organizational Change, www.prosci.com.

'Competitive performance' of a company is obtained through its 'competitive process' using 'competitive assets'.

Chung C.H. and Chen I.J. (1990) *Managing Flexibility of Flexible Manufacturing Systems for Competitive Edge*, Springer Verlag, Berlin, 280-305.

Dixon J.R. (1997) Measuring Manufacturing Flexibility: An Empirical Investigation, *European Journal of Operational Research*, 60, 131-143.

Erez M. and Somech A. (1996) Effects of Culture and Group-based Motivation, *Academy of Management Journal*, 39, 1513-1537.

French (2000) Measuring Systematic Unity in a Learning Organization, *Journal of Management in Engineering*, 16(4), 39-46.

Friedman V.J. (2002) The Individual as Agent of Organizational Learning, *California Management Review*, 44(2), 70-89.

Garg R.K. and Singh T.P. (2002) Managing Change for Competitiveness, *Global Journal of Flexible Systems Management*, 3(4), 13-22.

Garg R.K. (2005) Managing Socio-technical Change for Competitiveness in Indian Automobile Industry, *Ph.D. Thesis, Thapar Institute of Engineering and Technology (Deemed University) Patiala*, 68-70.

Gersick C. (1994) Pacing Strategic Change: The Case of a New Venture, *Academy of Management Review*, 37(3), 1-9.

Hambrick D.C., Canney D.S., Snell S.A. and Snow C.C. (1988) When Groups Consist of Multiple Nationalities: Towards a New Understanding of the Implications, *Organizational Studies*, 19, 181-205.

Hayes R.H. (1991) Requirements for Successful Implementation of New Manufacturing Technologies, *Journal of Engineering and Technology Management*, 7, 169-175.

Kampas P.J. (2003) Shifting Cultural Gears in Technological Driven Industries, *MIT Sloan Management Review*, Winter 2003, 44(2), 41-48.

Kanter R.M. (1999) From Spare Change to Real Change, *Harvard Business Review*, May-June, 123-132.

Katz R., Rebentisch E.S. and Thomas J.A. (1996) A Study of Technology Transfer in a Multinational Cooperative Joint Venture, *IEEE Transactions on Engineering Management*, 43(1), 97-105.

Langowitz N.S. (1992) Managing a Major Technology Change, *Long Range Planning*, 25(3), 79-85.

Malthus (1978) Skill-based Technological Change: Evidence from a Firm-level Survey, *Upjohn Institute for Employment Research*, 1-7.

Marx (1987) Skill based Technological Change: Evidence from a Firm Level Survey, *Upjohn Institute for Employment Research*, 1-7.

Michael et al (2001) Entrepreneurial Strategies for Wealth Creation, *Strategic Management Journal*, 22(6-7), 545-564.

Mohrman S.A., Glinow M. and Ann V. (1990) High Technology Organizations: Context, Organization and People, *Journal of Engineering and Technology Management*, 6, 261-280.

Morrison E.W. and Phelps C.C. (1999) Taking Charge at Work: Extra Role Efforts to Initiate Workplace Change, *Academy of Management Journal*, 42(4), 403-419.

Momaya K. (2000) *International Competitiveness-Evaluation and*



Enhancement, Hindustan Publishing Corporation (India), New Delhi.

Mumford E. (1983) *Designing Participatively*, Manchester Business School Press, Manchester.

Pattanayak P. (2000) Towards Reengineering Organizational Behaviour, *Productivity*, 41(1), 71-75.

Pava C. (1983) *Managing New Office Technology: An Organizational Strategy*, Free Press, New York.

Pettigrew A.M. (1987) Context and Action in the Transformation of the Firm, *Journal of Management Studies*, 24, 649-670.

Porter M.E. (1980) *Competitive Strategy*, The Free Press, New York.

Porter M.E. (1985) *Competitive Advantage*, The Free Press, New York.

Porter M.E. (1996) What is Strategy?, *Harvard Business Review*, November-December, 61-78.

Porter M.E. (1998) *The Competitive Advantage of Nations*, Macmillan Press, UK.

Prosci (2000) www.prosci.com

Quinn B. (1995) Understanding the Differences between Committees and Teams, *Library Administration & Management*, 9(2), 111-116.

Ricardo (1995) Skill-based Technological Change: Evidence from a Firm-level Survey, *Upjohn Institute for Employment Research*, 1-7.

Robbins S.P. (2001) *Organizational Behaviour*, Edition 9th, CD-ROM included, e-business updated Edition, Pearson Education, Low Price Edition, India.

Saeed B., Bowen D. and Sohoni V.S. (1993) *IEEE Transactions on Engineering Management*, 40(1), 54-59.

Sushil (1994) Flexible Systems Methodology, *Systems Practice*, 7(6), 633-651.

Sushil (1997) Flexible Systems Management: An Evolving Paradigm, *Systems Research and Behaviour Science*, 14(4), 259-275.

Tichy N.M. and Devanna M.A. (1990) *The Transformational Leader*, John Wiley, New York, NY.

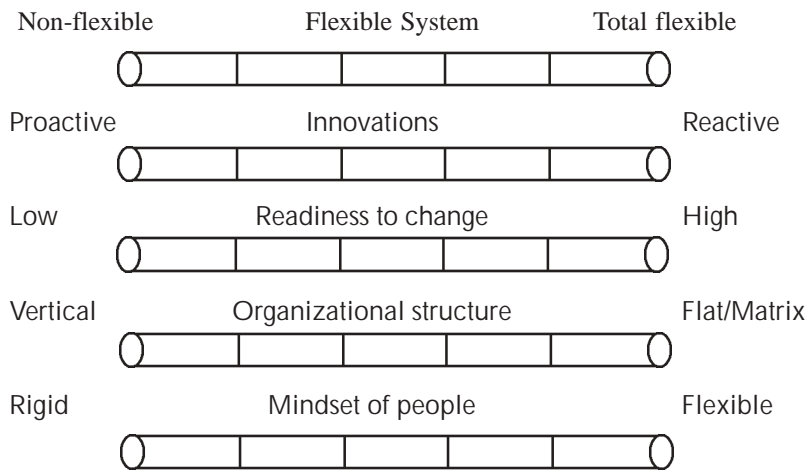
Van de V. and Poole (1995) Explaining Development and Change in Organizations, *Academy of Management Review*, 20, 510-540.

Wenting and Palma (2000) Current Status of Diversity Initiatives in Selected Multinational Corporations, *Human Resource Development Quarterly*, 11(1), 35-60.

Woodman R.W. (1989) Organizational Change and Development: New Arenas for Inquiry and Actions, *Journal of Management*, 15, 205-228.

Flexibility Mapping : Practitioner's Perspective

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



4. Develop a SAP-LAP (Situation Actor Process-Learning Action performance) model for "change mechanism" relevant to your organization.

Reflecting Applicability in Real Life:

1. How do you find the study presented in this paper relevant to your organization? Critically examine and use the relevant findings.
2. Based on the parameters in this paper, is it possible to use it for benchmarking purposes?
3. To what extent the findings of this paper are relevant for managing change in your organization?



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Strategic Insights into an E-governance Project - A Case Study of AGMARKNET based on SAP-LAP Framework

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Abstract

Several Governments, across the globe, are in pursuit of Information and Communication Technology (ICT) based solutions for facilitating good governance. While technology related issues are gradually becoming less critical, resolving implementation related issues still remain a daunting task. The implementation of ICT based applications becomes much more difficult when it involves actors and processes beyond the purview of an organization. The complex interplay of such actors and processes cause emergence of turbulent situations which are often difficult to handle. E-governance projects fall under this category. NICNET based Agricultural Marketing Information System (AGMARKNET) in India is a typical example of intricacies involved in implementing an e-governance project in a federal structure. The loose relationships among the implementing agencies involved in AGMARKNET coupled with the low success rates of e-governance projects in developing countries have prompted the author The views expressed are personal and not those of the organization to which the author belongs, to conduct a detailed study of this project from strategy perspective. The exploratory study throws light on importance of strategy in e-governance and has also helped in formulating research propositions to be validated as part of future work.*

Keywords : e-governance, agricultural marketing, AGMARKNET, SAP-LAP, strategic gap analysis

Introduction

Governments all over the world are in pursuit of ICT-based solutions for facilitating good governance. The peculiarity with ICT-based services is that they get matured over a period of time with increased participation of users. The expectations of users rise as they become accustomed to technology. As a result, the objectives and scope envisaged before launching of such projects generally need to be further expanded to accommodate growing levels of citizens' expectations. For example, Directorate of Marketing and Inspection (DMI), Ministry of Agriculture, Government of India launched a project AGMARKNET in March 2000 to empower farming community with market information by progressively networking various Agriculture Produce Wholesale Markets (APWMs) in the country. While the implementing agencies are striving hard to bring more and more markets under the network as per the primary mandate, concerns are already being expressed for enhancing the scope of service and making it reach the grass root level. While emerging service related issues were not part of the defined objectives, the initiative of Government will lose its core purpose if it fails to address them.

In recent years, many of the e-governance projects taken up at the central as well as state government levels in India have not delivered as per expectations. This could possibly be due to sticking to conventional planning and strategy framework. Such a framework, which follows a sequential

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path, is not capable of handling the dynamic context of e-governance. Like any other management context, e-governance consists of a "situation" to be managed, an "actor" or a group of actors to deal with the situation and a "process" or a set of processes that respond to the situation and recreate it. The actors in the government domain, by their very position, have limited freedom of choice which restricts their options. This leads to rigid and static processes which fail to cope up with the dynamic e-governance situations. The challenge, therefore, is how to handle the dynamically changing context of the projects of e-governance with limited government resources. The aim of this study is to explore deeper into the ongoing national level e-governance initiative—AGMARKNET from strategy perspective with focus on identifying the gaps in planning, strategy formulation and strategy implementation aspects.

Methodology

A review of literature has been carried out for better understanding of the challenges and issues involved in e-governance. Next, a case study of AGMARKNET project has been conducted using Situations-Actors-Processes (SAP) framework (Sushil, 2001). This was followed by a field study for obtaining feedback on various planning and strategic aspects of the project. The inputs from SAP-based analysis and field have been used to perform a Strategic Gap Analysis. The learning issues from SAP and Strategic Gap Analysis have been synthesised for recommending strategic actions and expected benefits therefrom for ensuring sustainability of AGMARKNET using Learning-Actions-Performances



(LAP) framework (Sushil, 2001). Finally, based on the exploratory study, research propositions have been formulated for further validation. The study was conducted during the period January-April, 2005.

Literature Review

Literature review is carried out to have a better understanding of the e-governance concept. The knowledge gained during the process has laid the foundation for identifying the area of research. After defining e-governance, subsequent discussion here is about challenges involved in its implementation and few suggested frameworks. Zwahr et al. (2005) have defined e-governance as shifts in state's governance mechanisms that are induced by ICT along the three major functions of state, namely - policy making, regulation and service delivery. Many authors have, however, preferred to use the terms e-government and e-governance interchangeably. Grant and Chau (2005) define e-government as leveraging ICT capabilities for quality public services, effective constituent relationship management and facilitating economic and social development goals of citizens, businesses and civil society. Main contributions of e-governance are identified as *e-administration*, *e-service* and *e-society* (Heeks, 2001).

Key challenges faced while implementing e-governance projects have been defined as e-readiness and closing of design-reality gaps for steering e-governance projects from failure to success (Heeks, 2003). The issues of digital divide and interoperability need special mention. Digital divide is a lost opportunity for the information "have-nots" to use ICTs to improve their lives (www.bridges.org). The information "have-nots" are generally in disadvantaged groups in developing countries. Services under e-governance have to be made accessible to the poorest of the poor. Another key issue is interoperability. A unified service delivery channel requires integration of databases within and across organizations. Various islands of automation have to be brought together to achieve something like single stop shop of government. However, unlike the private sector organizations, public entities face a far different decision-making environment of distributed control and divided powers. Interoperability is, therefore, more of an organizational, legal, political and social challenge than a technical one. Challenges involved in e-governance have been summarized as citizen relationship management, security aspects, legal issues, process re-engineering, system architecture, change management, organizational structure, partnerships and inter-department co-ordination (Reference Compendium, 2003).

These challenges cannot be met with limited government resources. To remain competitive in the new global economy, organizations must have rapid access to knowledge, competencies and resources regardless of where they exist (Susan and Mankin, 2002). Importance of collaborations and

stakeholders is thus increasingly being realized by organisations. In the context of e-governance, such frameworks are still rare in India. Tan et al. (2005) have argued that there is a rising need to view strategic stakeholder management as an important competitive imperative of e-government. This requires the adoption of more flexible structures and processes, coordinated change efforts, and an increased cooperation between government units, businesses and citizen partners (Aicholzerv and Schmutzer, 2000). Success factors of e-governance have been identified as proactive government, commitment, literate computer savvy population, framework for security, IT architecture, administrative reforms, connectivity through liberalisation and abounding IT skills of private sector (Gupta et al., 2004). It is estimated that only 15 per cent of the e-government projects taken up for development in developing/transitional countries are successes (Heeks, 2003).

Many frameworks have been suggested for e-governance by different authors of which few are discussed here. According to Gartner, e-governance matures according to four phases, namely - information, interaction, transaction and transformation (Backus, 2001). Moon and Welch (2004) used the model *Preferred speed of the implementation of e-government = f(familiarity, perceived effect of e-governance, concerns, e-government implementation barriers, controls)* to show that citizens and bureaucrats differ substantially in their perspectives for e-government. Grant and Chau (2005) have attempted a generic e-government framework that captures the commonalties and challenges

The conventional planning and strategic framework, which follows a sequential path, is not capable of handling the dynamic context of e-Governance.

existing in an e-government undertaking. The high rate of failure of e-governance projects is explained using a model based on the notion of design-reality gaps (Heeks, 2002). Okot-Uma (2004) suggested that e-governance implementation should comprise *stakeholder statement of requirements, baseline assessment, blue print for e-governance and implementation*. An iterative and incremental approach "Think Big, Start Small and Scale Fast" is proposed to get best results out of efforts put in (Gupta et al., 2004). Kumar et al. (2004) have argued that effectiveness parameters of e-governance programmes need to be pre-defined and factors of change need to be managed carefully to give real benefits to different stakeholders involved in such programmes. Factors of effectiveness have been identified as new value proposition, innovative use of technology to deliver services, funding from outside sources, design of projects, functionality, participation of citizens/stakeholders, role of political leadership and legal issues. Factors responsible for effective change management have been identified as organizational changes, people related changes, process-level changes and changes at 'inter-face' in partner agencies.

Learning Issues from Literature

A review of literature reveals that e-governance is a complex phenomenon. Besides technological challenges, there are political, social and economic challenges in implementing e-

governance. The failure rate of e-governance projects is estimated to be very high. However, much of the literature has so far been based on anecdotal evidence rather than a systematic evaluation of the e-governance projects in the field. This has been particularly true in the case of developing countries, and even more so of rural areas within those countries (Cecchini and Raina, 2003). Research on the subject is embryonic. Much of what is written on the subject comprises practitioner reports, government documents and white papers. (Grant, 2005). In general, studies have focussed on impact assessment and identification of design-reality gaps in few projects. The literature does not throw light on detailed evaluation studies of e-governance projects from strategy perspective. The high failure rates of e-governance projects, especially in rural areas of developing countries, could be due to inadequate application of strategic management principles in the life cycle of e-governance projects. The e-governance phenomenon, therefore, needs to be studied from strategic management perspective for evolving a strategic framework for e-governance.

AGMARKNET Case – A Brief Description

The agricultural marketing system in India is being revamped to meet the challenges posed by surplus crop production and liberalized trade environment. As part of the reforms initiated in the agricultural marketing sector, the need for establishing a sound Agricultural Marketing Information System in the country has also been strongly felt. AGMARKNET – a national level project has been launched to fill this gap. The organizations involved in the project are DMI and NIC at the level of central government and State Marketing Boards/Directorates (SMBs) and markets at state government level. The project is part of the Central Sector Scheme “Marketing Research and Information Network”. The scheme also includes undertaking research related to marketing aspects and educating farmers, marketing functionaries and other stakeholders on ‘Good Marketing Practices’ as part of market led extension through the network established under it. DMI provides funds to NIC and State Marketing Boards for networking of markets and market led extension activities respectively. The administrative control of the project is with DMI. Agriculture being a state subject in India, the markets are autonomous bodies under the control of respective state Marketing Boards.

The portal (<http://agmarknet.nic.in>), developed as part of the project, aims at providing “single window” service to cater to diversified demands of market information. Important categories of portal contents are commodity prices and arrivals (daily market prices and arrivals, weekly/monthly price trends, future prices from national commodity exchanges, international prices and so on), grades and standards, commodity profiles, *mandi* (market) profiles and market reforms related initiatives/schemes. Various segments of users that are expected to be benefiting from the

information service are: farmers, traders, processors, exporters, policy makers, academic organizations, government agencies and so on. The service is expected to promote efficient marketing in near future. Broadly, the components under which several activities are ongoing, have been identified as establishment of computing facilities and networking of markets, capacity building of market personnel to enable them to effectively use the computing facilities, application and database development and a portal service on market information. Efforts are also on to evolve a GIS-based national atlas of agriculture markets and dissemination of information in local languages. Interested readers may refer to (Suri, 2005) for a detailed description of project objectives, components, roles and responsibilities of involved organizations, financial involvement, progress made, targets to be achieved by the year 2007 and so on. Moni (2004) argues that the project has potential to expand to about 7000 agricultural produce wholesale markets located through out the country and further to 35000 rural markets in India thereby putting the progressive farmers on ‘global free trade zone on Internet’.

SAP Analysis

The situation, actors and process interplay in the context of AGMARKNET is presented below:

Situation

The project situation is categorised into **Pre-implementation, Implementation and Expansion Phases.**

The actors in the Government domain have limited freedom of choice which restricts their options. This leads to rigid and static processes which fail to cope up with the dynamic e-Governance situations.

Pre-implementation Phase is further classified into following sub-phases:

March 2000: Project Approval when the project was entrusted to NIC as a Central Sector Scheme approved by the Planning Commission for networking 170 wholesale markets and 40 SMBs in the country.

April 2000 to August 2000: Shaky Start which was characterised by uncertainties due to inadequate NICNET infrastructure to serve remotely located markets. The rigid procurement procedures and relying on multiple vendors approach were also found to be unfit for the rural centric project.

September 2000 to November 2000: Breaking the Deadlock during which efforts were made to do away with the conventional practice of involving multiple vendors in procurement and operationalization. Attempts were made to introduce flexibility in the established procurement procedures. A single vendor approach was suggested to avoid system integration related issues in rural areas. Equipment suppliers could finally be reduced from five to three and purchase orders were placed. Application development was taken up in parallel.

December 2000 to December 2001: Back to Deadlock Mode during which the project suffered further setbacks. The

major Internet Service Providers (ISPs) in the public sector, who were approached centrally, expressed inability in supplementing NICNET to connect markets in rural areas. Logistical constraints in supplying of equipment, non-readiness of several sites and backtracking from supply commitments by one of the vendors were other major hurdles which drastically slowed down the project progress.

Implementation Phase

January 2001 to December 2002: Constant Upstream Swimming

While foundation for the project was still being built, expansion to further 600 markets was approved during March 2002. It was attempted to adopt appropriate remedial measures based on learning from initial struggle. The functional strategy was modified by adopting a single vendor approach; permitting markets to obtain Internet connectivity from any local ISP and allowing them to enrich commodity list (initially restricted to 27 by DMI) as per local requirements. These remedial measures introduced the much desired flexibility in a complex project being implemented in an environment of rigid Government procedures. Despite these changes, issues like selection of unimportant markets by states, non availability of ISPs, non-readiness of sites for installing computers, transfer of trained personnel still keep emerging as the project expands.

The high failure rates of e-Governance projects, especially in rural areas of developing countries, could be due to inadequate application of strategic management principles in the life cycle of e-Governance projects.

Expansion Phase

Even after about 18 months since the project was initiated, the average number of markets reporting data (about 10) was still far less than satisfactory. A one-day workshop was organised on 22 Feb 2002 for working out strategies for strengthening AGMARKNET during tenth plan period (2002-2007). The workshop was represented by senior officers of 17 states. Expansion to 2000 more markets was approved. Average number of responding markets still being negligible, a Project Monitoring Framework was devised to address the issue. It comprised a state level Project Monitoring Committee, national level Standing Committee and department level Daily Monitoring Committee. The constant efforts resulted in relatively increased number of markets sharing data for dissemination. AGMARKNET is now in the select list of National e-governance Projects being reviewed at Cabinet Secretary level. Organisations like IBM, Microsoft, IFFCO, national multi-commodity exchanges, mobile phone operators, kiosk operators in rural areas have started showing interest for collaborations.

Actors, Processes and Interfaces

The study of the project reveals that there are several actors and processes which are interacting to create new situations. Actors involved in different phases and interfaces among major actors and key processes is presented in Appendix I and II respectively. There is a complex interplay among

multiple actors and processes during the life cycle of the project. Certain processes are handled by multiple actors belonging to different organizations. Timely completion of such processes is more of a management issue than a technological one.

Field Study and Strategic Gap Analysis

The low count of portal hits and operationalization delays in each phase indicate towards gaps in planning, strategy formulation and strategy implementation in the context of this project. This apparent gap and the complex interplay of actors and processes identified during SAP analysis, prompted the author to conduct a survey for getting a deeper insight into the project and suggest appropriate corrective measures. Key officials of Centre and State Governments besides market level functionaries and expected beneficiaries in the markets were surveyed. Keeping into view limited scope of this study and

Scale used:

F	LE	ME	SE	N
Full	To a large extent	To a medium extent	To a small extent	Nil

Table 1: Planning for AGMARKNET–Summary of Analysis

S.No.	Element	Coverage	Remarks
1.	Societal Sectors	SE-ME	Expected beneficiaries other than farmers find a limited or no mention in the plan document.
2.	Project Needs	SE-ME	Assessment made on the basis of experience of key officials. Target beneficiaries not involved.
3.	Constraints/ Bottlenecks	SE-N	Certain corrective measures have been taken based on learning from IX Plan. However, key issues like selection of insignificant markets by States, non readiness of sites, Reaching the grass root level, slow progress and so on have not been addressed.
4.	Alternatives	SE-N	
5.	Objectives	LE-F	Scheme objectives and activities have been elaborated to a large extent but the respective performance metrics has not been devised.
6.	Objective Measures	N	
7.	Activities	LE-F	
8.	Activity Measures	N	
9.	Agencies	LE	The respondents consider only States, markets, DMI and NIC as the agencies involved. However, the study reflects several other agencies which have a definite role in strengthening of the project. These have not been considered at planning stage.

other constraints, survey at market level was restricted to two major markets in Delhi, namely - Azadpur (for fruits and vegetables) and Narela (for cereals). Four structured questionnaires, comprising both open and closed ended questions, were devised to capture data from different segments. A total of 42 respondents were interviewed as per following break-up during the period January - March 2005: DMI and NIC Officials (5), SMBs (6), market nodal officers (3), data entry operators (2), farmers (13) and commission agents/ traders (13). The data collected has been analyzed both quantitatively and qualitatively.

An analysis of the survey from planning, strategy formulation and strategy implementation aspects of AGMARKNET is presented below:

Planning for AGMARKNET

The plan scheme documents of AGMARKNET and the information captured through the survey were analyzed in the light of programme planning framework for large and complex systems (Hill and Warfield, 1972). Table 1 depicts summary of the analysis.

The respondents confirmed that relationships among elements for the purpose of prioritization and establishing linkages was not thought of.

Involvement of State Marketing Boards/Departments and Markets

The surveyed state officials felt that they should have been more closely involved at the scheme formulation stage. The survey further revealed that these officials do not view the portal regularly; have neither been asked suggestions for portal improvement nor provided such suggestions of their own to DMI and that they have little knowledge about the vision and mission of the project. Lack of coordination with field level functionaries also emerged as such officials expressed unawareness about the scheme-related information.

The portal (<http://agmarknet.nic.in>) developed as part of the project, aims at providing "single window" service to cater to diversified demands of market information.

Table 2: Prior Knowledge about Market Prices and Arrivals

Sl. No.	Market Participant	Average Score	
		For Market being visited	For Other Markets
1.	Farmers	1.07	0.46
2.	Traders	3.22	3.67
3.	Commission Agents	1.5	0.25

Table 3: Importance given to Knowledge about Prices and Arrivals in Other Markets

Sl. No.	Market Participant	Average Score
1.	Farmer	3.69
2.	Trader	3.89
3.	Commission Agents	0

Table 4: Means for Knowing Market Information

Sl.No.	Means	Percentages	
		Farmer	Traders
1.	Radio	38.46	0.00
2.	Mobile Phones	61.53	100.00
3.	Landline Phones	84.61	76.92
4.	T.V.	30.76	0.00
5.	World of Mouth	38.46	0.00
6.	Newspapers	46.15	0.00

Table 5: Awareness Level of Market Participants

Sl No. Market Participant	Awareness About (Average Score)		
	Internet	AGMARK	AGMARKNET
1. Farmers	1.92	4	0
2. Traders	4	4	0
3. Commission Agents	4	4	0

Scale used:

4	3	2	1	0
Full	To a large extent	To a medium extent	To a small extent	Nil

Involvement of Market Functionaries

The surveyed markets are regularly reporting data. It was, however, found that the market personnel do not view the portal for getting information about prices prevailing in other markets for dissemination at local level. Neither do they use e-mail for exchanging information with other markets nor do they use market level software for local analysis. Also, they had little knowledge about purpose of the project.

Involvement of Market Participants

As summarized in Tables 2, 3, 4 and 5, the survey reflected that though both farmers and traders realize the importance of information about other markets, the former do not have

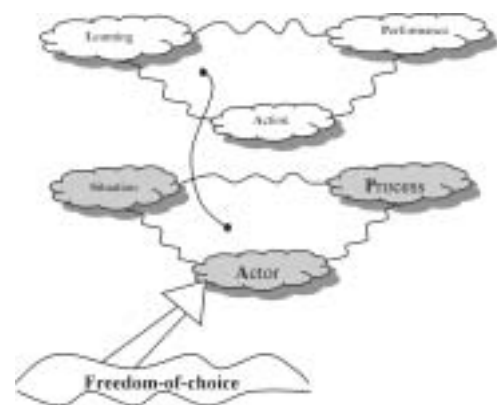


Figure 1: SAP-LAP Framework (Source: Sushil ,2001)

access to such information while the later possess this knowledge. Farmers generally bring produce to a particular market only. They depend on commission agents for knowing commodity prices in that market. For contacting these agents, they mostly use landline phones followed by mobile phones.

Table 6: Summary of Gap Analysis

Aspect	Gaps	Implications
Planning	Planning exercise undertaken by few key senior officials on the lines of general formats prescribed by Planning Commission and Ministry of Finance which do not treat e-governance schemes differently	Inadequate assessment of current and future needs, underestimation of resources, ignorance about stakeholders' interest, deadlock like situations leading to delays, subjective performance evaluation.
Strategy Formulation	Strategy formulation workshop was a one-time exercise which involved a narrow group of officials from DMI, NIC and States. The concept of collaborative frameworks, re-evolving strategy by involving all the stakeholders and constant scanning of changing environment is found missing. SWOT analysis was not conducted. Project's vision, mission and strategic objectives defining service levels to be achieved over time were also not defined.	Underestimation of requirements, varying degree of cooperation by states, lack of coherent efforts within and across the involved organisations, lack of clarity about roles and responsibilities at field level, ignorance about expansion of collaborative framework beyond the pre-defined partners.
Strategy Implementation	The action plan to meet growing requirements not linked to available manpower resources, irregular interaction among collaborating agencies at state level, loose relationships of field units with headquarters in case of both DMI and NIC, no accountability of states, driving forces are found to be strong leadership and a few committed people, no performance linked incentives.	Delay in completion of critical activities, repetition of implementation related issues in every phase, capabilities built over time are not getting transformed into sustainable competitive advantage for lack of ownership by states, progress may get affected with change in leadership, employees likely to get demotivated in the absence of incentives.

Farmers also get such information from newspapers, radio, world of mouth and TV; though such means were not found to be very popular among them. All the surveyed traders generally use mobile phones for getting market information. All the respondents expressed that in practice the notice board, electronic board or loudspeakers facilities in markets do not serve the basic purpose of bringing price transparency for enhancing bargaining power of farmers.

Internet awareness was found to be high among traders and commission agents but awareness level among farmers was found to be near medium extent only.

Though all the respondents were aware of AGMARK (grading and quality certification of agricultural produce promoted by DMI since the year 1937), none of them knew about AGMARKNET initiative of DMI. When informed about this service, the farmers expressed that it will facilitate them in knowing prevailing prices in nearby markets. The

traders did not show any interest in the service and expressed that they would continue to rely on their human chains.

LAP Synthesis: AGMARKNET

The SAP analysis of AGMARKNET case followed by the gap analysis based on field study leads to Learning-Action-Performance (LAP) The interplay of SAP and LAP makes the complete SAP-LAP framework as shown in Figure 1

Learning Issues

The gaps at planning, strategy formulation and strategy implementation stages and implications thereof have been identified on the basis of SAP analysis and field study. These are summarized in Table 6.

Based on learning issues, the organizational and functional level strategic recommendations for strengthening e-governance interfaces of AGMARKNET are arrived at. The organizational level strategic recommendations include sensitising stakeholders by bringing out shared vision and mission statements, financial and strategic objectives (a specimen of these has been worked out as part of the study), outsourcing of non-core activities, mobilising implementing agencies through appropriate control measures as well as reward instruments, massive campaigns for spreading awareness at grassroot level, exploring strategic alliances for bridging the digital divide and enriching portal contents, re-defining mandate of DMI, progressive introduction of e-trading, promoting AGMARKNET as a signalling system for decision makers at the centre and state level, exploring replication of AGMARKNET in developing countries and so on. Functional level strategic recommendations include addressing interoperability and security issues, localization of portal, quality certification for AGMARKNET, conduction of an impact study, assessment of portal in terms of usability factors, creation of customer response group, value addition by publishing analytical reports to facilitate planning and decision making at various levels and so on. The justification for these recommendations and expected benefits thereof are

Certain processes are handled by actors belonging to different organizations. Timely completion of such processes is more of a management issue than a technological one.

not presented here for lack of space. Some of the agencies with which strategic alliances can be worked out for

content enrichment and bridging of the digital divide have been identified at Appendix III and IV respectively.

Generalized Major Findings and Propositions

The learning issues from case analysis and literature review have been synthesized in the form of major findings and recommendations as follows:

- The methodology of formulating plan schemes proposals in India is not adequate for e-governance projects initiated from centre government and implemented through state governments. Keeping into view complex nature of e-governance projects, a systematic and holistic approach like the one prescribed by 'Program Planning

Methodology' needs to be adopted while formulating plans for such projects. The planning model should also have capability to handle dynamically changing context in case of e-governance projects. Strategy formulation should not be a one-time exercise. Strategy should be dynamically re-evolved based on regular consultation with stakeholders, inputs from field offices and constant assessment of internal and external environment.

Proposition-1

The conventional planning and strategic framework is not suitable for e-governance projects.

Proposition-1 [a]

Emergent strategy and iterative scope enhancement constitute the appropriate approach for e-governance projects.

- E-governance projects should have a well-defined vision, mission and strategic objectives linked to benefits to citizens and acceptable to stakeholders. It should be ensured that functionaries down the line understand and adopt these for coherent and focussed efforts within and across organisations. E-governance projects should have a unique value proposition for different stakeholders for ensuring sustainability. For example, the data generated from the project should be used by concerned agencies for formulating plans for other developmental activities. For overcoming the constraint of limited government resources, strategic alliances should be built with such agencies that are expected to gain from the unique value proposition. Spreading mass awareness and educating target beneficiaries should be part of strategy of e-governance projects.

The gaps at planning, strategy formulation and strategy implementation stages and implications thereof have been identified on the basis of SAP analysis and field study.

Proposition-2

Gaps in project planning, strategy formulation and strategy implementation are the major causes for failure of e-governance projects.

Proposition-2 [a]

Unique value proposition, stakeholders' involvement and their satisfaction, and awareness and education of target users are important factors for ensuring sustainability of e-governance projects

Proposition-2 [b]

Shared vision, mission and strategic objectives play a catalytic role in binding the stakeholders together

- E-governance projects generally have one to one correspondences with government departments whereas the subject matter for the intended service may fall under the purview of multiple departments. On the other hand, different organizations might have taken similar initiatives for service delivery. Such duplicate efforts

need to be avoided and technology has to be used for providing integrated services. Organizations should focus only on respective core competencies. Non-core activities should be outsourced and monitored strictly through service level agreements. However, the rigid procedural framework of government and functioning of departments in silos do not match with the flexibility targeted under e-governance projects.

Proposition-3

Limited choice of freedom with the actors in the government domain lead to nonflexible and non adaptive processes which are incapable of coping with the changing situations.

Proposition-3 [a]

E-governance projects can be effectively implemented by building alliances across the organizations.

Limitations

The inference about non awareness and low usage of AGMARKNET service is based on interviews with farmers, traders, commission agents, market level functionaries in two large markets of Delhi and hits registered at portal respectively. Other intended project beneficiaries could not be covered in the study due to limited scope. Progress of states in the areas of market led extension activities could not be studied for lack of availability of data. The list of organizations identified for building alliances is indicative

and not exhaustive.

References

- AGMARKNET Project Implementation Guidelines, Available at <http://agmarknet.nic.in>.
- Aicholzer G. and Schmutzer R.(2000) Organizational Challenges to the Development of Electronic Government, *Proceedings of the 11th International Workshop on Database and Expert Systems Applications* (DEXA'000), Greenwich, London, Available at www.is.lse.ac.uk/Support/ECIS2001/pdf/097_Zulfiquar.pdf
- Backus M. (2001) E-governance in Developing Countries, *IICD Research Brief-No1*, March, Available at www.ftpicd.org/files/research/briefs/brief1.pdf.
- Cecchini S. and Raina M.(2003) Electronic Government and the Rural Poor: The Case of Gyandoot, Information Technology in Developing Countries, *A Newsletter of IFIP Working Group 9.4 and Centre for Electronic Governance, Indian Institute of Management, Ahmedabad*, 13(2), November.
- Dhankar G.H. (2003) Development of Internet based Agricultural Marketing Information System in India, *Agricultural Marketing Journal*, XLV(4), January-March.
- Digital Divide: www.bridges.org
- Grant G. (2005) Realizing the Promise of Electronic Government, Editorial Preface, *Journal of Global Information Management*, 13(1), January-March.
- Grant G. and Chau D. (2005) Developing a Generic Framework for E-Government, *Journal of Global Information Management*, 13(1), 1-30, Jan-March, Idea Group Publishing.
- Gupta M.P., Kumar. P. and Jaijit B. (2004) *Government Online, Opportunities and Challenges*, Tata McGraw-Hill, New Delhi.
- Hill J.D. and Warfield J.N. (1972) Unified Program Planning, *IEEE Transactions:*

System, Man and Cybernetics, SMC-2(5), 610-621.

Heeks R. (2001) Understanding e-Governance for Development, *i-Government Working Paper Series Paper No. 11*, Available at www.sed.manchester.ac.uk/idpm/publications/wp/igov/igov-wp11.pdf.

Heeks R. (2002) Failure, Success and Improvisation of Information Systems Projects in Developing Countries, *Development Informatics, Working Paper Series, Paper no. 11*, January, Available at www.unige.ch/iued/wsis/DOC/270EN.PDF.

Heeks R. (2003) Most e-Government-for-Development Projects Fail: How can Risks be Reduced? *i-Government Working Paper Series Paper No. 14*, Available at www.sed.manchester.ac.uk/idpm/publications/wp/igov/igov-wp14.pdf.

Kumar P., Sushil and Gupta M.P. (2004) *Towards E-Government, Management Challenges*, Tata McGraw-Hill, New Delhi.

Marketing Research and Information Network, *Scheme EFC Memo for X Plan*, Available with Ministry of Agriculture, Government of India.

Misra D.C. and Dhingra A. (2002) *E-Governance Maturity Model*, Electronics Information & Planning. ISSN 0304-9876, 29(6-7), Mar-Apr.

Moni M. (2004) Digital Networks for Farmers: Ushering Market-led Agriculture Extension, Available at www.i4donline.net/july04/digitalnet.asp.

Moon M.J. and Welch E. (2004) Same Bed, Different Dreams? A Comparative Analysis of Citizens and Bureaucrat Perspectives on e-Government, *Proceedings of the 37th Hawaii International Conference on System Sciences*, Available at IEEE linked site www.computer.org.

Okot-Uma R.W'O. (2004) The Roadmap to e-Governance Implementation: Selected Perspectives, *Presented at Commonwealth Regional Pacific Workshop on Law and Technology*, 1-5 November, Wellington, New Zealand, Available at www.electronicgov.net/pubs/research_papers/guest/Roadmap2eGov.pdf.

Operational Guidelines (2003) *Central Sector Scheme, Marketing Research and Information Network*, Available at <http://agmarknet.nic.in>.

Planning Commission (2001) India as Knowledge Superpower, Strategy for Transformation, *Taskforce Report*, June.

Reference Compendium (2003) for IT Managers and CIOs on e-Governance, Department of Administrative Reforms & Public Grievances, Government of India, *National Conference on e-Governance*, 13-14 November, Chennai.

Report of the Working Group (2001) for X Plan, Agricultural Infrastructure/ Warehousing/ Rural Godowns/Marketing/Post Management/Processing and Cold Storage, Planning Commission, September.

Suri P.K. (2005) NICNET based Agricultural Marketing Information Network– A Farmers Centric Portal on Agricultural Marketing in India and a Step towards Globalizing Indian Agriculture, *Agricultural Marketing Journal*, XLV(4) January-March.

Susan G.C. and Mankin D. (2002) Complex Collaborations in the New Global Economy, *Organizational Dynamics*, 31(2), 117-133.

Sushil (2001) SAP-LAP Framework, *Global Journal of Flexible Systems Management*, 2(1), 51-55.

Tan C.W., Shan L., Pan S.L. and Lim E.T.K. (2005) Managing Stakeholder Interests in e-Government Implementation: Lessons Learned from a Singapore e-Government Project, *Journal of Global Information Management* 13(1), 1-30, Jan-March.

Taskforce Report (2001) *India as Knowledge Superpower - Strategy for transformation*, Planning Commission, June.

Zwahr T., Finger M. and Mueller P. (2005) More than Digitization-The Transformative Potential of E-Governance: An Exploratory Case Study, *Proceedings of the 38th Hawaii International Conference on System Sciences*, Available at www.computer.org.

Appendix I Participation of Actors in Different Phases

SI no	Actors	Phase		
		Pre Implemen- tation	Implementation	Expansion
1.	Agricultural Marketing Adviser, DMI	✓	✓	✓
2.	Economic Advisor, DMI	✓	✓	✓
3.	Scheme In-charge and team, DMI	✓	✓	✓
4.	Nodal Officers (27), DMI field units		✓	✓
5.	In-charge, DMI Branch Head Office		✓	✓
6.	Director (Finance) and Director (Agriculture Extension)	✓	✓	✓
7.	Nodal Officer, National Institute of Agricultural Marketing			✓
8.	Group Head, NIC	✓	✓	✓
9.	National Co-ordinator and team, NIC	✓	✓	✓
10.	State Co-ordinators (35),NIC	✓	✓	✓
11.	District Informatics Officers (550+),NIC		✓	✓
12.	Head, GIS Division, NIC			✓
13.	Joint Director(Purchase), NIC	✓	✓	✓
14.	Joint Director(Finance),NIC	✓	✓	✓
15.	Head (Hardware Support)		✓	✓
17.	Vendors		✓	✓
18.	Managing Directors/ Commissioners(SMB/SMD)		✓	✓
19.	Secretary, Market		✓	✓
20.	Data entry operator		✓	✓
21.	Project Beneficiaries (Farmers, Traders, Processors, Exporters, Multi-Commodity Exchanges, Fertiliser Companies like IFFCO, Mobile phone operators, Commodity Boards/Directorates, Research Institutes, Economists, Newspapers and so on.)		✓	✓
22.	Important external actors: Cabinet Secretary, Secretary(DIT), Secretary(DAC), TDIL Division (DIT)			✓

Appendix II Actors and Processes Interplay

SI No.	Processes	Actors (As per appendix I)
1.	Formulation of State proposals	18
2.	Sanctioning of State Proposals	1,2,3,6
3.	Procurement	8,9,13,14,16
4.	System Integration, Internet connectivity	10,11,17,18,19,20
5.	Training of Marketing Personnel	3,4,9,10,11,14,18,19,20
6.	Operationalisation at Markets	4,10,11,17,18,19,20
7.	SLAs	9,10,14,15
8.	Data Preparation and Transmission	20
9.	Data Collation	9
10.	Data validation	3,9
11.	Web publishing	9
12.	Database and portal maintenance	9
13.	Portal Enrichment	3,4,5,9,18,19
14.	Contents preparation in local languages	3,4,9,10,18
15.	Project Monitoring and review	3,4,9,18
16.	Market led extension activities	4,18
17.	Preparation of GIS based atlas	7,12
18.	Wider Dissemination	1,2,3,4,8,9,10,11,18,19,22
19.	Project Monitoring and Control	1,2,3,4,8,9,10,18

Appendix III Suggested Agencies for making Strategic Alliances/Collaborations for Content Enrichment (Source: Based on learning issues)

S. No	Agency	Expected Benefits
1. 2.	Commodity Directorates Commodity Boards	Updated commodity profiles Effective monitoring of the prices/arrivals situation for respective commodities
3.	National Institute of Agricultural Marketing	Enrichment of portal with market research studies carried out by the Institute
4. 5.	Indian Agricultural Statistics Research Institute, Directorate of Economics and Statistics	Value addition with statistical analysis of market information
6.	Indian Council of Agricultural Research	Latest crop research information on the portal
7.	National Horticulture Board, Agricultural and Processed Food Products Export Development Authority, Marine Products Exports Development Authority, Indian Institute of Packaging, National-Agricultural Co-operative Marketing Federation of India Ltd., National Co-operatives Development Council, National Dairy Development Board, National Bank for Agriculture and Rural Development, State Trading Corporation, World Trade Council, Tribal Co-operative Marketing Development Federation of India Ltd. Export Promotion Councils	Access to agricultural Marketing promotional initiatives taken by other organisations Strengthening of forward linkages
8.	<i>Inter Ministerial Task Force</i> Commerce, Health, Consumer Affairs, Food, Food Processing Industries, Consumer Affairs, Rural Development	Instant sharing of decisions (by other Ministries) which have impact on Agricultural Marketing
9.	Commodity Exchanges	Access to future prices information Promotion of e-commerce through such agencies
10.	International Organisations, for example, Food and Agriculture Organisation, Codex Alimentarius Commission	Access to information on quality and food safety standards and international market trends

Appendix IV
Suggested Agencies for making Strategic Alliances/collaborations
for Breaking the Internet Barrier for Widening the Reach
 (Source: Based on learning issues)

S. No	Agency	Expected Benefits
1.	Mobile Phone Operators	Access to million of users without any further investment by Government
2.	Commodity Boards	
3.	National/State Institutes of Agricultural Marketing	Awareness among farmers and market functionaries visiting the institute Awareness through publications in local languages
4.	National/State Institutes of Rural Development	
5.	Indian Farmers Fertilizers Co-operatives (IFFCO) and other such agencies	IFFCO has about 37000 farmers co-operatives, ~ 500 farmers service centres; planning to diverse into e-commerce; installing farmers friendly kiosks at strategic locations. Cooperatives in rural areas can play a major role in widening the reach of AGMARKNET
6.	Krishi Vigyan Kendras	Direct access to farmers
7.	Dte of Extension field offices	
8.	Kissan Call Centres	Direct access to farmers through toll free no 1551
9.	Agri Clinics, Community Information Centres (CICs)	Reaching the rural masses
10.	Agencies running information kiosks in rural areas	
11.	All India Radio, Doordarshan	Conventional means have much wider reach and are more popular
12.	Local Newspapers	
13.	Cable TV networks	

Key Questions Reflecting the Applicability in Real Life:

1. Use SAP-LAP framework to carry out strategic analysis of a large IT project or an e-Governance project concerned with your organization
2. Identify gaps in the planning strategy formulation and strategy implementation stages of the selected project and study the implications of these gaps on project performance



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New Knowledge Creation Scenario in Indian Industry

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Abstract

We are in the knowledge economy where continuous knowledge creation is the key to sustainable competitive advantage. Management scholars worldwide agree that knowledge is the critical resource today. India is being hyped as new destination for global research and development. Research was conducted to understand the current state of New Knowledge Creation in selected sectors namely software, pharmaceutical and petroleum marketing of Indian Industry taking both macro and micro aspects as well as both private and public sectors. The findings are not very encouraging as they reveal though people rate new knowledge creation as quite important for their organization, there is a lack of attitude towards knowledge creation and the findings of the study have serious implications.

Keywords : competitive advantage, new knowledge creation, public-private sector comparison

Introduction

We are witnessing the knowledge revolution. The half-life of knowledge is getting reduced with a fast pace. Yesterday's advanced knowledge is turning into today's ignorance. The products life cycle is being getting shortened around the world with fast technological changes. World over, management scholars agree that knowledge has emerged as the critical resource (Pillania, 2005). Today, the only way to have a competitive advantage is through innovation and upgrading (Porter, 1997). Indian CEOs feel that innovations will be the key differentiator (IBM, 2004).

India is being hyped as the new source of global innovations (Swaminathan 2004, Mahanta 2004, Walia 2004). Global survey by London based Economist Intelligence Unit (EIU) positioned India as third most favourable destination for research and development investments (Gupta, 2005).

The President of India is talking of making India a developed economy whereas the Prime Minister has established a Knowledge Commission for making India a knowledge super power. The researcher strongly feels that innovation is the guiding torch, which could make it happen in the knowledge-driven, services-led world economy.

The creation of new knowledge plays a key role in economic development and growth. Poor countries differ from rich ones not only because they have less of wealth but less of knowledge (World Bank, 1997). Understanding the current state of knowledge creation in a developing country like India is an important step in analyzing what steps need to be taken to stimulate further economic development and growth. Research was conducted to understand the current state of new knowledge creation in Indian Industry. To have a macro view of the situation experts from industry, academia and

policy makers were asked about the attitude of Indian companies towards New Knowledge Creation. To have the micro view, five firms each were selected from two industries namely Software and Pharmaceutical and four firms from Petroleum Marketing Sector, thus, covering both private and public sector.

Review of Literature

Following is the abstract of selected literature arranged in descending order by year.

Das (2004) based on published secondary data finds that following economic liberalization in India, barring a few exceptions, the research and development of most industries decreased and the total annual innovation output of both public and private sectors came down.

IBM (2004) study "Your turn: The Global CEO Study 2004" finds that Indian CEOs feel that innovation will be a key differentiator. They understand that people through innovation can make a huge difference to their growth plans.

KPMG-NASSCOM (2004) study identifies the current shortcomings in Indian research and development (R & D), suggests recommendations for improvement and enlists areas in which opportunities lies for Indian R & D.

Un and Cuervo-Cazurra (2004) based on literature study identify two strategies namely organization level and project level strategy for knowledge creation. The two are substitute approaches and both highlight the focus on interaction among people.

Roy and Dhawan (2002) on the basis of their empirical study of work environment in CSIR labs find that to increase the motivational level of scientists labs need to improve the working conditions, better communication systems, regular technology upgradation and involve scientists in decision

making.

Soo, Devinney, Midgley and Deering (2002) purpose a simple approach, namely, sources-uses-output approach for knowledge-creation. Firms can measure knowledge indirectly by measuring certain firm processes like problem solving, decision-making or outcomes like innovation & financial performance that serve as proxies for knowledge creation. There is a number of 'knowledge traps' to which even the best firms seem to fall victim.

Nonaka, Toyama & Konno (2001) outline a firm-level model of knowledge creation consisting of three elements, namely, the SECI process-process of knowledge creation via conversion from tacit to explicit knowledge, ba-the shared context for knowledge creation and knowledge assets-the inputs, outputs and moderators of knowledge-creating process. These three elements have to interact with each other organically and dynamically. Further, they discuss the role of leadership—creating and communicating the knowledge vision of the company, facilitating and utilizing ba effectively, understanding the knowledge assets of the firm—in facilitating the knowledge-creating process.

Levin (1999) based on a cross-case comparison at multiple firms, suggests that favourable outcomes for a knowledge-intensive routine require not only an organizational ability to absorb knowledge but also a high degree of comfort with the situation and the use of power within the organization to make the knowledge flow happen.

Mashelkar (1999) emphatically says that indeed a nation's ability to convert knowledge into wealth and social good through the process of innovation determines its future. Attitudinal changes and mindset change will assume greatest importance in India. Organizations need to set up truly innovative and provocative mechanisms that drive innovation. Citing examples he stresses that it requires a driving force for innovation, no matter how able and competent you are and CEOs will have to assume the role of Chief Innovation Officer in India.

PRDC (1999) identifies the weaknesses and suggests improvements in the pharmaceutical R & D. The low level of profitability combined with comparatively small size of the companies was largely responsible for the low investment in R&D. A high level of innovation and IPR management coupled with strategic manufacturing and aggressive marketing will largely determine Indian pharmaceutical industry's future.

Berger and CII (1998) in the report 'Innovation in India' based on a study of ten firms conclude that India needs to put innovation on national agenda. Compared to developed countries, the report puts India high on entrepreneurship.

Madhavan and Grover (1998) argue that New Product Development Management viewed as a knowledge-creation activity, should emphasize cognitive team processes rather than purely social processes. Trust in team orientation, trust

in technical competence, information redundancy, and rich personal interactions are important process variables for the effective and efficient creation of new knowledge.

Porter (1998) stresses that firms have to set the goal of learning. The companies that are going to be successful or remain successful will be the one that can learn fast, can assimilate this learning and can develop new insights.

Powell (1998) observes that in innovation-driven fields like Biotechnology and Pharmaceuticals, firms are engaged in a learning race. Firms are learning from collaboration as well as learning how to collaborate which require the development of skills to facilitate the transfer of information and knowledge from outside sources and their subsequent dissemination and deployment within firms. There is need to develop regular venues for the informal transmission of information, such that the process itself becomes tied to knowledge seeking and creation.

Prahalad (1998) highlights that success recipes from the past may no longer be the success recipes for the future. He explains that in a recent survey on the sources of competitive advantage that Japanese managers rated first for the future was not quality, it was the capacity to create knowledge.

Sikka (1998) based on the analysis of in-house research and development centers of innovative firms in India stresses for forging, strong linkages between the in-house research and development centers and the national labs and technical institutes to attain technological competence in the industrial sector.

Judge, Gerald & Robert (1997) report research findings on a study of innovation and R&D communities with the biotech industry. Technology cycle time (TCT) was found to be shorter in highly innovative units that were focused on a "sense of community" rather than a "bureaucratic hierarchy". Communication, learning and knowledge flowed easily in goal-directed communities where management developed strategic objectives and context, but gave great freedom and autonomy to the R & D units within this context. Community empowerment was the key. They concluded: the greater the goal-directed community level that is achieved in the R & D unit, the more innovative it is.

Manasco (1997) in this interview with Schrage Michael finds that shared space is the key element, the key ingredient, the key medium for successful and effective collaboration. The conventional wisdom that innovative teams generate innovative prototype is wrong, instead, the reverse is true. Both internal and external collaborative relationships are needed.

Manasco (1997) interviews Davis Stan and finds that to have a learning organization, you have to have a learning business. The more you have a knowledge-based offering the smarter it gets. Half-life of knowledge is very short and so mechanisms for upgrading it on a continuous basis become ever more important. One of the most significant implications

India is increasingly being recognized as the emerging innovation hub of the world.



of the current knowledge revolution is that individual success will revolve around productive and perpetual learning.

World Bank (1997) examines the role of knowledge in advancing economic and social well being. It says that poor countries differ from rich ones not only because they have less capital, but because they have less knowledge. Knowledge cannot be static, nor can it move in one direction only. Instead, it must flow constantly back and forth across an ever-changing web, involving all those who create and use it.

Drucker (1993) stresses that society is in a management revolution stage in which knowledge is applied to knowledge itself. The most important responsibility of management is productivity of knowledge because it is going to be the determining factor in the competitive position of a nation, an industry, a firm.

Hedlund and Nonaka (1993) highlight that creating and exploiting knowledge within an organization revolves around the interaction of tacit and explicit knowledge and the transfer and transformation of knowledge between individuals, organizational units and the surrounding environment.

Nonaka (1991), in this path breaking paper, explains the knowledge-creating process at Japanese firms and the lessons western companies/world can learn from them. Japanese approach puts knowledge creation exactly where it belongs: at the very centre of a company's human resource strategy. He distinguishes between tacit and explicit knowledge and explains the process of new knowledge creation, which consists of four basic patterns, namely, from tacit to tacit, from explicit to tacit, from tacit to explicit and from explicit to explicit resulting in a kind of spiral of knowledge. He tells how figurative language and symbolism helps in converting tacit knowledge into explicit knowledge. Further, he emphasizes the importance of redundancy and creative chaos in the knowledge creating Japanese companies.

Drucker (1985) highlights that amongst the history making innovations, knowledge-based innovations rank high. He identifies the characteristics of knowledge based innovation, namely, long lead time and convergence of several kinds of knowledge. Knowledge-based innovations require careful analysis of all the necessary factors, clear focus on strategic position and need to learn and to practice entrepreneurial management. Knowledge-based innovation poses certain challenges and is temperamental, capricious and hard to manage.

Polanyi (1966), in this classic article, articulates his concept of tacit knowing using Gestalt psychology. To him perception appears as the most impoverished form of tacit knowing. He elaborates on functional structure, phenomenal structure, semantic aspect and ontological aspects of tacit knowing. It is not by looking at things, but by dwelling in them or by interiorization that people understand their joint meaning. An explicit integration cannot replace its tacit

counterpart and the process of formalizing all knowledge to the exclusion of any knowing is self-defeating.

The literature review brings out following important points:

1. New knowledge creation is crucial for economic development of a nation.
2. Communities and interaction of people among them plays a crucial role in new knowledge creation.
3. Leadership can be the guiding force and create culture of trust for new knowledge creation.
4. The new knowledge creation in India needs improvement. There is strong recommendation for attitudinal changes and mindset change for new knowledge creation in India.
5. There is a lack of in-depth studies on new knowledge creation at the organizational-level in India.

Research Methodology

The methodology used for carrying out the research is discussed briefly here.

Data Sources: This research work was based mainly on primary data collected from companies under study and a number of experts from industry, academics, government bodies, etc.

Research Approach: Since the purpose of the paper is to look at the current scenario, the survey method was used to know firsthand from the experts as well as employees about new knowledge creation. The other approaches like focus group, observation etc were not practically possible because of the geographical spread of the companies and experts under study and the limited resources available with the researcher.

Research Instrument: Two sets of questionnaires were prepared for two categories of respondents namely experts and employees as the level of knowledge and expertise of the two varied

and so the nature of questions asked were different. Experts gave the macro picture, i.e. the industry whereas employees gave the micro picture, i.e. the firm. The questionnaires were discussed with statistical experts to check for any bias. One questionnaire was administered to experts in the field of knowledge management to study information technology for knowledge management in Indian industry. The experts consisted of academicians, industry consultants and government policy makers. The second questionnaire was administered to the executives in the firms under study. This questionnaire was first pre-tested on a sample of twenty respondents and necessary improvements were made.

Contact Method: To collect the primary data, the questionnaires were distributed by mail or in person; depending on the distance to the concerned person and after that a few personal interviews were taken.

Attitudinal changes and mindset change will assume greatest importance in India. The CEOs will have to assume the role of Chief Innovation Officer in India.



Sampling Plan: The universe for the industry study consisted of three sectors of Indian economy, namely: software, pharmaceutical and the petroleum-marketing sector. Software and pharmaceutical sectors are studied because these sectors heavily depend on new knowledge creation, are high performing sectors and from these sectors India has got high expectations. Petroleum marketing sector is a basic sector, is not supposed to be highly dependent on research, eats a large chunk of import bill and is a public sector. That is why it was selected as the researcher also wanted to make a public-private sector comparison. From the pharmaceutical sector the firms taken, namely, Ranbaxy, Cipla, Glaxo and Dr. Reddy's Lab were leading firms in BT 500 (Business Today, 2000) survey of India's most valuable companies for the year 2000. The firms in BT 500 were ranked based on their market capitalization. Though Novartis was ranked fourth in the survey, there was no response and so Dabur, which was ranked sixth in the pharmaceutical sector, was the fifth firm for study as shown in Table 1.

From the software sector, the firms taken, namely Wipro, HCL Technologies and Infosys, were leading firms in BT 500 survey. Tata Consultancy Services (TCS), the biggest software firm in India, was not a publicly listed company. It was not listed on stock exchange and was privately owned by Tata Group

Table 1: Companies from Pharmaceutical Sector

Sr.No.	Rank	Company	Market Capitalisation (Rs. Cr.) (1999-2000)
1.	10	Ranbaxy Laboratories	9,973.0
2.	13	Cipla	5,844.5
3.	22	Glaxo India	4,202.5
4.	31	Dr. Reddy's Laboratories	3,094.5
5.	40	Dabur India	2,615.0

Source: BT 500, Business Today, 2000

and so falls out of BT 500 survey, but was taken for study because it was the biggest software firm in terms of annual turnover. Lastly, though Satyam Computer Services was ranked 4th in BT 500, there was no response and so CMC, though lower in rank in BT 500 survey, was the fifth company of the study as shown in Table 2.

From the petroleum-marketing sector, all the four major players, namely, Indian Oil Corporation (IOC), Bharat Petroleum (BP), Hindustan Petroleum (HP) and IBP Ltd. (IBP) were included in the study. Incidentally, all four of

Table 2: Companies from Software Sector

Sr.No.	Rank	Company	Market Capitalization (Rs. Cr.) (1999-2000)
1.	2	Wipro	48,107.1
2.	3	HCL Technologies	29,413.6
3.	4	Infosys Technologies	28,980.4
4.	26 (PSU)	CMC	751.6

Source: BT 500, Business Today, 2000

these were in the public sector, as shown in Table 3.

From each firm, ten people were selected on a random basis for the study. The focus was on middle level of management as scholars around the world emphasize on the

Table 3: Companies from Petroleum Marketing Sector

Sr.No.	Rank (PSU)	Company	Market Capitalization (Rs. Cr.) (1999-2000)
1.	2	Indian Oil Corporation	17,250.6
2.	9	Hindustan Petroleum Corporation	5,578.5
3.	10	Bharat Petroleum Corporation	4,249.6
4.	38	IBP Co.	294.6

Source: BT 500, Business Today, 2000

role of middle managers in new knowledge creation.

For expert opinion, thirty responses were gathered from industry, academics and government policy makers. This was more of a judgmental and convenience

sampling and discussion groups at a Yahoo website were also used.

Data Analysis: The data so collected was tabulated and was checked for bias. Finally, percentages were calculated to find out the practices prevailing in the industry. In the final presentation, figures were used.

Limitations of the Study

The study has two limitations. Firstly, it is limited to only three sectors and only five firms from software and pharmaceutical sector and four from petroleum marketing sector. Secondly, the sample size is not very big, i.e. fifty people from software sector and pharmaceutical sector and forty people from petroleum marketing sector.

Empirical Findings

Experts Opinion

The attitude towards new knowledge creation is quite pathetic as shown in Figure 1. The prevailing notion is that it is the job of research and development (R&D) dept. only.

Software Sector

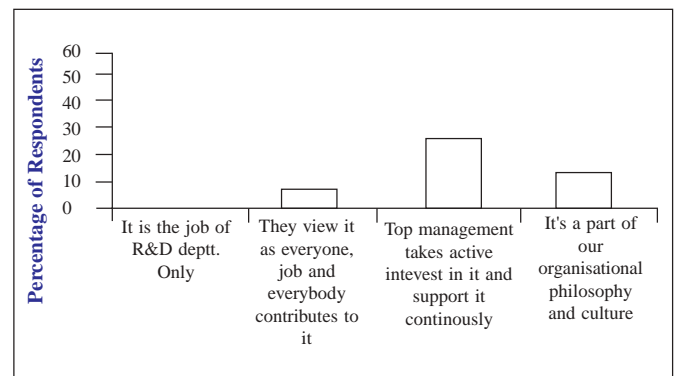


Figure 1 : Attitude towards New Knowledge Creation in Indian Organizations

- Majority of the respondents' say new knowledge is important to very important for their organization as is clear from the figure 2.

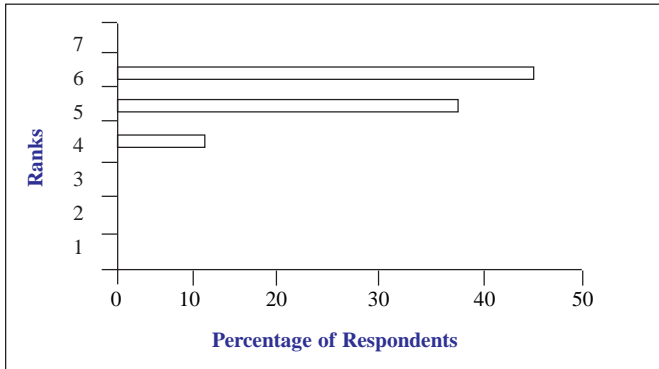


Figure 2 : Importance of New Knowledge for the Organizations

- There is lack of participation by firms under study in industry based research groups for creating new knowledge. Seventy four percent (%) say they do not participate at all, 16 percent say they rarely participate, 8 percent say the participate but occasionally and only two percent say they participate regularly in such research work. 90 percent of the respondents at CMC, 80 percent at HCL Tech, 70 percent at TCS, 70 percent at Wipro and 60 percent at Infosys say they never participate whereas 30 percent at Infosys, 20 percent at Wipro and 20 percent at TCS say they rarely participate.

There is focus on in-house knowledge creation and a lack of participation by the software firms under study in industry based research groups for creating new knowledge.

- Figure 3 gives a summary of how an organization gets new knowledge. The present research work considered five modes of knowledge generation: creation, acquisition, collaboration, adaptation and networking. Creation means establishing in-house research and development centers and creating knowledge within the organization. Acquisition means buying knowledge available outside the firm. The most direct and often most effective way to acquire knowledge is to buy it—that is, to buy an organization or hire individuals who have it. Collaboration means making joint efforts with another firm/institution for new knowledge creation. Adaptation means taking knowledge from outside the firm and adapting it to the firm's context as well as adapting the firms' own knowledge with the changing times. Networking means informal links among people within or outside the firm resulting in sharing and creation of new knowledge. It clearly shows the focus on creation for new knowledge with a majority of the respondents at Infosys (60 percent), Wipro (60 percent), TCS (60 percent), HCL Tech (70 percent) and CMC (80 percent).

- The attitude towards creating new knowledge in the organizations is quite pathetic as shown in Figure 4.

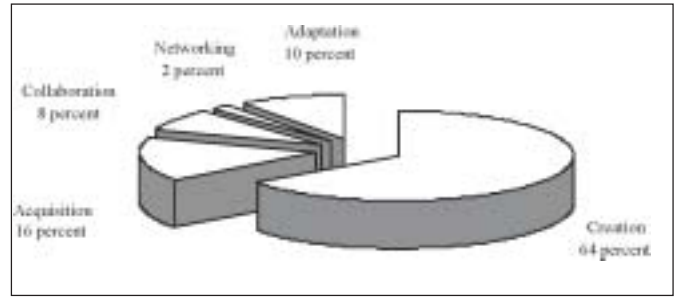


Figure 3: How does Your Organization get New Knowledge?

The prevailing notion is: it is the job of R&D department only. 70 percent of the respondents at CMC, 60 percent at HCL Tech, 40 percent at TCS, 30 percent at Wipro and 30 percent at Infosys think new knowledge creation as job of R&D department only. A significant number, i.e. 30 percent of people at Infosys say new knowledge creation is a part of their organizational philosophy and culture. A significant number of people at TCS (40 percent) and CMC (30 percent) say their top management takes active interest in it and supports it continuously.

- Forty six percent of the respondents say that the processes for contributing knowledge to the organization's repositories are seamlessly integrated

into work activities, 36 percent do not say so and 18 percent have no idea about it. Majority of the respondents at Infosys (60 percent), Wipro (60 percent) and TCS (50 percent) are positive on this aspect whereas a significant number of the respondents at CMC (40 percent), TCS (40 percent), HCL Tech (40 percent), Wipro (30 percent) and Infosys (30 percent) give negative response.

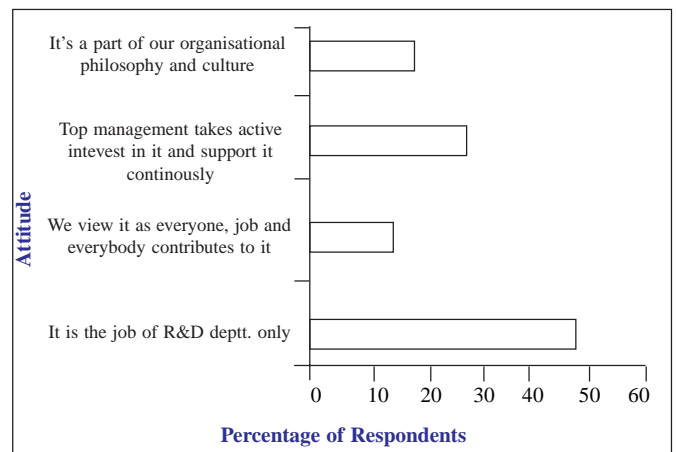


Figure 4 : Attitude towards New Knowledge Creation in the Organizations

Pharmaceutical Sector

- Majority of the respondents' say new knowledge is important to very important for their organization as is



clear from Figure 5.

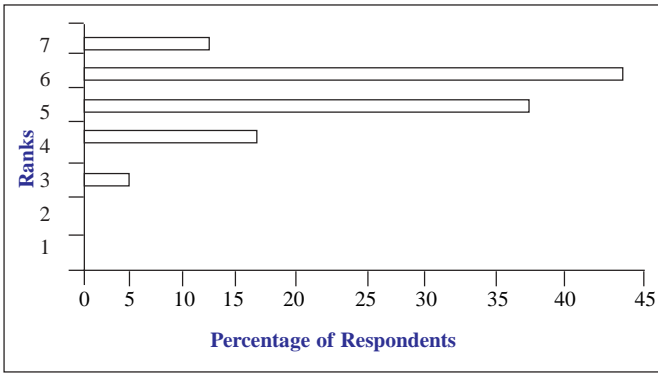


Figure 5 : Importance of New Knowledge for the Organizations

- There is a lack of participation by firms under study in industry based research groups for creating new knowledge. Sixty two percent say they do not participate at all, 28 per cent say they rarely participate, 6 percent say they participate but occasionally and only four per cent say they participate regularly in such research work. 90 percent of the respondents at Cipla, 80 per cent at Glaxo, 60 percent at Reddy’s Lab and 50 per cent at Dabur say they never participate whereas 40 per cent at Ranbaxy say they rarely participate.
- Figure 6 gives a summary of how an organization gets new knowledge. It clearly shows the focus on creation for new knowledge with a majority of respondents at Reddy’s Lab (70 percent), Ranbaxy (70 percent), Glaxo (70 percent), Cipla (80 percent) and Dabur (80 percent).

The majority of the respondents in pharmaceutical firms under study see new knowledge creation as important to very important. Nearly a half of the respondents find that the processes for contributing knowledge to the organization’s repositories are seamlessly integrated into work activities.

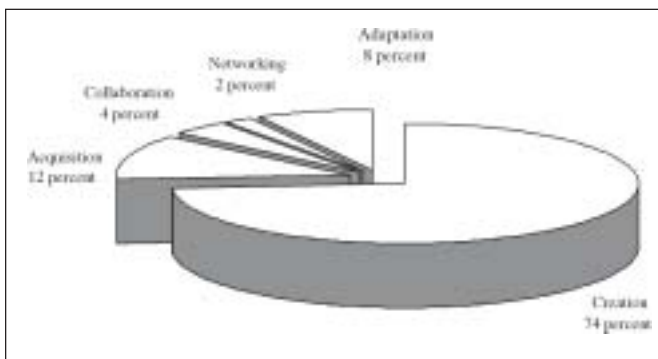


Figure 6 : How does Your Organization get New Knowledge

- The attitude towards creating new knowledge in the organizations is not encouraging. The prevailing notion is: it is the job of R&D department only as displayed in Figure 7. 70 per cent of the respondents at Cipla, 60 percent at Dabur, 50 per cent at Glaxo, 40 percent at Ranbaxy and 40 percent at Reddy’s, think new

knowledge creation as job of R&D department only. A significant number, i.e. 30 per cent of people at Reddy’s Lab say new knowledge creation is part of their organizational philosophy and culture. A significant number of people at Ranbaxy (30 per cent) and Dabur (30 per cent) say their top management takes active interest in it and supports it continuously.

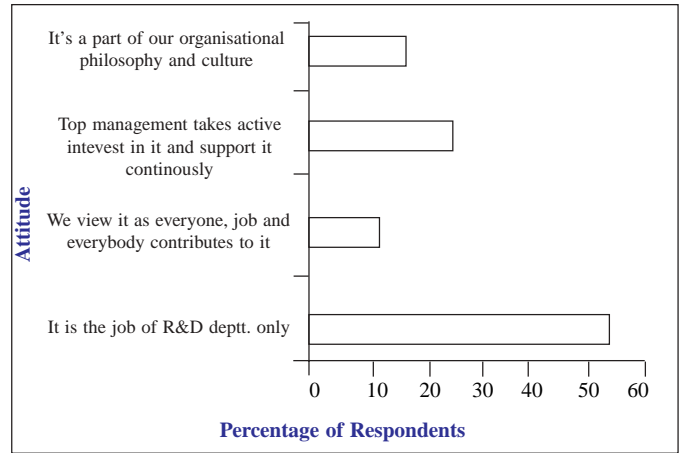


Figure 7 : Attitude towards New Knowledge Creation in the Organizations

- Forty four per cent of the respondents say that the processes for contributing knowledge to the organization’s repositories are seamlessly integrated into work activities, 34 percent do not say so and 22 percent have no idea about it. Majority of the respondents at Reddy’s Lab (60 per cent) and Ranbaxy (50 per cent) are positive on this aspect whereas a significant number of the respondents at Cipla (40 per cent), Glaxo (30 per cent) and Dabur (30 per cent) gave negative response.

Petroleum Marketing Sector

- Majority of the respondents say new knowledge is important to very important for their organization as is clear from the figure 8.

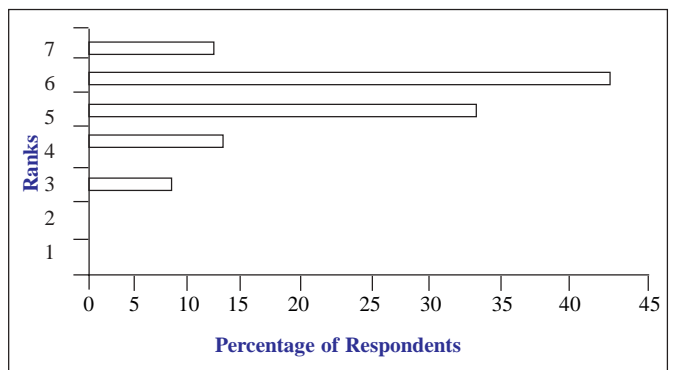


Figure 8 : Importance of New Knowledge for the Organisations



- There is lack of participation by firms under study in industry based research groups for creating new knowledge. 67.5 percent of the respondents say they do not participate at all, 22.5 percent say they rarely participate, 7.5 percent say they participate but occasionally and only 2.5 percent say they participate regularly in such research work. 80 percent of the respondents at IBP, 70 percent at HP, 60 percent at IOC and 60 percent at BP say they never participate whereas 30 percent at HP, 30 percent at IOC and 20 percent at BP say they rarely participate.
- Figure 9 gives a summary of how an organization gets new knowledge. It clearly shows the focus on creation of new knowledge with a majority of the respondents at HP (80 percent), IBP (70 percent), IOC (60 percent) and BP (60 percent) focusing on creation of new knowledge.

The attitude towards creating new knowledge in the petroleum firms under study is not encouraging. The prevailing notion is: it is the job of R&D department only. The processes for contributing knowledge to the organization's repositories are not seamlessly integrated into work activities.

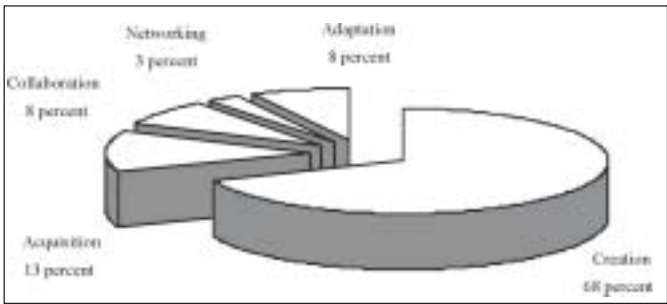


Figure 9: How does Your Organization get New Knowledge?

- The attitude towards creating new knowledge in the organization is quite dismal. The prevailing notion is: it is the job of R&D department only as displayed in figure 10 Eighty percent of the respondents at IBP, 70 percent at HP, 60 percent at IOC, and 40 percent at BP, think

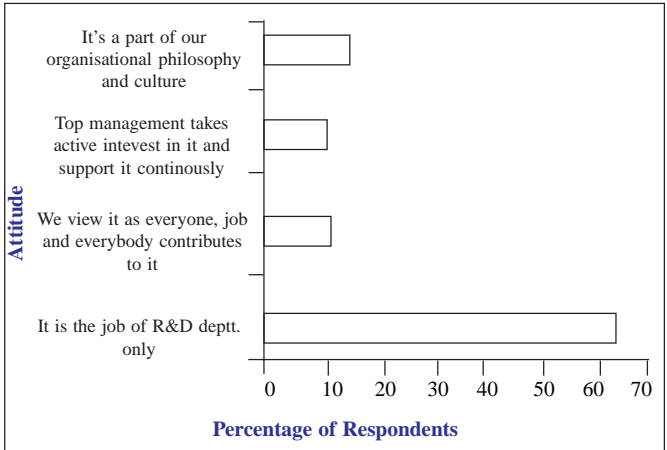


Figure 10 : Attitude towards New Knowledge Creation in the Organizations

new knowledge creation as job of R&D department only. A significant number i.e. 30 percent of people at HP and 20 percent at IOC say new knowledge creation is part of their organizational philosophy and culture. A significant number of people at BP (20 percent) say their top management takes active interest in it and supports it continuously. Also, a good number of people, i.e. 30 percent at BP view it as everybody's job and everybody contributes to it.

- Thirty five percent of the respondents say that the processes for contributing knowledge to the organization's repositories are seamlessly integrated into work activities, 45 percent do not say so and 20 percent have no idea about it. Majority of the respondents at BP (60 percent) and IOC (40 percent) are positive on this aspect whereas majority of the respondents at IBP (70 percent) and HP (60 percent) gave negative response.

Sectoral Comparison

- A very high majority of the respondents in the software sector (96 percent) and a high majority of the respondents in the pharmaceutical sector (80 percent) rate new knowledge as important to very important for their organization whereas a high majority in the petroleum marketing sector (82.5 percent) rate it as average to important on the seven-point scale.
- Majority of the respondents in each sector, i.e. software sector (66 percent), pharmaceutical sector (74 percent) and petroleum marketing sector (67.5 percent) say their organization get new knowledge through creation.
- There is a lack of participation in the industry based research groups in all the three sectors as majority of the respondents in software sector (74 percent), pharmaceutical sector (62 percent) and petroleum marketing sector (67.5 percent) say that they do not participate at all in such studies.
- Nearly half of the respondents in the software sector (52 percent) and the pharmaceutical sector (48 percent) think new knowledge creation as the job of R&D deptt. only whereas majority of the respondents in the petroleum marketing sector (62.5 percent) are of the same opinion. This is in line with the experts' opinion that new knowledge creation is looked upon as the job of R & D deptt only in the Indian industry.
- The processes for contributing knowledge to the organizations' repositories are not seamlessly integrated into work activities across the three sectors. The situation is slightly better in software and pharmaceutical sectors as compared to petroleum sector.
- Overall the scenario is worse in petroleum marketing sector, i.e. public sector followed as compared to pharmaceutical and software sector, i.e. private sector.

So the state of new knowledge creation in the private sector is slightly better than the public sector.

Implications

These findings have serious implications for the organizations under study as well as the industry and the country. The positive finding of the research work is that employees are aware of the importance of new knowledge. And the negative aspect is that new knowledge creation is not given as much importance as it requires.

The public sector, in particular, needs to take a serious look at new knowledge creation in the present time of privatization and liberalization. Even the basic sectors such as petroleum-marketing needs to continuously create new knowledge in order to serve the new highly demanding consumer. Software sector must create new knowledge and applications so as to move up in the value chain in the global business. Pharmaceutical sector in particular needs to focus more on new knowledge creation in the changed regime of patent laws.

In this knowledge-driven, services-led global economy, knowledge is the most critical resource and if we are not able to create new knowledge continuously, competitiveness of Indian firms, Indian industry and the country is at stake as Porter (1997) and Drucker (1993) have emphasized on the role of knowledge and productivity of knowledge for competitiveness. The President of India is talking of making India a developed country but this could not happen if we are not able to create new knowledge, disseminate it and implement it.

Conclusion

We are in a knowledge economy where continuous innovation is the key to sustainable competitive advantage. Though people rate new knowledge creation quite important for their organization but their attitude towards new knowledge creation is not encouraging as new knowledge creation is thought as the job of research and development department only. In this competitive and fast-technology-changes time an organization needs to go for a number of ways for new knowledge creation but in Indian industry the focus is on creating new knowledge in-house and other options are not in practice. Also, the processes for contributing new knowledge are not streamlined in the organization or employees are not aware of it.

Directions for future research: This research work provides some ideas on new knowledge creation in three selected sectors of Indian economy in general and the selected firms in particular. But new knowledge creation is a very important aspect and further research can be carried out in other industries as well as on related aspects like academia-industry interactions in new knowledge creation in Indian context.

References

Berger R. and CII (1998) India High on Enterprise, Low on Innovation,

Businessline, Chennai, Jan19, 1.

Business Today (2000) BT-500: India's Most Valuable Private Companies, *Business Today*, Oct. 6, 112-129.

Das P. (2004) Economic Liberalization and R&D and Innovation Response of Indian Public and Private Sector Industries, *International Journal of Management & Decision Making*,5(1),76.

Drucker P.F. (1985) *Innovation and Entrepreneurship*, Harper Collins Publisher Inc. New York 107-129

Drucker P.F. (1993) *Post Capitalist Society*, Butterworth-Heinemann, London.

Drucker P.F. (1993) *Post-capitalist Society*, Oxford: Butterworth-Heinemann, 176.

Gupta A. (2005) The New Face of Global R&D, FICCI website. www.ficci.com

Hedlund G. and Nonaka I. (1993) Models of Knowledge Management in the West and Japan. In *Implementing Strategic Process: Change, Learning and Cooperation*, Lorange, P. et al. (ed.), Oxford: Basil Blackwell.

Judge W.F.Gerald and Robert D. (1997) The New Task of R&D Management: Creating Goal-directed Communities for Innovation, *California Management Review*, 39(3), Spring, 72-85.

KPMG-NASSCOM (2004) Strengthening the Human Resource Foundation of the Indian IT Industry, *NASSCOM*. www.nasscom.org.

Levin D.Z. (1999) Transferring Knowledge within the Organization in the R&D Arena, Northwestern University, Dissertation Abstracts on Disc, *ProQuest Searchware*, Jan 1997–Sept 2000.

Madhavan R. and Grover R. (1998) From Embedded Knowledge to Embodied Knowledge: New Product Development as Knowledge Management, *Journal of Marketing*, 62(4), 1-12.

Mahanta S. (2004) India as Hub of Intellectual Capability, *Times of India*, New Delhi.

Manasco B. (1997) Leading Lights: Technology Designer Michael Schrage, *Knowledge Inc*, www.knowledgeinc.org

Manasco B. (1997) Leading Lights: An Interview with Author and Consultant Stan Davis, *Knowledge Inc*. www.knowledgeinc.org.

Mashelkar R.A. (1999) Resurgence of Innovative India: The Challenge and the Strategy, *Sir Purshotamdas Thakurdas Memorial Lecture*, The Indian Institute of Bankers, Mumbai.

Nonaka I. (1991) The Knowledge-creating Company, *Harvard Business Review*, Nov-Dec, 96-104.

Nonaka I., Toyama R. and Konno N. (2001) SECI, Ba and Leadership: United Model of Dynamic Knowledge Creation, *Managing Industrial Knowledge*, Nonaka I. and Teece D. (ed.), 13-41, Sage Publications, London.

Pharmaceutical Research and Development Committee (PRDC) (1999) *Report. Transforming India into a Knowledge Power*, Govt. of India.

Pillania R.K. (2005) Leveraging Knowledge: Indian Industry, Expectations and Shortcomings, *Global Business Review*, 6(2), Forthcoming.

Polanyi M. (2001) The Tacit Dimension, *Knowledge and Strategy*, Zack H. M. (ed.), 135-146, Butterworth – Heinemann, New Delhi.

Porter M. (1998) Creating Tomorrow's Advantages, *Rethinking the Future*, Gibson R. (ed.), 48-61, Nicholas Brealey Publishing, London.

Porter, M.(1997).Creating Tomorrow's Advantages.In Gibson, R. (ed.). *Rethinking The Future*, Nicholas Brealey Publishing, London. Pp.47-61.

IBM (2004).Your turn: The Global CEO Study 2004.IBM website www-1.ibm.com/services/us/index.wss/ibvstudy/bcs/a1001708?cntxt=a1000401

Powell W.W. (1998) Learning from Collaboration: Knowledge and Networks in the Biotechnology and Pharmaceutical Industries, *California Management Review*, 40(3), 65-77.



Prahalad C.K. (1998) Strategies for Growth, *Rethinking The Future*, Gibson R. (ed.), 62-75, Nicholas Brealey Publishing, London.

Roy S. and Dhawan S.K. (2002) Preliminary Pointers towards Improving the Work Environment in CSIR Labs: Remarks from an Empirical Study, *Current Scienc*, 82(3), 269-273.

Sikka P. (1998) Analysis of in-house R&D Centers of Innovative Firms in India, *Research Policy*, 27(4), 429-434.

Soo C., Devinney T., Midgley D. and Deering A. (2002) Knowledge Management: Philosophy, Processes and Pitfalls, *California Management Review*, 44(4), 129-150.

Swaminathan S.A.A. (2004) R&D: India's New Star Industry, *Times of India*, New Delhi, 10.

Un and Cuervo-Cazurra (2004) Strategies for Knowledge Creation in Firms, *British Journal of Management*, 15, S27.

Walia N. (2004) India: The Outsourcing Hub of Patent Idea, *Times of India*, New Delhi, Jan, 4.

World Bank (1997) *World Development Report: Knowledge for Development*, World Bank New York:



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Flexibility – Thinking Shift for Organizational Excellence

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Abstract

Organizations of modern era are passing through highly competitive battlefield environment. For survival/sailing through one has to be ahead of the fiercely competitive benchmark obtaining in the world. The wind of liberalization, privatization and globalization (LPG) is creating a fast changing business scenario. The organizations are becoming boundaryless and more transparent, culminating into a global village concept. Industry deregulations, increasing customer focus, changing employee's values, work – ethics are a few factors that have placed unprecedented demands on business enterprises. Rapid technological changes and the shrinking time for the break even, demands the organizations to unleash their brainpower in order to maximize their throughput and be in the game competitively. It will be observed herein that Flexibility System Management (FSM) is the one single most dominant factor, which imparts the desired momentum to the organizations.

The author, in this paper, has made an attempt to gather and examine the valuable inputs from various Government R & D organizations / public sectors and an analytical approach has been made with the help of essential flexibility norms for achieving organizational excellence. It is prudent that the knowledge workers in the organizations work rather passionately, which may yield in better positive productivity and in turn help the corporate sector to transform into a 'Passionate Organization'. The Balanced Score Card (BSC) technique has also been applied to achieve the same. Emerging trends in HR has been suitably discussed for enhancing the productivity of the organizations. The present paper opens up new vistas for further research work and various manifestations of Flexibility System Management in enhancing the functions of R & D organizations for accomplishing excellence.

Keywords: liberlization, privatization, globalization, flexibility system management, passionate organization

Introduction

Modern organizations are passing through highly competitive battlefield scenario. The barriers across the world are gradually diminishing under the fast changing economic, fierce global competitiveness, cross cultural / cross functional settings and the ever-changing technological environment. Also, with the strong waves of globalization and liberalization sweeping across the world, India too has to take a bold initiative to make qualitative changes in the economic as well as educational and technological policies. In this scenario Defense R & D Organizations (DRDO), some other government (public) and private sectors have made a significant leap in developing world class organizations as well as competent technologies.

The 'Technological Education' cum strategic HR management is the single most dominant factor and is an essential pre-requisite for shaping the future of any organization and in turn the country. Authors have primarily concentrated in this paper, about how to enhance the throughput of primarily a DRDO establishment or a public sector undertaking by applying Flexibility System Management (FSM) for giving an upshot in the organizational productivity - both dimensions of technology and human resource are to be focused, and for this the people have to unleash their brainpower, work passionately with the *power of full engagement*. It is prudent that the knowledge workers in the organizations work rather passionately, for yielding better positive results and in turn help the corporate sector in transforming to a "Passionate Organization"

The subject is very vast and due to constraints of this paper, few themes only – firstly,

An essential pre-requisite for shaping the future of any organization and in turn the country is technological education cum strategic HR management.

The 80/20 principle and B. Sc. techniques bring out discrete work culture in synergetic fashion for enhancing the productivity of the organization.

emerging due to modifications of Pareto Law (80/20 principle) and secondly, techniques of Balanced Scorecard (BSc) will be discussed for achieving the organizational goals. *Chaos Theory*, obtaining out of Pareto Law has been discussed in some details so as to home down to what vital few (20 per cent) is to be tackled first and then 80 per cent is to be attended in priorities fashion for better time management. The HR score card wherein application of Balanced Score card (BSc) propagated by Kaplan Norton (1996) suggests very pragmatic steps for achieving financial throughput which is the main aim of any organization. The above techniques bring out discrete work culture in synergetic fashion for enhancing the productivity of the organization. Finally, it will be observed that the present paper will open up new avenues for further research work and various dimensional manifestations of ‘essential flexibility norms’ for accomplishing organizational excellence.

Overview of the Problem

Generally, in the DRDO and other public sector like ordinance factories, government undertakings, primarily design – development of a product and product development (DGQA – Director General Quality Assurance) work is carried out. For these activities technological inputs, reverse engineering and so on are main factors, wherein the core group of knowledge workers find the design / developmental solutions in a modus operandi of project management mode.

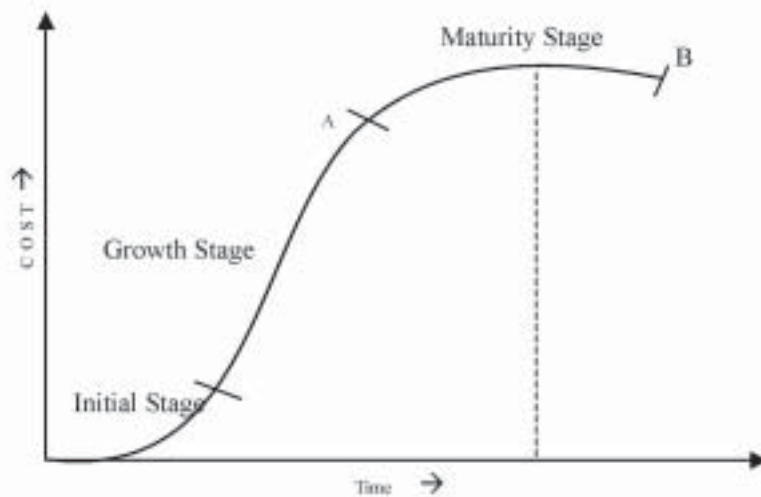


Figure 1: Product Project Life Cycle
(Domain A and B should be aimed to be for longer period)

The product progress, as per product life cycle “S” curve (Figure 1), should stay in the market for maximum period with desired customer focus / satisfaction – this is what the main goal is. For these, ‘breakthrough technologies’ are to be acquired / blended in the existing one. In the competitive market, there is no place for obsolescence both in the product and human resources. Newer technologies and specialized task – forces are pre-requisite for continuous development and sustenance of the product. Therefore, main endeavour is to keep pace with the market and technology. To cope with these activities, it is not only essential to have ‘fast and appropriate scientists / engineers’ but also they should be on ‘faster tracks’.

The need of the hour is to have fast and appropriate scientists/ engineers on faster tracks

Opening the Door

Technology and people should travel together for the development of a product. For keeping pace with the competitive battlefield, we resort to the following few technologies:-

- Flexibility System Management (FSM), Sushil (2000)
- Theory of constraints (TOC), propagated by Eli Goldratt (1990)
- Six – Sigma approach, propagated, by George Eckes (2001)
- Balanced Scorecard (BSc), by Kaplan & Norton (1996)
- Modern Management of Product techniques , by Harold Kerzner (2003)
- And many other like “Full Engagement” and “Emotional Manifestations of People”

To achieve the above breakthrough technologies firstly we should have an appropriate and stable / tangible system and system theory as per the norms spelt by Peter Senge (1999). As a sound and dynamic system, rather ‘Smart System’ and ‘Smart Technologies’ can only produce ‘Smart Products’, which are durable / ruggedised as per the defense needs / usages – which are also repetitive in nature.

Breakthrough Technologies

Due to space and temporal limitations, herein, the following three technologies only will be discussed for getting requisite synergy of technology and the knowledge worker. These are:

- Modification of Pareto Law Models.
- Full – Engagement – Emotional manifestation model
- HR Scorecard model

These are briefly described in the succeeding paragraphs.

Modifications of Pareto Law (80 / 20) Principle

Before applying modifications / manifestations of Pareto Law, let us examine what it is. Pareto Law is also known as ‘Pareto Principle’ 80/20 rule, Principles of least effort, ‘Principle of Imbalance’ and so on. Going very briefly to the historical background, 80/20 principle was discovered around 1897 about 100 years before by an Italian economist, Vilfredo Pareto (1848 – 1923). Koch (2001) has defined 80/20 principle as:

“The Pareto law or 80/20 principle states that there is an inbuilt imbalance between causes and results, inputs and outputs and efforts and rewards.”

Koch typically divides causes, inputs or efforts into two categories:

- a) The majority that have little impact,
- b) A small minority, which has a major, dominant impact.

The following are outcomes of Pareto Law:

1. Perhaps it is the most famous time management principle of all the time.
2. After years of research, it has been concluded that any society could be divided into two groups: - the ‘vital few’ the top 20 per cent who controlled most of the money; and the ‘trivial many’ the bottom 80 per cent who owned very little.
3. Pareto concluded and proved mathematically that the top 20 per cent of people in any society ended up owning 80 per cent of the wealth. Further studies with the Pareto principle have shown that the ratio applies to almost any economic activity.
4. In time-management, the Pareto principle says that 20 per cent of the things you do will account for 80 per cent of the value of all the things you do.
5. The key to high throughput / productivity is to identify our top 20 per cent of tasks and activities before we begin – it is then crucial to work on those ‘vital few’ single mindedly with full engagement / commitment all day long.
6. Also at the same time we must simultaneously avoid getting distracted by the bottom 80 per cent of the tasks that contribute very little to our life or work.

80/20 Thinking is Non Linear (Chaos Theory)

It has been rightly observed by Rowan Gibson (1996) that:

“Roads are linear and linear thinking is useless in a non-linear world”

- Rowan Gibson (1996)

It is observed that world’s business functions in a non linear fashion. Engineers, Scientists and Historians have long ago abandoned linear thinking. It also leads to chaos theory of disorder – a predictable non-linear.

The chaos theory expert Edward Lorenz asks:

“Does the flap of a butterfly’s wings in Brazil set off a tornado in Texas?” Prophets have failed to foretell the arrival of major environmental, social, political, economic upheavals or so. (Refer Figure 2).

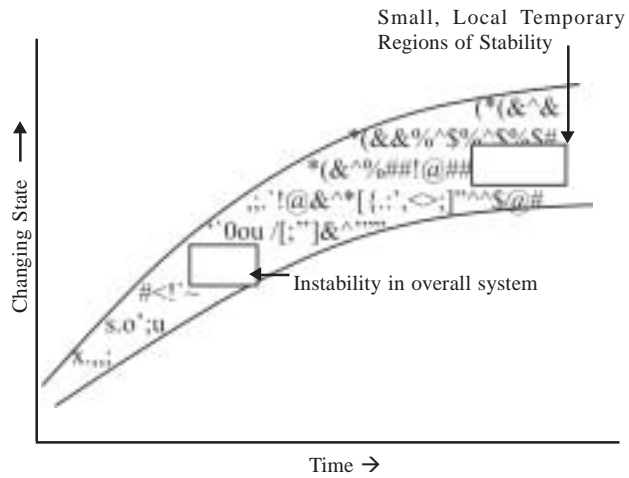


Figure 2: Chaos Theory

The innovative feature of the concept scenario of multiplicity – many ideas may emerge depending upon the impact of several variables, most of which are uncontrollable. (Figure 3)

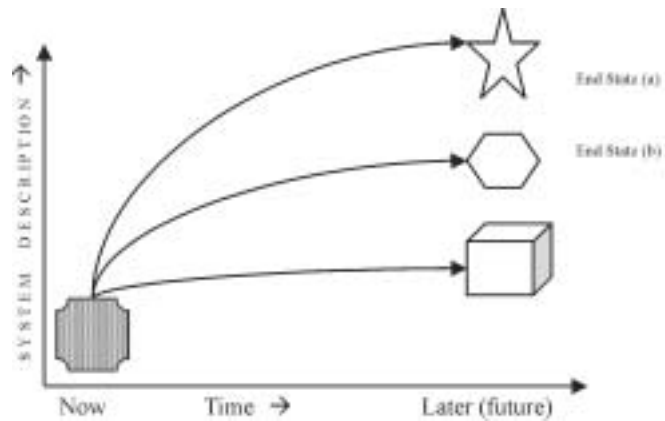


Figure 3: Future Scenario Concept

The life of a typical organization is shown in Figure 4, with its growth, crisis and demise – a painful demise, sometimes quick, sometimes prolonged, follows (Robert J. Allio).

Thus, we see that price we pay for living in the past is to become part of a history. As per

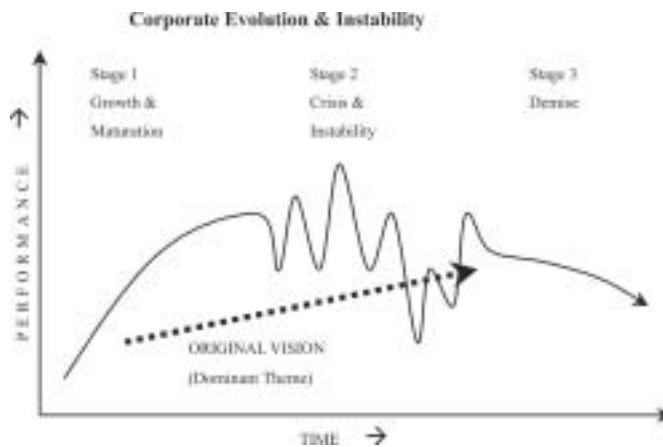


Figure 4: Corporate Evolution and Instability

Peter F. Drucker, “we have to slough off yesterday for creating better tomorrow.” Reverse is also true, if we are committed to yesterday then we can not create tomorrow.

Stable systems are ‘fail – safe’ - they minimize the probability of failure by introducing high negative feedback. Resilient systems by contrast are ‘safe – fail’ – they minimize the consequences of failure with small creative ‘adjustments’ (*adaptability* or *flexibility*) and dynamic equilibrium leaders can avoid periodic and traumatic transformations and instead of the inexorable demise, illustrated in Figure 4. The good and potential CEO’s / Leaders can launch the firm into a new growth trajectory. (Refer Figure 5) down below – there may be more crisis stages than the one shown here.

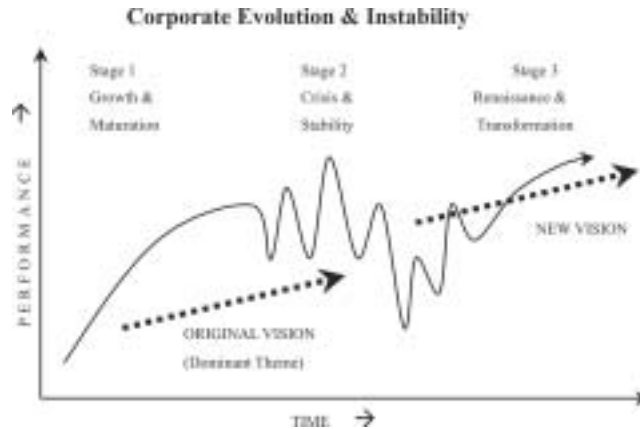


Figure 5: Corporate Evolution and Instability

Bill Gates at Microsoft exemplifies this type of adaptability. The original Microsoft view was “a Computer in every home and every desk” (All running Microsoft software). But Gates recognized the rapid surge of internet technology as a major threat and quickly redirected resources to match the success in the market place of Netscape and others.

Thus, the role of the dynamic organizations, leader should be able to adopt his behaviour or more accurately, bring to the foreground a behaviour pattern that fits the needs of the organization at a particular time.

The analogue in the Hindu mythology is *VISHNU*, who changes himself into many different forms (*avatars* – incarnations) to preserve order in the world. The *avatars* include Rama (the warrior), Krishna (Cowherd) and Buddha (the teacher).

Accommodating Diversity and Heresy

Typical successful organizations develop strategies that produce growth and more success. The leader generally is responsible for the delicate balance between stability and unity on the one hand, and innovations and change on the other; between enforcing conformity and allowing heresy. Excess structure, the draconian constraints of a bureaucracy, will drive creative individuals out of the fold. Poets like *Shakespeare* touch our hearts with their love sonnet, each adhering to a fourteen line structure. In business, these rules take the form of exhortations like, “Satisfy Customers” or “improve the product – continuous improvement – *KAIZEN* or so.”

A delicate balance between stability and unity on the one hand and innovations and change on the other, typify successful organization.

The leader must apply these insights and allow sufficient disorder (Novelty) within the organizations so that innovation (inventions that are applied practically) can flourish. (Refer Figure 6).

Introducing “genetic diversity” within the organization helps promote this innovation. It



Figure 6: Chaos or Stagnation Balance

can be observed in Figure 6 that *too much disorder, of course leads to disarray, while too much order leads to stagnation*. Disorder is the breeding ground for creativity, and good leaders prosper by “*letting a hundred flowers blossom and a hundred schools of thought contend*” (Mao speech, 02 May 1956).

The visionary capability of great leaders empowers them to take risks that others dare not but these characteristics of leaders suggest that greatness is associated with heresy – a quality that conflict / contradict with the need of the organization for safe and reliable behaviour. After all, people were convinced that the earth was flat until the year 1492! Leaders must learn how to sort out the potential Copernicuses, Darwins and Leonardo Da Vincis of their organizations from the lunatic fringe.

Resistance to Change

The complement of ‘*adapting*’ to change is the challenge of ‘*creating*’ change, which requires overcoming the intrinsic resistance to change that every system exhibits. Great socialist, Kurt Lewin and others observe that for adaptability or flexibility to a new state an organisation has to *unfreeze*, before *freezing* the system – moving to its new position.

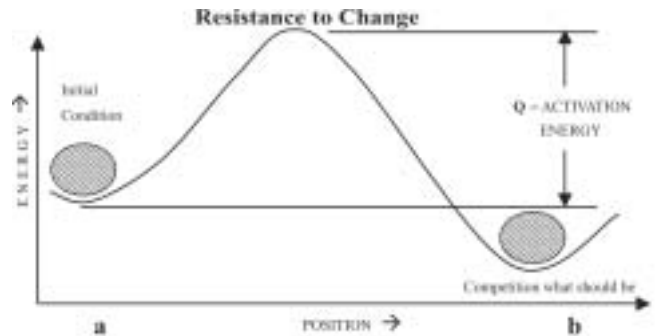


Figure 7: Concept of Resistance to Change Model

We can see the analogue for this process is fundamental thermodynamics terms (Figure 7). The system at point ‘a’ in Figure 7, needs to move to a more attractive (lower energy) state at point ‘b’. But an energy barrier of height Q prevents this movement.

In social systems, Q corresponds to the intrinsic resistance to change experienced by all the organisations (in our case Government / public sector), in which members are attached to their status quo: for them the uncertainty of the new world at ‘b’ raises catastrophic expectations.

Addressing Modifications of Pareto Law

80/20 Principle as has been observed earlier is a philosophy and finds use in many walks of life and has wide management applications. But it has a major limitation / snag of ‘*linear thinking*’ which is an over simplification of reality as world of business is ‘*non-linear*’. It sometimes create chaos and imbalance and away from normal conventional norms. Herein, the 80/20 principle can be modified as 20/60/20 for the organizations in question. It is our common experience that out of 100 persons, 20 per cent or so of the population of a corporate organization receive any agenda very enthusiastically and always are very positive to do any thing (Refer Figure 8). At the same time the bottom 20 per cent are always very hard to accept change and are almost incorrigible and opposed to accept any change.

Applying the formula of 20/60/20 and re-thinking / re-inventing of 80/20 principle into 50/50 principle much more and maximum throughput (sales / profit) can be achieved culminating into enhanced productivity and organizational excellence (Pathak, 2002).

Rethinking 80/20 Principle – Opening the Hood

Referring the Figure 8 wherein the 80/20 principle (Pareto Law) has been modified as 20/60/20 circles, we observe that the top 20 per cent does not need to be convinced and the bottom 20 per cent can not be. And decidedly, this 60 per cent middle one, which can be motivated for joining / merging into top 20 per cent segment. If half of 60 per cent is motivated to upper 20, the ratio of 50/50

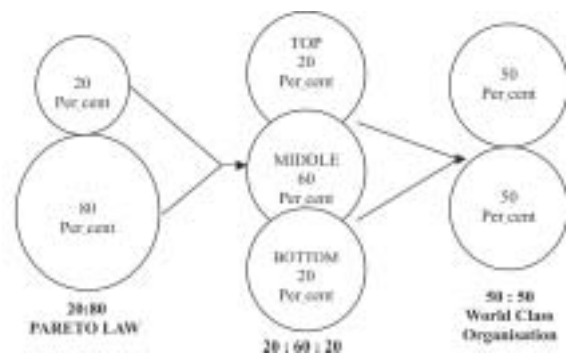


Figure 8: Paradigm Shift for Pareto Law

Adaptability or flexibility requires overcoming the intrinsic resistance to change

To develop into a top world class organization, the 80/20 principle needs to be re-invented into a 50/50 principle



will change the whole scenario into a top world class organization.

Of course, in this entire proposition, the people of the organization have to unleash their brain power to the fullest extent.

80/20 Principle and Time Management

As has been observed, in 80/20 principle by focusing / controlling few critical activities (that really matters) we can manage more throughputs. The 80/20 principle treats time as a friend and not an enemy. It can be said that, if we double our time on the top 20 per cent of activities, we could work a 'two – days work' and achieve more than now. In spite of showing time in the graphical representations from left to right, we can show (Refer Figure 9) as a series of interlocked and ever larger and higher triangles, calling them as 'Time – Triad'.

Treating time as a friend and not an enemy can lead to higher achievements

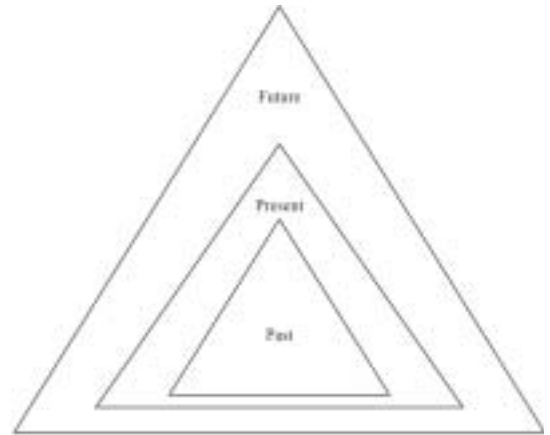


Figure 9: The Time Triad

Giving freer rein and better direction to our most positive 20 per cent time (herein, upper top circle / segment) future can be interpreted as a dimension of the present and the past – sometime on optimism that the future will be better than the present.

Full Engagement – Emotional Quotient Manifestations

The author (Pathak 2002) has developed emotional quotient manifestations, wherein a passionate work – culture was suggested (Paper presented at IITM, Gwalior, 2002). Jim Loehr & Tony Schwartz (2003) have propagated the concept of the "Power of Full Engagement". Authors have attempted a model out of both models (Refer Figure 10), for achieving the maximum synergetic effect out of both.

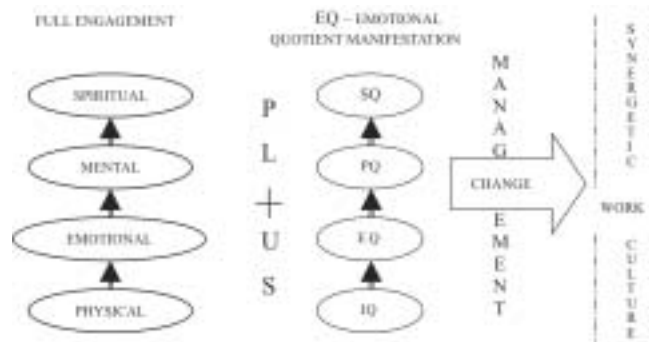


Figure 10: Full Engagement – Synergy Model (EQ – Manifestations)

"Full Engagement Concept" primarily deals with / speles out:

- Energy and not time is our most precious resource, and
- Energy, not time, is the fundamental currency of high performance.

'Full Engagement' power concept begins with spiritual connection of PURPOSE. Also, high positive energy is the fuel of high performance. (Refer Figure 10(a)).

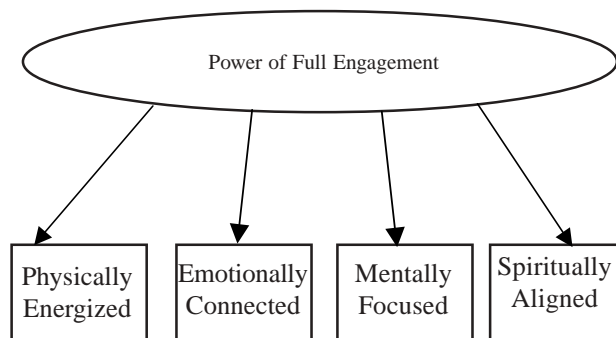


Figure 10 (a) : Power of Full Engagement



Pathak in his paper has discussed manifestation of EQ (Emotional Quotient) into further PQ (Passion Quotient) and SQ (Spiritual Quotient). Once people work with passion and full engagement, the performance and productivity is at the fullest extent. That is both combined, Full engagement and passionate working imparts an upshot synergetic work culture which culminates into higher dimensions of work throughput. The model itself (Refer Figure 10) speaks about the success story.

Flexibility System Management

Before, HR Scorecard model is discussed, let us see what is flexibility and its ingredients very briefly. Sushil (2000) has given thorough details of all flexibility dimensions in his book 'Flexibility in Management'. Figure 11 explains the various aspects of the flexibility concepts, that is, 'continuum or options', 'dynamic interplay or change' and 'freedom of choice', which are highly inter-related.

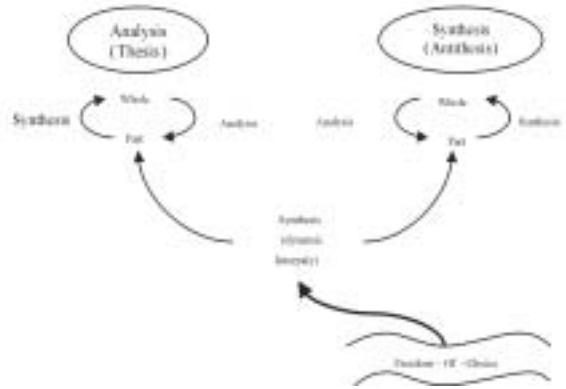


Figure 11: Concept of Systemic Flexibility

Flexibility works on the principle of continuum, of dynamic interplay and freedom of choice and is integrative in approach

Flexibility is the *systemic* approach, that is, out of the system theory i.e. holistic approach or *integrative approach*. In short flexibility is defined as:

“Flexibility is the ability to change or react with little penalty in time, effort, cost or performance”.

Or

“Flexibility is a multi-dimensional 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”.

Flexibility is the agility, versatility, adaptation to change for sustainable advantage.

The concept of continuum works on two ends or extremes which usually form a pair of opposites. For example, good and bad, pleasure and pain, life and death, above or below and so on. ‘Participative type’ of organizational management is more suggestive as a balanced exercise by the management.

HR Score Card Strategy

This is a balanced scorecard technique based on four criteria: Financial, Customer Focus, Processes, Learning and Growth (strategic aspect). Balanced Scorecard, is defined as: *“A carefully selected set of measures derived from an organization’s strategy. The measurement selected for the Scorecard represent a tool for leaders to use in communicating to employees and external stakeholders the outcomes and performance drivers by which the organisation will achieve its mission and strategic objectives”.*

The Balanced Scorecard provides executives with a comprehensive framework that translates a company’s vision and strategy into a coherent set of performance measure”

This suggests a seven step model (Becker et-al; 2001) for strategic mapping of the organizations, these are:

- a) Step 1 : Clearly define business strategy
- b) Step 2 : Build a business case for HR as a Strategic Asset.
- c) Step 3 : Create a strategy map
- d) Step 4 : Identify HR deliverables within strategy map
- e) Step 5 : Align the HR architecture with HR deliverables
- f) Step 6 : Design the strategic HR Measurement system
- g) Step 7 : Implement Management by measurement

Figure 12 gives the requisite strategic map – the competency skill attainment focus.

Having clear understanding of the firm / organizations competitive strategy and operational goals – and a definitive statement of the employees competencies and behaviours the firm’s objectives in synergetic fashion. The bottom most part in Figure 12, Learning and Growth has two parts Lag Indicators and Lead Indicators.

Lag Indicator: Measures that provide outcomes of actions previously taken are called lag indicators.

Financial performance measures an excellent review of what has happened in the past, but are inadequate in addressing the real value-creating mechanisms in today’s organization - intangible assets as knowledge and network of relationships.

Lead Indicators: Balanced scorecard complements these lag indicators with the drivers of future economic performance known as Lead Indicators.

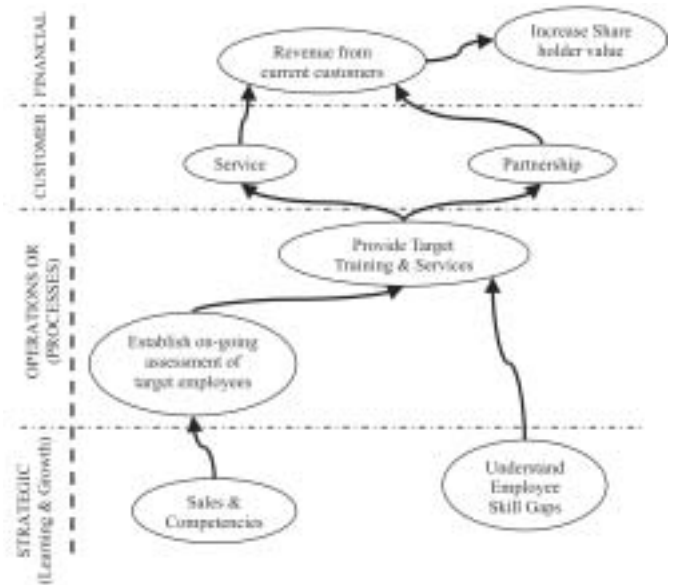


Figure 12: Strategy Map – Competency Skill Attainment Focus (at SBU level)

As has been observed in the present paper the following recommendations are suggested for better throughput / productivity:

- a) The people of the organization have to unleash / release their brain to the fullest extent.
- b) All personnel must work with the attitude of full engagement / commitment – right from top to bottom levels.
- c) The labs / establishments of DRDO organizations should enhance flexibility in terms of organizational structure, its processes and human resource practices. Some of the examples can be given as de-centralization, delegation, positive attitudinal flexibility. In all these activities leadership style of functioning is the single most dominant factor which will enhance flexibility and thus productivity to the maximum.
- d) People must follow HR Balanced Scorecard methodology for the development of product. The outcome of the whole study presented in this paper boils down to rethinking / reinventing the potential model system of High Performance Work System (HPWS). HPWS ensures a

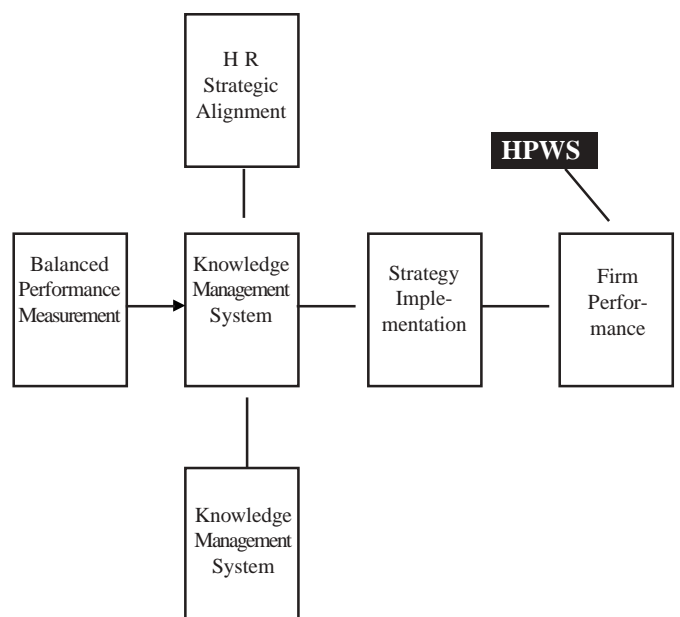


Figure 13: HR and Strategy Implementation

holistic approach of each element HR system in culminating into maximizing / optimizing their overall quality performance 'human capital' throughout the organization. (Refer Figure 13).

- e) People of the organization must work on Pareto Principle – should strive for working on modified Pareto Principle (50:50). The brass tag of all these techniques ushers in bringing out that with managing less we can manage more effectively, that is, further a focused work culture should be evolved for higher performance.
- f) It is observed that DRDO organizations have excellent infrastructure facilities, however, flexible thinking and better decision making in the projects and other activities will really take this organization to higher technological platform.
- g) 'Organizational Redesign', global competition, technology advancement, industry deregulation, increasing customer expectation and changing employee values are a few factors that have placed unprecedented demands on business enterprises. For big and small organizations alike, speed, quality and agility is the formula for winning in today's global environment. It is being proved that organizational redesign helps the internal resources to develop the competencies to sustain and further develop the organization as the external business environment changes. Some of these competencies to focus on are
 - i. **Change Management** : the ability to deal with uncertainty and change.
 - ii. **Maturity** : The stability of performance under stress
 - iii. **Openness** : Being open to new ideas and different practices
 - iv. **Flexibility / Adaptability**, and
 - v. **Contextual thinking** : The ability to see the bigger picture and develop cognitive complexity.

Focusing on each one of the above factor by the leaders of the organization will be critical towards increasing competencies in the workforce.

- h) Another interesting dimension in restructuring the organization is outsourcing HR, which is an emerging trend amongst the privet sector organizations, but most of the government organizations are still skeptical about it. There are three main financial drivers behind HR Outsourcing.
 - i. Save money (ongoing expenditure)
 - ii. Avoid capital outlay (Often a more important consideration than direct cost savings)
 - iii. Turn a fixed cost into a variable cost (thus, if the workforce shrinks, HR costs can be reduced accordingly.)

Three forces are converging to fuel the HR outsourcing movement among governments. From a service stand point, outsourcing invariably means upgrading to new, often state of the art services that provide a better work environment or employees while giving HR executives the tool they need to manage more effectively, bringing in the modified Pareto Principle the organizations must try to outsource the 50 per cent of the least important tasks, to begin with, which is also supposed to be performed and finished in time. Wherein, the HR team inside the organization concentrates on the important and crucial 50 per cent of the tasks, increasing / maximizing throughput / productivity of the entire organisation.

Conclusion

In the present paper, the organisational capabilities have been studied under the light of modified Pareto principle, full engagement work culture and balanced scorecard techniques. The models suggested/discussed in the paper with unleashing the 'Brain Power' of the people in the organisation will definitely take the firm to higher crescendos.

We conclude the paper with *Lord Kelvin's* eternal management anecdote

"When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you can not measure it, when you can not express it in numbers,



your knowledge is of a meager and unsatisfactory kind”.

- William Thompson (Lord Kelvin)
(1824 – 1907)

References

- Allio R.J. (2002) *Leadership – Myths Realities*, Tata McGraw-Hill, New Delhi.
- Becker B.E., Huselid M.A. and Ulrich D. (2001) *HR Scorecard*, Harvard Business School Press, USA.
- Ecke G. (2001) *Making Six Sigma Last*, John Wiley & Sons, USA.
- Goldratt E. (1990) *Theory of Constraints*, The North River Press, USA.
- Kaplan R.S. and Norton D.P. (1996) *Translating Strategy into Action – The Balanced Scorecard*, Harvard Business School Press, USA.
- Kerzner H. (2003) *Modern Management of Projects Techniques*, John Wiley & Sons, USA.
- Koch R. (2001) *The 80/20 Principles*, Currency Doubleday Publication, USA.
- Loehr J. and Schwartz T. (2003) *The Power of Full Engagement*, Free Press.
- Pathak R.C. (2002) Rethinking Metanoia of 80/20 Principle, *Proceedings of Second Global Conference on FS*, IIITM, Gwalior.
- Pathak RC. (2002) Thinking beyond Emotional Intelligence, *Proceedings of Second Global Conference on FS*, IIITM, Gwalior.
- Senge P.M. (1999) *The Fifth Discipline*, Random House, UK.
- Sushil (2000) *Flexibility in Management*, Vikas Publishing House Pvt. Ltd., New Delhi.

