Chapter 7
DELIVERING VALUE WITH ORGANISATIONAL INNOVATIONS

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We missed Industrial revolution and the Scientific revolution that preceded it. Did we also miss manufacturing revolution? Or did it ever take place? Many experts now refer to a manufacturing revolution that took place in 80's and bemoan the fact that India missed it. Economic Times in its editorial on 18th May 2001 says `*India missed the manufacturing revolution of the 1980s, during which south east Asia and China built up enormous capacities and economics in making everything from polyester and fibre optic cables to bicycles, watches, shoes and semiconductor chips'*. How and why we missed manufacturing revolution will continue to be debated, but few facts stand out. We goofed up production by giving it a low status. Best of our engineers and managers avoided shop floor in view of poor career prospects and perhaps also due to the (natural) desire of high caste Indians not to dirty their hands.

Priorities of Indian manufacturing industry are:

- Ability to provide consistent quality with low defects and
- Ability to introduce new products and flexibility in terms of design changes, managing changing, volumes or product mix.

Manufacturing performance indicators are:

- worker productivity
- customer return rates
- profitability
- first pass yield
- customers perception of quality
- on-time delivery
- manufacturing to design changes
- manufacturing cycle time
- speed of new product development
- delivery lead time
- finished goods inventory
- market share
- change-over times
- procurement lead times
- raw materials inventory
- work-in-process inventory
- raw material defect rates
- average unit production cost

And improvement in them requires a combination of technical innovations and organizational innovations.

ORGANISATIONAL INNOVATIONS

Technology is about knowledge. We may associate it with physical artifacts, new machines or products but they are only the tip of an iceberg. Below the waterline most of technology is made up of knowledge and skill, the understanding of "know-why" and "know-how". The technological strength of a company like 3m is not simply the products like Scotch tape or Post-it-notes. It lies in the deep knowledge, which underpins those products; knowledge about surfaces and how to coat them, the different physical and chemical properties of materials involved, the complex process technologies involved in coating layers often only microns thick and the many factors needed to bring such products successfully to the market place. Equally important are Organisational innovations.

We have seen that knowledge is embodied in equipment, value added components, work flows and standard operating practices. These are the result of both technical innovations and organisational innovations. In our discussion so far, the primary focus was on technical innovations, how to acquire new technical innovations, how to generate them and how to appropriate them. Technology base of a firm is fortified with both technical innovations and organisational innovations.

Technical innovations are visible in knowledge embodied in equipment design, manufacturing process sheets, whereas organisational innovations are embodied in organisational processes. A key aspect of all organisational innovations is their immutable linkage to `*orgnaisational behaviour (OB)* '. An example is TQM, which aims to create new organisational behaviour around improved quality and continuous improvements. Components of TQM include:

- Underlying values and beliefs about the nature of quality.
- Processes for assuring quality, moving from inspection to underlying process management.
- Structures covering how quality is managed with a shift from specialised inspectors to overall prevention and correction at the source.
- Strategic framework in which quality is seen as a major objective and deployed within local and individual objectives.

Like technology changes, organisational changes are also mostly result of progress made through incremental improvements. We have seen that technical competence does not emerge overnight, nor it can be bought by acquiring technology from the market or hiring a key scientist or engineer. It has to be learned the hard way by a process of accumulation over time one which involves mistakes and blind alleys as well as success. Same thing applies for competence embedded in organisational practices. Like acquisition of embedded forms of technical innovation, organistaional innovations in the form of best practices can

be benchmarked and acquired. Transfer of Best practices is running the last mile in a technology capability building program.

DOUBLE-LOOP LEARNING

Learning includes two types of learning:

1. Technical learning, to acquire and accumulate technical competence.
2. Organisational learning, to create or acquire routines for managing the process of technological change.

The relative importance of Technical learning and Organizational learning can be put in a simplified way, as shown in table .

Table 7.1: Technical learning Vs Organisational learning

	Technical learning	organizational learning
Assembled products Manufacturing firms	XXX	X
Non-assembled Products manufacturing Firms	XX	XX
Service Organizations	X	XXX

X - less important
XX -equally important
XXX -more important

Although learning is important, it is not automatic. When organisations fail to learn on either of these dimensions, they do not develop technological competence. More important, they often repeat the same mistakes in managing the process of change. Technical Learning is seen as following a pattern of reflecting on experience, building up conceptual models and then testing their validity by experiment. If we want to learn well from new technology then we will need:

- Structured and challenging reflection on the process, what happened, what worked well, what went wrong etc.
- Conceptualising, capturing and codifying the lessons learned into frameworks and eventually procedures to build on lessons learned.
- Experimentation, the willingness to try to manage things differently next time, to see if the lessons learned are valid.

- Honest capture of experience (even if has been a costly failure) so we have raw material to reflect on.

What is learned and developed with each learning cycle is not only technological knowledge added to the Firm Specific Knowledge base of the firm but also knowledge about how to manage the process itself. To take an analogy, human beings not only acquire new content of knowledge as they grow, but they also learn to learn; some develop more effective learning strategies than others, whilst for others it is case of `*some people never learn'*. There is also the issue of `*unlearning*' – of eliminating those practices that do not contribute to success.

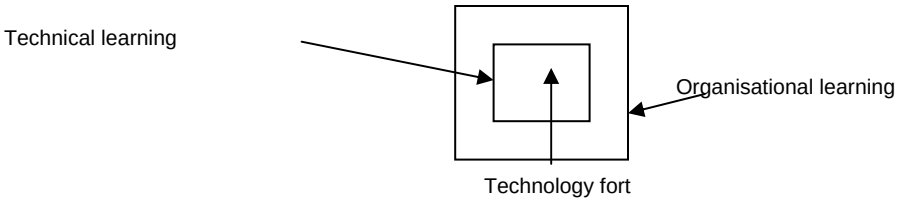


Fig 7.1: Double loop learning

In many Japanese plants working on total productive maintenance programmes, operators are encouraged to document the operating sequence for their machinery. This is usually a step-by-step guide often illustrated with photographs and containing information about know-why as well as know-how. This information is usually contained on a single sheet of paper and displayed next to the machine. It is constantly being revised as a result of continuous activities but it represents the formalisation of all the little tricks and ideas which the operator have come up with to make that particular step in the process more effective.

Learning curves demonstrate the reduction in unit cost after repetitive production. There is also learning that manifests in Quality, Reliability, Speed of innovation, design simplification through Value engineering etc. Priorities of most Indian firms are on product innovation, quality and reliability improvements and cost reduction. In view of significant gaps in technology, it would appear that Indian firms should take up OrganisationaL Learning only after they achieve global level technical competencies, but that would not be possible as technical competences and organizational processes are interlaced. The cases of Reliance Refinery and Tata Steel given at the end of the chapter illustrate their drive towards excellence in these areas . The picture could be different for MNC subsidiaries like Dell - the strength of Dell is its Business methods. As we have seen in IPR, Business methods are patented in large numbers in USA. For service organizations like ICICI, HDFC, Nerula organizational routines are certainly more important than embodied technology utilized by them. Same is the case with large consumer product companies like Hindustan Lever or co-operatives like

Amul. As we will see latter Organizational Learning is all pervasive and effects positively technical learning.

There are two types of complexity, `*dynamic complexity'* and `*detail complexity'*. Mixing many ingredients in a stew involves detail complexity as does following a complex set of instructions to assemble a machine or taking stock of inventory in a discount retail store. The second type is dynamic complexity, situations where `cause' and `effect' are subtle and where the effects over time of interventions are not obvious. When an action has one set of consequence locally and a very different set of consequences in another part of the system, there is dynamic complexity. When the same action has dramatically different effects in the short run and in the long, there is dynamic complexity. When obvious interventions produce non-obvious consequences, there is dynamic complexity. After mastering detail complexity, which involves technical learning, the focus has moved to understanding dynamic complexity that involves organisational learning for leveraging competitive advantage. Globalisation shoved in liberal doses of dynamic complexity to the Indian platter.

Box 7.1
Volvo car Corporation (VCC)

Two of the more significant competitive priorities that have emerged in the automobile industry are the introduction of the platform strategy in new product development and the integration of IT in the product as well as in the organization of production and aftermarket activities. Both developments have contributed to an emphasis on knowledge management and organizational change as a means towards the end of keeping up with the fast pace of change at the level of technology and customer demands.

VCC has recently reorganized its product development process in accordance with a platform strategy. By using a platform approach, a company can develop a set of differentiated products or derivatives. In the case of the automobile industry, this generally refers to common technology content and processes for different car models (frames, chassis, engines, etc.). The advantage of the platform strategy is that it allows an extensive amount of reusable efforts, investments, experiences and knowledge. This implies a radical shift in the product development process to include the possible options that a platform can offer in the early stages of the development process. Introduction of a platform has far-reaching consequences in that it affects, among other things, lead times, R&D strategy, international operations and last, but not least, product development performances. Platform mode of organizing product development included a reduction in the time needed to develop and test parts and components, because economies of scale could be realized with respect to machinery, equipment, tooling and the engineering time needed to produce them.

Thus, the introduction of platform meant a major revision in the timetable for the conduct of the unit's activities. To make it possible, VCC had simultaneously embarked on a project aimed at developing an IT-based after-market system. This system involved using the new technical possibilities offered by IT to provide for communication between mechanic and car, training program, diagnostic operations, electronic tools, etc. Once the platform and after-market IT-based system projects were ready, VCTS (Volvo Car Technical Services) would have the responsibility for the car industry's most advanced aftermarket process with respect to both the technical content of the car and the required IT-based system. This system required that VCTS develop an infrastructure that would be accessible to repair shops and retailers worldwide and allow them to make remote diagnostics and download software.

These new developments demanded processes and competencies that did not exist within the firm at that time. The organization had to undergo radical structural changes to be able to handle issues of that high degree of complexity. The most important factor in this context is the radical impact of IT on VCTS' internal organization and work practices as well as its relation with the external market. Traditionally VCC had a strong engineering culture with high emphasis on safety as defined by exhaustive testing and careful retooling. The introduction of IT in this setting implied that VCTS would have to acquire a full range of specialized competencies within this area. Some were needed because of the new products and systems and other were needed in combination with existing competencies to speed up and improve the quality of working practices.
(source: *Golaleh Ebrahimpur andMerle Jacob, "*Restructuring for agility at Volvo Car Technical Service (VCTS)", European Journal of Innovation Management Volume 4 . Number 2 . 2001 . pp. 64±72)

History of organizational innovations

Organizations are constantly seeking and trying for new answers to old problems. Considerable investments have been made in transfer of best practices like Advanced Manufacturing Technology (AMT), Total Quality Management (TQM), Business Process Reengineering (BPR), Quality Circles. But results are not uniformly satisfactory, most attempts ended with a whimper. It is not that original ideas were flawed or initial evidence was wrong, rather it was that the adopting organizations assumed they could simply be copied without either customizing the best practice or changing the mindsets in their organization. They mostly ended as square poles in a round hole.

For some time there was a debate whether best practices (Co design with suppliers) moored in social beliefs & value systems could be migrated from one country (Japan) to another (US). This was set to rest with US firms employing joint ventures to access and acquire the Japanese best practices in Automobiles.

Manufacturing has changed over the period and with it the value creation has shifted from embedded technology to operating practices. A brief over view of manufacturing is given here.

Manufacturing assembled products

Mass production was an industrial method, whose use had been growing in the US for well over hundred years before Henry Ford applied these mass production methods to car assembly. This method had its origins in 1798, with a firearms manufacturer, Eli Whitney getting an order from US government for 10,000 muskets. In those days, it was usual to make each gun by hand as a piece of craftsmanship, but the order of 10,000 was too large and too urgent to be handled that way. Whitney, built machine tools so accurately, that they could duplicate the separate parts of these muskets identically. Instead of painstakingly fitting the parts of each individual gun together and making tiny adjustments with files and grindstone until they worked smoothly, muskets could now be

assembled quickly from interchangeable parts. Other gun manufacturers were quick to adopt Whitney's idea of interchangeable parts, and during the 19th century it spread to such industries as clock and watch making and manufacture of Sewing machines, Typewriters and Bicycles. Compared to the assembly of a car, however, these were relatively simple devices and all were easily portable from one workbench to the next. The first principle of mass production, Ford wrote, is that ` *the work must be brought to the man, not the man to the work'*. The moving assembly line was Ford's means of achieving this. Complimentary to this method of production were the principles of work measurement propounded by Federick Winslow Taylor. Ford incorporated many of Taylors ideas in his plant in 1914. It took about seven years to reach the point where each operation was brought into mass production process. Ford produced a car every minute and brought down price of car to $260, against his promise of $400.

This system of mass production has the following characteristics;

- long runs,
- stabilised engineering design,
- concise product lines,
- repetitive operations by each worker,
- a high proportion of the total cost spent on direct labour,
- intensive use of labour standards and incentives,
- many identical machines in the factory,
- batch processes,
- job shop layout,
- disconnected flows
- and a substantial amount of materials handling done by employees, industrial engineering based on breaking a job down into parts.

Constrained by smaller plant capacities, most Indian manufacturers except for few like Bajaj could not master mass production technology. And with cumulative learning Bajaj has become the world's lowest two wheeler producer, a feat repeated by Maruti for small cars later.

Lean production

From mass production, the pendulum swung to small batch production, called lean production. Toyota introduced several new concepts in modern manufacturing technology like, Just-In-Time, Target Costing, Concurrent Engineering, Cell type layout, one minute change over, right at the first time, TQM etc. These techniques retained the flexibility of small batch production with economy of process line production with no inventories in the pipe line. Again simple concepts but as Indian firms with Japanese collaborations found it very difficult to implement (see Box).

Box 7.2
Lean production at Maruti

Researcher Sumila Gulyani, studied the effects of poor transportation on lean production for the Indian Auto Industry. Most of the car assemblers strongly believe that lean production is a necessary if not sufficient condition for competitiveness. Lean production is considered necessary because it offers `proven' means by which firms can dramatically cut costs and improve performance. JIT deliveries and low inventories lie at the heart of lean production process. Many lean assemblers require their suppliers to deliver several times a day and the deliveries tend to be highly scheduled. At Toyota, deliveries are required to arrive within a narrow two hour window. Parts are delivered directly to the assembly line to be fitted into the vehicle, they are neither tested nor warehoused at the assembly plant. Maruti buys imported components from Suzuki and for domestic purchases relies on 400 major suppliers located in the northern western and southern regions of the country, some are located at about 2500 kms away. To enhance its competitiveness, Maruti has been trying to cut inventories and implement JIT/ lean production. The total value of inventories as a percentage of sales have fallen from 20% (57 days of stock) in 1992 to 10% in 1997(39 days). Analysis showed that both buffer stock and in-transit inventory increase with distance of supplier, for imported items stock for 25 days of consumption has to be maintained (transit time is 35 days). Only local suppliers (those within a distance of 80 km) are able to deliver both frequently and on a just-in-time basis. Maruti is aggressively pushing their distant suppliers to relocate to the immediate vicinity.

Outsourcing model

To meet competition from Japanese producers, American multinationals came with a business model, to outsource production to low labour cost countries. Today HP gets all its printers, most of its PCs and low-end servers outsourced, Lucent technology outsources $8 billion, nearly 45% of its output and Cisco contracts out nearly 80% of its products. The American MNCs developed manufacturing units in Taiwan, Singapore, Hongkong followed by Malaysia, Thailand and now China. In 80's these were referred to as '*screw-driver technology'* units by Indian press, as the initial activity was restricted to assembling subassemblies/ parts supplied by the MNC. The way East Asian countries transformed simple screw-driver technology into cutting edge manufacturing technology is no less than a revolution. East Asian countries came with their own brand of manufacturing centered around creative adoption and outward orientation. *Screw driver technology* not only provided them an opportunity to train their workers but more important, gave them access to global consumer. They understood the meaning of quality, reliability, timely delivery and customer satisfaction. They were driven to reduce costs by MNCs threatening to shift their orders to others waiting to catch-up. In software Indian firms have done exactly the same thing, meeting requirements of US customers.

Mass customization

Henry Ford launched mass production 90 years ago with his revolutionary assembly line for the Model T car. Now a new dream is at hand: to turn mass production on its head with the help of flexible systems and Internet ordering. The goal is to deliver precisely the car that a customer wants, as and when he wants it. As with cars, so with washing machines, refrigerators, window-frames, packaging equipment and even collectable dolls. All sorts of companies are discovering that, if they make their factories lean and flexible, they can run their

businesses differently, freeing idle capital that has been tied up in stocks of parts and finished products. The Internet has provided a handy means of linking up supply chains, in real time, in order to put this revolution into effect.

Mass customisation—the selling of highly individual products but on a mass scale—is a logical next step in the progress of BTO ("build-to-order"), the manufacturing of goods only as and when there is an order from a customer. Michael Dell dethroned Compaq, the PC-industry leader, with the simple business model of direct sales over the telephone and the Internet. The Dell customer specifies what features he wants on his PC and pays upfront by credit card. The machine is then assembled and dispatched, usually arriving within three days. Dell Computer manages this by restricting its computers to several key modules, and stocks a variety of each, allowing a wide choice of customer specification. In fact, Dell PCs can be put together in about four minutes flat, with a further 90 minutes needed to load up the software. Most of the customisation comes from the software that is chosen. The essence of BTO production is to have standard pre-assembly of such modules, which are then configured at a late stage in the manufacturing process.

Computers are not the only consumer products for which lead times to delivery have shrunk. Photographic development is another, going from five days to one, or even to one hour for premium services in which the job is done in special mini-labs rather than in the big photo-processing factories of yore. Another is spectacles, some retailers can now deliver individually tailored lenses within an hour. In these cases, the key enabling development has been the arrival of production methods that allow manufacturing to be farmed out to small, local sites , a sort of "distributed manufacturing" with fewer giant plants and more small ones assembling from pre-fabricated modules closer to the end-user. See illustration of a washing machine factory in Box .

Box 7.3

Maytag

In Maytag's washing-machine factory there are three levels of sophistication. One part of the factory makes a traditional basic model in a traditional manner, with one long assembly-line conveyer belt and lots of offline areas in which faulty machines are taken out of the loop for repair. A second line, making more sophisticated products, has a number of smaller production cells instead of a long line, and only a few offline repair areas. Instead of a conveyer belt, machines come along on little pads that stop them at each station for a while. The third production area, making the most advanced Atlantis washing machines, consists of just seven cells. In these, groups of workers make whole boatloads of washers, which come off the line at the rate of one a minute and each operator can see what is going on around him. The cell arrangement is also more flexible than one long line, in that seven different variations of a washing machine can be turned out at the same time.

Business process Reengineering

Business Process Reengineering (BPR) came into prominence following work by Hammer and others with major service sector organizations such as banks and insurance companies, which had invested heavily in I.T, as a way of raising productivity. Process Reengineering effectively takes a blank sheet of paper and asks how we could best perform this process to achieve customer satisfaction and then compares the resulting model with what actually happen. The purpose of reengineering is to "make all your processes the best-in-class." Frederick Taylor suggested in the 1880's that managers could discover the best processes for performing work and reengineer them to optimize productivity. BPR echoes the classical belief that there is one best way to conduct tasks. Typically it identified unnecessary activities which fail to add value and which introduce delays and redundancy into the system. Not surprisingly, BPR also highlights areas where there is over manning and has thus been a catalyst for many “downsizing” programes. BPR draws heavily from industrial engineering and OM (Organisation and Methods) practices.

Critics of BPR argue that it is often used to increases productivity by cutting costs but does nothing to increase the revenues or sales. Other critics warn that although BPR may lead to a competitive advantage, it is destined to be short-lived. When one company lowers its costs of doing business, other companies will immediately follow, and the competitive advantage is lost. BPR falls short when dealing with new products or services, since any strategic objectives achieved are simply the by- product of improved productivity. Companies such as American Express and Amoco were able to learn from earlier reengineering failures, and succeed on later attempts. This may explain the continued interest in reengineering, despite the high failure rate. Processes can be reengineered to varying degrees depending upon the different levels of ambitions felt for the degree of change. The BPR initiatives can be categorized as follows:

Process improvement

Process improvement is the lowest degree of BPR. It usually entails improvement of that part of a process which falls within a particular business function rather than improvement of the entire end-to-end (cross-functional) process. It can yield incremental but not dramatic increments to the existing process. This is done by cutting off non-value-added activities. Process improvement can lead to dramatic cost-reduction in "support" or "underpinning" processes, far beyond what can be accomplished through traditional cost-cutting efforts. Most BPR efforts happen to deal under this category.

Process redesign

This involves the total redesign of an end-to-end process, and may provide radical process performance improvement (e.g. 50% or more) in terms of cost, perceived quality and cycle time. Such a redesign requires an analysis of the process model at higher levels of the organizational hierarchy involving a vision-led examination of the basic elements of people, processes, information and

technology. Process redesign of core or strategic processes is usually aimed at reaching the "best in class", attaining competitive parity with those firms who have, in the past, set the standards and made the rules.

Business Transformation

This is the highest degree of BPR as it aims to 'reinvent the business' through a top-down reappraisal and redesign of the total business. It starts with the fundamental self-evaluation of the organization by asking why the organization exists and what is it trying to achieve. Only then does the organization go on to look at how it actually performs its processes to achieve its goals, and how the processes should be improved.

Once processes are identified and mapped, deciding which ones require reengineering and the order in which they should be tackled is not a trivial part of the reengineering effort. No company can reengineer its high-level process simultaneously. Typically, organizations use 3 criteria to help them make their choices. The first is dysfunctional: Which processes are in the deepest trouble? The second is importance: Which processes have the greatest impact on the company's customers? The third is feasibility: Which of the company's processes are at the moment most susceptible to successful redesign?

A Methodology for Strategic BPR

The purpose of a BPR methodology is to provide a roadmap that will help the BPR team gets to where it wants to go. The methodology should help the team understand, think about the question such things as:

- Corporate strategy and process objectives
- Customer Expectations and perceptions
- Value-added aspects of core processes
- Shortcomings of current processes and the potential for radical change
- Organizational restructuring and process management
- Positioning and empowering the human resource

The methodology consists of six stages, which are divided into three phases:

Phase 1	:	Business Understanding
(Planning)		Project planning & Training
Phase 2	;	Business process identification
(Design)		Process envisioning
Phase 3	;	Process Redesign
(implementation)		Process implementation

Box 7.4
Mahindra & Mahindra

Automotive Division of Mahindra & Mahindra Ltd. is in the business of manufacturing and marketing Utility Vehicles, LCVs and Services for the last 52 years. It is the market leader in this

segment enjoying more than 50% of the market share. M&M brand denotes Ruggedness, Durability, Reliability, Easy Maintainability and Operational Economy. The customer profile primarily includes individuals, traders, entrepreneurs, contractors, tour operators, taxi owners, car hire companies, government departments and institutions.

The continued deregulation & liberalisation of Indian Economy has provided an impetus to rapid growth. India is expected to become a major export base for auto components and aggregates. Global automobile giants are entering the Indian market. Increasing GDP growth rate, multi-motorisation and envisaged higher investment in infrastructure is expected to give further boost to the Indian automobile industry. The Company is gearing itself to meet these challenges through rapid upgradation and expansion of manufacturing technologies through additional investment. This would be supported by modern, elegant and efficient distribution network with consumer friendly work ethics. The Automotive Division has utility vehicles manufacturing plants at Kandivli (Mumbai), Igatpuri (Nashik) in the State of Maharashtra and LCV assembly plant at Zaheerabad in the state of Andhra Pradesh, together employing more than 12,000 employees.

The Division has embarked upon Business Process Re-engineering since 1994 in order to utilise its resources more efficiently and enhance customer service level. The re-engineering of operations was primarily necessitated due to intense domestic competition, entry of global players in the segment and enhanced customer expectations. The spread of the product is uniformly distributed in North, South and West regions of India and has marginal presence in East. Nearly 70% of the company's products are sold in semi-urban and rural markets. With models like, the Armada and its planned new versions, the Company plans to cater to the niches in urban market. The distribution is managed through a network of more than 150 dealers spread across the country, which is supported by company’s 18 Area Offices. Apart from this, the vehicles are serviced through 30 Authorised Service Centres and 60 Stockists for meeting the need of genuine spare parts. The marketing strategy of the division revolves around rationalising models, delivering value for money, increasing safety features, incorporating fuel efficient engine, improving the quality of after sales service and maintaining low price product image. For the high end market, the strategy adopted is to offer products with more comfort level with option of accessories to meet special needs of individuals. Currently the Export focus is on African, South American, South Asian and Middle East markets, where the need and use of vehicles is akin to India.

The repositioning was initiated at the 50-year old plant at Kandivili- the company's largest manufacturing facility. It had a bloated workforce that produced very little on the one side, and was militantly unionized on the other. And a management that was now paying the price of caving in too easily to union demands in the past. Over-manning was not the only problem. There were turf battles and the work culture in the company was being further vitiated by corruption in the purchase department. Keshub Mahindra had then recognized the need to change radically the way M & M did business. Stamping out corruption was the easy part. People involved were sacked and that sent the necessary message down the line. The difficult part was dealing with the unions. The company had tried out various VRS schemes in the past but none yielded results. The big turning point in labour relations came in 1994, when the company decided to implement its Business Process Reengineering (BPR) programme, as an experiment at its engine plant in Igatpuri. BPR is based here on the principle of cellular manufacturing where plant layout is recognized drastically and the workers are asked to do multi-tasking through multi-machine manning. The company conceived the programme with help from Lucas Engineering Systems of UK. BPR was seen as the only way to attack the company's age - old problem of manufacturing inefficiencies, poor productivity, long production cycle and sub-optimal output. Although quite common elsewhere in the world, it was a new concept in India. BPR was always going to be a part of the company's plans of global level quality and cost by the year 2000 or 2001. As a prelude to implementing it in all five manufacturing facilities, a decision was made to assess its benefits and impact on unions at the Igatpuri plant. The idea was to build up something which could serve as a framework for the future. Expected, there was stiff resistance from unions. A five-month strike followed, but the management refused to back down. Because the entire future

of the company depended on what the BPR was going to achieve. A determined management kept the plant running with the help of senior staff, and the first sign of benefits of BPR was visible almost immediately, when around a hundred officers were able to produce 35 engines-a-day, as against 1,200 employees who were earlier producing 70 engines. The workers finally gave in and in exchange got a 30% pay hike. Productivity at Igatpuri has since gone up by 190%. While the number of engines produced at the plant has gone up to 125-a-day, the number of employees went down to 760. The 400 excess workers were redeployed at the company's new Ford Escort assembly plant in Nashik. BPR was implemented at its Nashik plant too and it achieved a 125% improvement in productivity. BPR has enabled the company to achieve two things simultaneously: a new and modern working relationship with its employees, where productivity is the main criteria; and equally important, bringing its manufacturing systems upto international standards.

The implementation of Business Process Reengineering (BPR) and the ERP implementation later in 1997 have prepared the Company to face the challenges posed by the technological revolution. The business process reengineering effort had a strong Web component, in anticipation of supply chain management implementation to follow. They established private Web sites for our 400 dealers to collect sales information and for our 800 suppliers. The Quality Leadership at Dealerships programme has been initiated to transform the old-style dealers into more informed and aware ones who will become the Company's partners in its latest avatar.

In 2000, M&M implemented mySAPTM Supply Chain Management (mySAPTM SCM) to first build on and then improve its business processes. M&M articulated clear objectives for this global competitiveness initiative enabled by mySAP SCM: reduce inventories across the supply chain by aligning the company's business processes for IT-enabled supply chain management and ensure availability of tractors as per sales requirement – right model, right place, right time – at minimum cost.

Global deliver systems for software firms

Success of software firms like Infosys foxed many an analyst, they do not create value in the traditional sense as they neither generate IP nor create a market. They take on sub-contract, software maintenance contracts on an increasingly large scale. Slowly contours of a new organization innovation, often referred as "*Global Software Delivery System*" emerged.

The value proposition of the Indian software industry can be summed up as "*faster, better, and cheaper*." As corporation's world-wide embrace new technologies, new business models, new paradigms and leverage the power of these to bring benefits to its consumers, they need firms like Infosys to take responsibility on an end-to-end basis for up gradation and maintenance. They ensure that existing piece of software is upgraded to keep pace with changes in technology, or changes in the marketplace. Indian software companies have been very proactive in accepting, embracing, and practising state of the art methodologies and processes; in investing heavily in tools, technology, and infrastructure; in reducing time to market as well as cost; and in improving quality, productivity, and response time. In the new paradigm, the Indian software industries have brought tremendous value in the area of e-commerce. Defining Global software delivery model, Narayan Murthy says, " *What this model does is it seeks to minimise the amount of time that we need to spend at customer*

locations and maximise the effort that we can spend at cost competitive locations in countries like India". The advantages of this model are twofold: (1) it's a scaleable model because countries like India have a large number of professionals; and (2) it also brings tremendous monetary opportunity for the customer.

Box 7.5

Infosys drive towards excellence

At Infosys, the basic framework for excellence started with the ISO initiative covering all support and management areas. Achieving CMM Level 5 proved a significant milestone in the context of improvement of software delivery processes. This was just the beginning of a journey of continuous improvement. The Infosys Excellence Initiative is a single umbrella for all performance improvement and quality focused activities. This covers different dimensions of the organization: core delivery processes, functional and cross-functional processes and organizational management processes. Having achieved Level 5, the highest level of process maturity as per the CMM model, Infosys continues to focus on achieving excellence in the software delivery processes by introducing required changes in process, introducing new technology and focusing on defect prevention. Organization wide teams on Defect Prevention (DP), Process Change Management and Technology Change Management constantly analyze data on effort, defects and schedule, and introduce systematic improvements in project performance.

Organisational processes:

- The Cost of Quality (COQ) Model for Infosys has three components: prevention, appraisal and rework/failure cost. It is calculated as the percentage of effort spent on training and DP activities, reviews, testing, and rework, to the total engagement effort. The COQ is consistently coming down because of the emphasis on defect prevention and improving review effectiveness.
- The Capability Maturity Model (CMM) provides software organizations with guidance on how to gain control of their processes. A maturity level as per CMM, is a well defined evolutionary stage and provides a layer in the foundation for continuous process improvement.
- The Malcolm Baldrige framework covers all aspects of the functioning of an organization. The Baldrige framework is one of the most widely used performance improvement models in the world. This framework provides a composite picture of the entire company and helps Infosys compare their practices with world-class organizations. Importantly, it helps align all improvement initiatives in the company.
- Rapid growth at Infosys and resulting complexity in business processes in terms of location disparity and organizational structures called for a proven methodology to enhancing cross-functional processes. In March 2000, Infosys piloted Cross Functional Process Mapping (CFPM), a methodology developed by Motorola University based on the Six-Sigma principles. Based on the success of initial pilots, Infosys institutionalized CFPM across the organization. CFPM is an integrated part of the Infosys Excellence Model. Over 5% of the organization, across the globe, has been directly associated with this program till date (2000), with the improvements affecting the entire organization.
- Satisfaction Surveys are conducted annually as a critical measure of performance and improvement. Survey findings are analyzed and used to drive process improvement or changes.

Shift to Value

Companies offering the powerful combination of low prices and high quality are capturing the hearts and wallets of consumers in Europe and in the United

States, where more than half of the population now shops weekly at mass merchants like Wal-Mart and Target, up from 25 percent in 1996. Many mainstream companies now face steep cost disadvantages and lack the product and service superiority that once set them apart from low-priced competitors. This "*shift to value*" had its roots in the 1970s and '80s, when Japanese automakers and consumer electronics manufacturers thrived by selling cheaper and initially inferior products that eventually became more reliable than those of the competition—and remained cheaper. Today, as value-driven companies in a growing number of industries move from competing solely on price to catching up on attributes such as quality, service, and convenience, many traditional players rightly feel threatened.

Value's competitive edge

Two strengths underlie the growing power of value players in consumer markets. The first is an impressive cost advantage rooted both in industry-specific sources and in relentless execution. Dell's competitive PC prices stem from a very efficient supply chain and low manufacturing costs. These advantages are typically years in the making and so difficult to emulate that rivals lacking them find it hard to compete on price.

The value players' second strength is a shift in consumer perceptions of the quality they offer. The gap, both real and perceived, between value players and their more mainstream competitors has narrowed when it comes, for example, to service, convenience, and the buying experience. This virtuous cycle—more customers, more productivity, better economics—generates bona fide opportunities for value players to move into new product and service categories. Since 1997, Dell has tripled its US market share in low-end servers to more than 30 percent, making it the market leader over rivals such as Gateway, HP, and IBM. More recently, Dell introduced a successful handheld computing device, launched co-branding partnerships with Lexmark in printers and with EMC in storage systems, and began scaling up production of consumer electronics products such as flat-screen televisions.

As value players gain share, at varying speeds, within industries and across the economy, they change the nature of competition by transforming consumer attitudes about trade-offs between price and quality. They also trigger competitive responses as they create attention-grabbing amounts of shareholder value. These responses include the efforts that companies make to become more distinctive by experimenting and renewing themselves with new product and service categories, formats, and the like. Companies also seek to raise their game in execution—particularly in areas such as managing price perceptions and reducing costs that are crucial for competing with value players.

Management Guru Prahalad has prophesized that many innovations generated to meet demands of Bottom of the Pyramid (BOP) market would soon gain acceptance by tier 2 &3 markets and MNCs should focus on this BOP market

because that is where the next billion dollars is to be made. He cited several examples, few of them from India.

Box 7.6
Air Deccan

A low-cost carrier or low cost airline (also known as a *no-frills* or *discount* carrier / airline) is an airline that offers generally low fares in exchange for eliminating many traditional passenger services. The concept originated in the United States before spreading to Europe in the early 1990s and subsequently to much of the rest of the world. Typical low-cost carrier business model practices include:

- a single passenger class;
- a single type of airplane, reducing servicing costs;
- a simple fare scheme (typically fares increase as the plane fills up, which rewards early reservations,)
- unreserved seating (encouraging passengers to board early and quickly)
- flying to cheaper, less congested secondary airports (avoiding air traffic delays and taking advantage of lower landing fees)
- short flights and fast turnaround times (allowing maximum utilization of planes)
- simplified routes, emphasizing point-to-point transit instead of transfers at hubs (again enhancing aircraft utilization)
- emphasis on direct sales of tickets, especially over the Internet (avoiding fees and commissions paid to travel agents and corporate booking systems)
- employees working in multiple roles, for instance flight attendants also cleaning the aircraft or working as gate agents (limiting personnel costs)
- "Free" in-flight catering and other "complimentary" services are eliminated, and replaced by optional paid-for in-flight food and drink.

The first successful low-cost carrier was Pacific Southwest Airlines in the United States, which pioneered the concept when their first flight took place on May 6, 1949. With the advent of aviation deregulation the model spread to Europe as well, the most notable successes being Ireland's Ryanair, which began low-fares operations in 1991. Low-cost carriers pose a serious threat to traditional "full service" airlines, since the high cost structure of full-service carriers prevents them from competing effectively on price - the most important factor among most consumers when selecting a carrier.

India's first low-cost airline, Air Deccan started service on August 25, 2003. The airline's fare for the Delhi-Bangalore route were 30% less than those offered by its rivals such as Indian Airlines, Air Sahara and Jet Airways on the same route. The success of Air Deccan has spurred the entry of more than a dozen low-cost airlines in India.

Air Deccan is a unit of Deccan Aviation Private Limited, India's largest private heli-charter company. Deccan Aviation has done reasonably well in selling the concept of chartering private helicopters as a means of transportation, and has built a reputation for providing speedy and reliable heli-services for company charters, tourism, medical evacuation and off-shore logistics.

Warwick Brady has taken charge as chief operating officer of India's low-cost airline Air Deccan. Brady, who spent three years with Ryanair, was chosen following a rigorous search by the airline. He was the deputy director operations of Ryanair with the overall responsibility of the Stansted Airport. As the deputy chief executive officer of Buzz, he was instrumental in restructuring, restarting and assimilation of Buzz into Ryanair.

BUILDING AN AGILE ORGANISATION

While organizational change has been a traditional item on the menu of management literature for several decades, the notions of flexibility and agility as properties of organizational structure or as goals in themselves are of more recent vintage. The concept of organizational agility aims to inscribe *receptivity to change* itself as the most important value of corporate culture. Transforming today's companies into organizations that can support agility remains a major challenge for managers.

Successful adoption of organizational practices to optimize utilization of new technology is an exercise in change management. In response to the pressures for change;

(a) new processes have to be designed, defined, piloted, tested and refined,
(b) staff have to be trained,
(c) culture has to be changed,
(d) organisational structure have to be modified,
(e) reward systems have to be updated,
(f) affected customers and suppliers have to be consulted /informed
(g) and new management monitoring / control systems have to be designed and implemented.

There will be resistance, operational pressures, fatigue, failure, interruption, finance constraints and unexpected complexities. There are also risks that change program will fail, may result in reduction of customer base, loss of profitability, and worse failure of the entire business.

Change programs

Three popular pathways to change programs are;

- parallelism ,
- living on the brink of chaos and
- early implementation.

In Parallelism, the focus is on development of many parts simultaneously, leading to faster delivery of results. This calls for major shift in the way people work and is based on the assumption that people must be able to solve problems as they arise. Living on the brink of chaos maintains existing operations and new ways are tried along side old ways. People have to get used to working in upheaval. Working groups are created, used, dismantled quickly. Mistakes have to be corrected quickly before they threaten entire change. Early implementation prioritizes and targets those changes where the results are quickly visible so that all the employees can feel them. This prepares the organizations for cultural change.

People change their knowledge, attitude and behaviour when they become dissatisfied with status quo or when there is more desirable substitute. A successful change involves; recognizing the need for change, learning a new behaviour or substitute and feeling comfortable with the new situation. The movement from unfreezing to refreezing is shown in the figure.

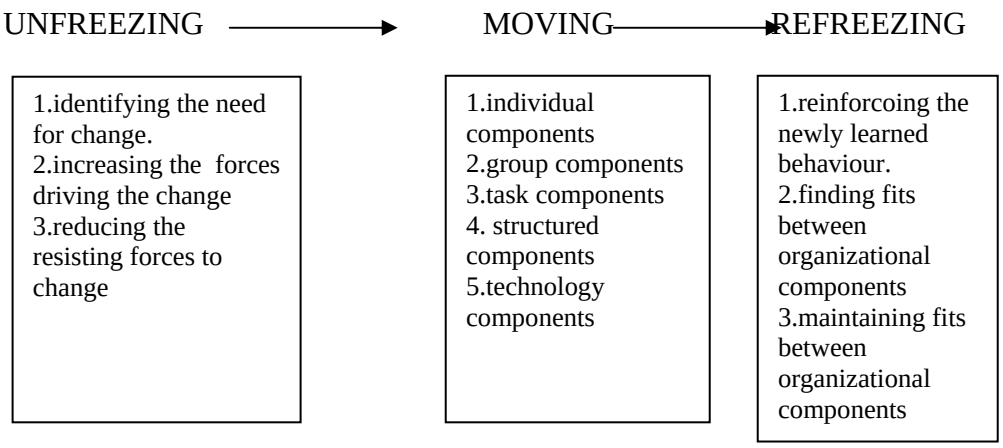


Fig 7.2: Change process

Planning

Unlike absorption of imported technology, adopting Organisational innovations has less technical uncertainty but more people uncertainty due to the fact that the project has to be implemented by operational people rather than developmental people. Operational people have less experience and feel less comfortable with uncertainty. They are more likely to feel threatened by new innovations. Also they have to cope with the day-to-day business as usual while they prepare for the transition to the new technology. They in effect have to do two jobs.

Adoption of organizational innovations to be planned by:

- describing goals/ objectives,
- identifying participants, roles, impacts
- designing methods to deal with impacts
- identifying resources needed /available
- targeting completion date desired
- listing possible constraints
- breaking project into steps
- identifying milestones/ decision points
- designing project paths

- designing tracking methods
- identifying persons responsible
- designing project communication methods

Critical is the communication to rest of organization especially to those to be affected. Softening of attitudes takes place with announcement of progress, tours of site (where change is piloted), discussions of problems, consultations with others not affected, putting highlights on bulletin boards etc. For acceptance of and overall enthusiasm for the new technology, communication has to start long before the physical work begins. The new technology should not be a surprise to any one in the company. People must see how the new technology will help the company survive and thrive thereby protecting their jobs rather than being a threat to them. Even if the new practice will result in some staff reduction, the point has to be made that if this company does not do this and the competitor does, all the jobs are in jeopardy.

The level of detail required depends on the role of the receivers. The production workers and those of downstream need to be informed about things that affects them by announcements of progress, explanation of reasons for delays and tours to site so that they can begin visualising the new environment. They also need a forum to discuss concerns and to point out any short comings they see in the plan. The greater the level of involvement in the planning and construction phase that these people have, the less resistance to the new process will be.

Another major hurdle is preoccupation with the existing operations. Solution lies in accounting for existing operations in plan, have sufficient labour available, involve operating people in making the plan, communicating priorities etc.

Box 7.7

Adoption of CAD and CAM

Despite the phenomenal growth in the utilisation of "stand alone" technology systems, in the majority of manufacturing companies DEM (Design Engineering manufacturing) processes still exchange information using paper drawings and reports, much as they did a century ago. Integrating a DEM process through the interfacing of CAD, CAE and CAM systems is much more challenging, from an organizational point of view, than introducing a single stand alone system. At the same time, organizational challenges to integration appear to be much more difficult to overcome than financial and technical problems.

The implementation of a CAD/CAM strategy is partly dictated by characteristics that are unique to each adopting firm. Social scientists' perspectives on organizational design, particularly after the "socio-technical systems" design tradition, would suggest that organizational issues should be managed in parallel with technical issues. Technical integration should be mirrored by organizational integration if its full potential benefit is to be realised.

Researchers, Tarek Tantoush & Stewart Clegg examining CAD, CAM and integration experiences in ten UK companies noticed a cultural or mental gap in non–integrating firms. The experience of users was that CAD improved productivity of redesign but not that of original design work. A minority of relatively young but highly-qualified engineers advocated the potential advantage of linking CAD to the company's mainframe system. There were tensions between senior management and these young engineers: the latter rejected the old-style bargaining

attitudes and felt threatened by them, recognising the major role that the personnel department played in running the company, and the way that this channelled power away from technological competence. They identified both a "cultural" and "mental gap" between themselves and the "old fashioned", "computer illiterate" managers. The younger managers blamed senior management for blocking their initiatives to develop the company's CAD system into an integrated set-up. Senior management was often criticised for being traditionalist and unwilling to learn and adapt.

Tto overcome communication differences so as to pave the way for a corporate decision to adopt a concurrent engineering (CE)-centred integration strategy, some of the key design engineers under the leadership of the chief design engineer, turned to their colleagues in production and sought to persuade them. Their efforts were to no avail. The production function was traditionalist in work methods as well as attitudes. Indeed, production personnel were strongly associated with the shop floor and often called the "direct boys downstairs" (i.e. mostly apprenticeship trained, blue-collar employees) as opposed to the "indirect boys upstairs" (i.e. mostly university graduates and professional white-collar office staff). A status dimension was quite explicitly embedded in these vocabularies of meaning in use.

Many people in production were adamant that they should know more about the integration project and participate in it. Since all training schemes were traditionally planned and controlled in-house by the technical department, they were particularly concerned that under DEM ,for future training, the trainers should not be appointed from the technical department but rather from outside the company (i.e. neutral trainers should be sought), Since the two main integration enthusiasts were also formally responsible for training, many people in production resisted training because of fears that superior computer knowledge and discretionary powers by the trainers - and advocates of integration - would be used to reinforce the advantaged position of the trainers.

To the delight of the traditionalists in production, senior management decided not to adopt an integrating strategy while adding new rules that strengthened the status quo. The integrationists were even prevented from contacting outside suppliers directly; they were allowed to do so only through the traditionalist sales engineers. Senior management remained adamant that an integrating strategy was unlikely to be adopted in the foreseeable future.

Based on their findings, the researchers developed a conceptual model of change, focussing on the internal politics of technological and organizational change, taking a wider view of individual and group actions , influenced by the various social, cultural and legal characteristics of the wider society. Individual members of an organization cannot lead a totally functionalist organizational life free from the political contexts that embed them; their experience must be influenced by interaction and mutual dependence within their respective organization as well as with the outside environment. Interaction and mutual dependence are important for understanding how the past, the present and the future are linked together by continuity as well as how they are distinguished by change.

(source: *Tarek Tantoush and Stewart Clegg* ," CADCAM integration and the practical politics of technological change" Journal of Organizational Change Management Volume 14 Number 1 2001 pp. 9-27)

Adoption of Best Practices

To compete with new competitive pressures, firms have to deliver not just low priced goods and services, but also products of greater quality and diversity. New strategy involves a combination of intra-firm and inter-firm organizational changes, as well as acquisition of technology. Intra-firm change management requires firms to reorient their internal organisation, giving much attention to optimizing production flow through the application of techniques such as Just- In-Time (JIT), changing production layout, introducing new methods of quality assurance and instituting processes to ensure continuous improvements. Many of the required changes are conceptually simple and can easily be grasped; the journey to implementation however is long and rickety, littered with casualties. These, less codified yet widely diffused technologies (best operating practices) are classified as *`public knowledge'* in the codification-diffusion model. The challenges in adopting best practices are:

1. *Best practices are not static, they represent a moving target and firms need to continually strive towards deeper levels of adoption and integration*.

See example of Crompton Greaves given in .

Box 7.8

Best practices at Crompton Greaves

Crompton Greaves Ltd (CGL) is a large Indian electrical engineering company. It began life as a British owned company, Crompton Parkinson works (India) ltd, producing ceiling fans and small electric motors in the worli district of Bombay in 1937. Over the following 60 years, it diversified into a broad range of electric products, adding transformers and switch gear. Fans produced by CGL were once sold at a premium. To meet competition from small producers and from China, CGL had a taken a number of initiatives to adopt new procedures aimed at improving quality, reliability and reducing cost.

Year	New procedure introduced
1984	Focus on HRD, establishing specific training targets
1985	-quality circles, small group improvement activities in various areas -value engineering
1986	-total productive maintenance, JIT, Cellular layout, single minute change of die, etc -statistical process control, zero defect policy,
1990	ISO accreditation
1991	CI (continuous process improvement program), kaizen
1992	Business process reengineering
1993	New TQM with customer focus
1994	supplier development, reduction in number of suppliers, partnership mode
1995	R&D, corporate R&D established
1996	MRP2, inventory control

All these initiative were focused on adopting new practices rather than developing/ acquiring new product designs.

2.There is synergic, systemic links between several of these best practices and they are effective when implemented together.

Box 7.9
Sunderam Fasners

Suresh Krishna's highly successful company, Sundram Fasteners Ltd is one of few Indian engineering firms which can claim to be world class. It won the TPM excellence award in 1995 and for five consecutive years, it has been awarded the best supplier of the year by General Motors, US. The company was started thirty five years ago and has never lost an hour of working time due to industrial disputes. There was a period in the 1970s when all the other major companies in the TVS group of which it is a part - experienced prolonged strikes; but Sundram Fasteners worked three shifts, as normal, throughout this time. The company has always been relationships-based rather than systems-based. Suresh Krishna sees himself as having exercised traditional authority. Hindu culture is hierarchical and patriarchal and there is immense respect for seniors and for authority. He is a self-consciously benevolent paternalist.

The successful introduction of TPM (Total Productive Maintenance) in the firm may have depended considerably upon the Chairman's authority, as managers argue, but it has actually brought with it a powerful shift towards greater reliance on system. The company is gradually and not without some strains in the older plants - coming to depend less on personal loyalty and trust and much more on *confidence* in transparent and negotiated systems and procedures. The change is reflected in the recruitment policies adopted in newly established plants. Whereas in the past, in Sundram Fasteners as in most other Indian companies, recruitment depended heavily upon personal recommendations, it now involves an open, transparent and competitive process in which even the recommendation of the Chairman himself is studiously ignored.

The new religions of Indian industrial managers, drawn mainly from Japanese exemplars, religions like Total Productive Maintenance (TPM) and Total Quality Management (TQM) involve pervasive surveillance, even if employees are themselves drawn into the surveillance system through team-working and practices of continuous quality assurance. The shift from hierarchical controlled compliance systems, embedded in personalised relationships to ones which are characterised rather by confidence in expert systems, is more of a social transformation than a routine adaptation.

(source: THE GREAT TRADITION GLOBALIZES: REFLECTIONS ON TWO STUDIES OF THE INDUSTRIAL LEADERS OF MADRAS, Prof. John Harriss , 2001, Development Studies Institute , London School of Economics and Political Science)

From out of best practices, processes are to be derived, for targeting. Identifying tasks from best practices is not easy, there is a large gap between what a task looks like in a process manual and what it exactly is in reality. There is a gap between what people think they do and what they really do. Actual work practices are full of tacit improvisations that the employees who carry them out would have trouble articulating. They have been doing it routinely; the challenge is to identify those routines that exist in successful organisations and adopt them in the receiving organisation by large scale mobilised learning.

Diffusion of Organisational Routines

Organisations develop particular way of behaving, which become `*the way we do things around here*' as a result of repetition and reinforcement. These patterns reflect an underlying set of beliefs about the world and how to deal with it and form part of the organisational culture. They emerged as a result of repeated experiments and experience around what appears to work well-in; in other words they are learned. Overtime the pattern becomes more of an automatic response to particular situations and the behaviour becomes what can be termed as `*routine*'.

It does not mean, that it is necessarily repetitive, only that its execution does not require detailed conscious thought. The analogy can be made to driving a car, it represents a bahavioural routine in that it has been learned to the point of being largely automatic. Overtime, organisational behaviour routines create and are reinforced by various kinds of artifacts-formal and informal structures, procedures and processes, which describe the way we do things around here and symbols, which represent and characterise the underlying routines.

Routines can be described as established sequence of events for undertaking tasks enshrined in a mixture of technologies/ formal procedures or strategies and informal convention or habits. They are analogous to `*genes*' in human body, discovery of which is essential to understand related human behaviour. Yet, one may transplant genes but cannot ensure replication of human traits. Similarly best practices cannot be replicated by imitating underlying routines.

Routines are seen as evolving in the light of experience that works – they become the mechanisms that transmit the lessons of history. In that sense, routines have existence independent of particular personnel, new members of the organisation learn them on arrival and most routines survive the departure of individual members. Equally, they are constantly being adopted and interpreted such that formal policy may not always reflect the current nature of the routine. Best practices (behaviour) can be visualised as made of several routines (genes) and mobilised organistaional learning(environment).

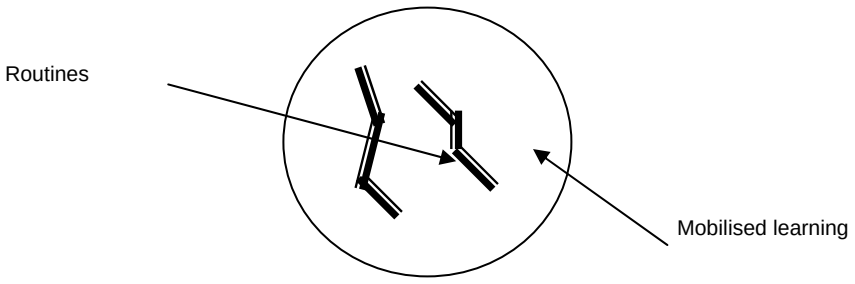


Fig 7.3 : Best practices

Dynamic theory of the business enterprise argues that proficiency rests fundamentally on the firm's underlying coordinative capabilities. A firm becomes superior because it has certain organisational abilities: it allocates resources to more promising projects, it harnesses experience from prior projects, it hires and upgrades human resources, it integrates new findings from external sources, and it manages a set of problem-solving activities associated with that technology. It follows from this argument that central to these "organisational abilities" are the unique organisational routines. Reviewing, revising, redesigning and replacing routines lies at the heart of change management for routines.

Examples of routines

- *systems and procedures* from recording orders through to dealing with deliveries. These routines comprise the very essence of formal organisation, and without them the company would cease to function as a task achieving unit;
- I*nformal, implicit and relatively unplanned and emergent activities*, such as informal decision-making, which even organisational members rarely able (immediately) to understand and articulate;

Tacit nature of many routines makes it difficult to identify and understand how they support a particular competence. We have seen in the second chapter that part of the technology is codified/ embodied knowledge and other part is tacit.

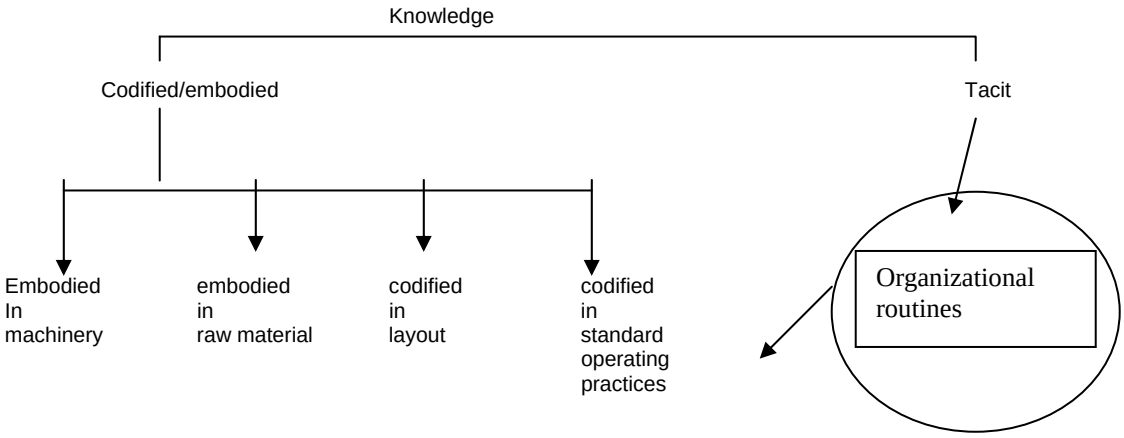


fig :7.4 : codification of routines

Organizational routines can be visualized as tacit activities, Organisation Learning and Knowledge Management processes aim to capture them and codify them as standard operating practices. For successful adoption, organisations need to focus first on transformation of attitude and only thereafter on automation of the codification process through Information Technology. Often, the difference

in the payout from investment in expensive IT tools like ERP is attributed to this deficiency of failure to set in right attitudes.

Learning 'Adoption'

Adoption is an individual entity's decision to accept or reject the new object. Marketing theory talks of `early adopters', users who buy a new product early based on their perception of utility/ needs. Adopting a child calls for several adjustment processes within the family. Innovation adoption is defined as the decision taken to make full use of an innovation as the best course of action available. It is a part of innovation–decision process involving a series of actions and choices overtime, through which an individual / organisation evaluates a new idea and decides whether or not to incorporate the new idea into ongoing practice. The process and outcome are influenced by prior conditions, characteristics of decision making unit and perceived characteristics of innovation. Outcome of the decision would be either `adoption' or `rejection'.

The World Bank document (1999) `Knowledge for development' in its simplicity says that there exists a global stock of knowledge to meet most of needs of the developing nations and all that is needed is to create conditions necessary for their diffusion into the homes of the needed. Green revolution spread because of farmers adopting the new technology. The potential of new seeds could not be unleashed until millions of small farmers planted the new seeds. Adoption was a critical decision for the farmer, his livelihood depended on it and he was not in a position to take a risk. Farmers with extensive landholdings could limit their risk by trying the new seeds with test sowing on only part of their land. These are the early adopters. Poor farmers, unable to borrow and lacking insurance or the savings to fall back on in the event of failure, could only watch and wait until their wealthier neighbours proved the value of the new seeds. The rate of adoption was very slow. In Asia it took two decades for the percentage of cropland planted with new wheat varieties to raise from 40% to 90% despite possible dramatic gains, the productivity gains were of the order of 100% for wheat, 70% for Maize and 50% for rice.

After technology acquisition, technology adoption (along with needed organizational innovations) is the next step on the technology capability ladder. Capability transfer is the end goal while technology acquisition is the initial first step. Technology dynamism can be visualized as the youth and vigour displayed by the firm in moving up and down the steps (Fig). There is difference in the firm's decision to adopt a new innovation and its employees decision to adopt that new innovation. The firms' decision to adopt an innovation (either by licensing or any other means) may be motivated by '*rationalism*', `*bandwagon pressure*' or `*forced choice*'. Rationalism assumes that firms are free to choose whether to adopt new technologies based on fit with their strategy; under bandwagon pressure firms adopt innovations to imitate direct competitors. The

choice to adopt a particular technology may be a forced decision by Government organizations, customer or vendors.

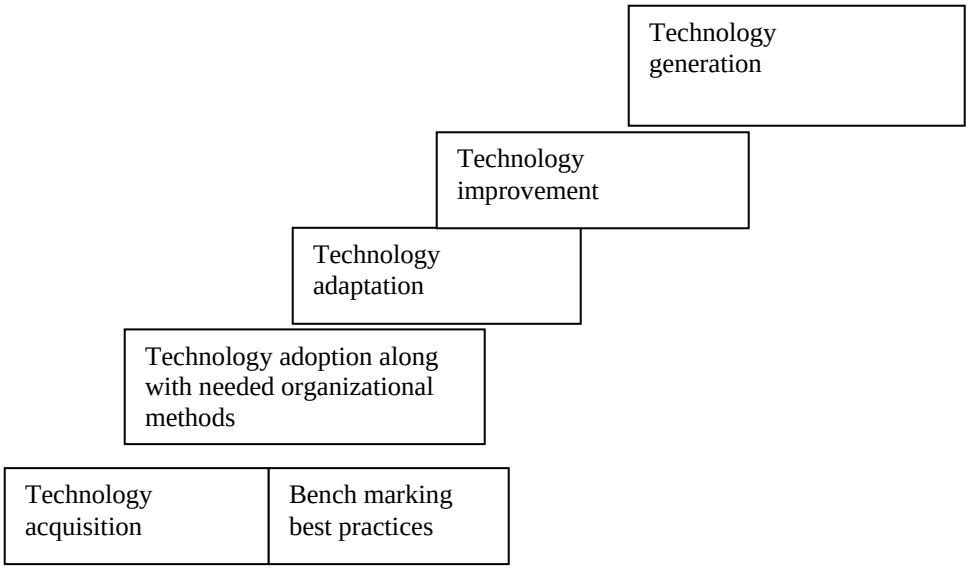


Fig 7.5 : Technology capability ladder

Adoption is the receiving organisation's collective decision to accept the new technology and implement it sincerely by making necessary changes within the organisation and across the organisations. Management decision to adopt a new innovation has to be supplemented by employees positive attitude towards the new innovation. Initial discussion on management of technology change focussed exclusively on workers resistance to new technology and the ways and means to overcome it. Latter, technology acceptance is seen in its wider perspective, a complex process involving everyone in an organisation.

Internal Labour Market Determinism

In 1987, German Association of car manufacturers estimated that only 34% of their capacity is used and to increase it to 44%, there is need to introduce flexible work schedules, which means rotating shift work. But the industry wise contract between the association and the metal workers did not permit it. This is referred as '*Internal Labour Market Determinsm*'. Fear of losing jobs and apprehension of higher work load are key factors influencing resistance to change by workers.

It is now recognised that for organization to adjust itself to a new technology, the technology must have a certain fit with the firm's organisational structure, processes, values and beliefs. Innovation imposed on organization without internal receptivity is bound to fail. Internal resistance results from incompatibility between the nature of innovation and the existing configuration of interests and resources. Thus two issues of critical importance in technology adoption are opposition to the new technology from employees and difficulties in adopting best

practices. In India most of the studies on technology change focussed on union resistance to change, covering a wide range of industries from printing, engineering, food, steel and textiles. The analysts observed that product innovations in performance maximizing areas might occasion a different form of resistance as employees could impose costs without immediate fear of job loss. Either the benefits are shared among the employer and employees or the costs are passed on to the customer. On the other hand process innovations designed to cut costs, frequently involve the alternative of acceptance or closure.

Fear of losing job

In the 18th century England, Ned Ludd led a movement to destroy manufacturing machinery in the belief that its use led to a fall in employment. A Neo-Luddite is a person who opposes technology especially the use of computes in the work place. One casualty of technology up-gradation is the emergence of surplus manpower. Economists argue that in the long run Information Technology does not increase unemployment. But in the short run as some skills become redundant, those persons need to be redeployed or temporarily laid off.

Suddenly one finds excess people everywhere. Global consultants Anderson Consulting feel they are significantly over manned. Bank of America had shut down its retail service and gave a severance pay to all employees. At Standard Chartered Bank the surplus staff was shifted into a new division called the banking services division for providing relief services. At Siemans after two VRS the firm is now focussing on retraining and redeployment. Air India has redeployed 250 employees from non-operational areas to operational areas, started outsourcing services like baggage handling and security, encouraged employees to go leave for 5 years without pay, introduced a 3 day working week with 60% salary. Insurance megalith LIC has 1.25 lakh employees and new entrants need people in hundreds only. This type of downsizing has been going on in US for the past decade. Boeing has also become casualty of the global meltdown and may cut as many as 50,000 jobs. Modernising production practices like lean manufacturing techniques, more efficient layouts for factory floors and installing new computer will increase assembly to a record 620 planes while laying off 20% workforce. More than half of Boeing employees are white collared, and they are the prime target for layoff, 80% of the job cuts will be in commercial airplane group. Layoffs increase the stress and reduce productivity. It can create a multitude of negative psychological behavioural consequences for those left behind. Traumatic downsizing is usually an indication of:

- neglect of manpower planning till 90s. Both the public sector and private sector have surplus people.
- better management practices currently adopted.
- Recession.
- IT making many activities redundant.

Indian industry has taken to downsizing by adopting the VRS route. This has created problems because there is no social security net. What options are

available to Indian management when they find they are burdened with surplus manpower in some sections? Downsizing is accepted as unpleasant but necessary. The changes in IT are continuous and adoption to new IT technology calls for regular changes in the job profiles. Repetitive use of VRS lowers employee morale and could bring about a social backlash against use of new technology.

Productivity improvements, multi-skilling

McKinsey analysis (2001) of labour productivity in India shows the poor levels of productivity so far achieved in India.

Table 7.2 : Productivity in India

Index USA =100(1998)

Sector	Productivity
Telecom	25
Retail super markets	20
Software	44
Automotive assembly	24
Steel	11
Apparel	26
Retail banking	12
Power generation	9
Dairy processing	16
Housing construction	15
Wheat milling	7
Power transmission and distribution	9
Average	15

In India, prior to liberalization, employers and unions were engaged in collusive bargaining. Unions tended to impose limitations on output, insist on inflated manning scale, and resist the introduction of new methods if the privileges of the existing workers are threatened and discourage or even prevent employment of women. Trade union approaches were guided by the tripartite Model agreement arrived at during the 15th session of the Indian labour conference in 1957. It laid down that there should be no retrenchment on account of technological change. Labour gained from obstruction and recalcitrance, obtaining higher wages and reduced workloads. Management largely accepted low productivity and over manning passing on the costs to the consumer. Where productivity improvements were negotiated, they were difficult to enforce.

Internal and external liberalization began to place strains on this accommodation. Companies were forced to consider how to increase efficiency at their established plants, challenging previously established practices. Automation started with the aim to reduce the fatigue of workers and expediting the tasks of material handling, loading and unloading. Next phase saw low cost automation in the manufacturing methods through simple pneumatic, hydraulic, electric,

mechanical and electronic devices for improving productivity. Now automation is indispensable to maintain quality and reliability from chips to manhole covers. Unions came under pressure to negotiate increased flexibility in the form of movement between similar jobs and the integration of new tasks into production work and multi-machine working. Workforce reductions in large enterprises through the means of voluntary retirement schemes were negotiated. As the union resistance weakened, employers pushed for changes in working practices (see box).

Box 7.10
Siemens

The 1992 agreement at Siemens states:

(a) workmen will accept deployment from one job to another or from one activity to another;
(b) workmen of the same job level and trade will work anywhere in the department wherever required either due to absenteeism or workload;
(c) workmen wherever necessary will continue to work, if possible, without having the usual group/ gang strength;
(d) workmen in a higher job will do jobs one level lower;
(e) changes in working practices will be introduced in order to comply with ISO 9000 procedures, in consultation with the union;
(f) workmen will inspect the first few components with the help of standard measuring instruments before giving the same for inspection;
(g) workmen will operate computer terminals as part of their job and
(h) individual workmen will record and report outputs as required.

Analysis of current attitude of workers towards technology change identified two contradictory aspects. First, at the macro level a positive attitude towards change existed, showing traditional apprehensions of new and changing technology was giving way to a readiness and attitude of challenge towards the change. However, at the micro level, defying the first trend of a global attitudinal drift was the fact of `Localisation' of this attitude and its determinants. This suggests that the local social, cultural and industrial arrangements exert a significant influence on the workers. As a general phenomenon, technological change was taking place rapidly and had wide acceptance. Within the organisational context, the workers were striving for an alignment of technological change with their social and organisational identity.

Management responsibility

As per ILO study, in the 80’s, due to accelerated pace of technological change and structural adjustments, the initiative on organisation of work on shop floor, seemed to have shifted from trade unions to management with a view to coping with requirements for increasing productivity. Introduction of JIT and TQM is associated with more flexible working, team working and employee involvement but at the same time impose greater discipline and place more discretion in the hands of management. Mini-factories and cellular layouts require multi-tasking and the flexible deployment of labour. Workers in cells and in teams are expected not only to operate several machines, moving between them as required, but also to carry out simple inspection, maintenance and machine-setting operations. TQM puts greater responsibility on workers to produce correctly first time and monitor the results of their work. These pressures are

reinforced by the use of cells, internal clients and reduced stocks. The responsibility given to the worker can take many forms; visual inspection, 100% testing by means of fixed gauges or measurement, as well as more complex techniques such as statistical process control. The search for quality improvements, stock reductions and more rapid throughput of parts and products is never ending and involves attention to detail and continuous minor improvements. Direct production workers play a role in this and their understanding is mobilized through small groups, which may be called quality circles, improvement groups, *kaizen* groups, etc.

The introduction of these changes involves two basic challenges for management. First, workers must be supplied with the skills and knowledge required for multi-tasking, team working and participation in improvement activities. There is evidence to show that companies, which introduced JIT and TQM raised their educational requirements and invested heavily in training. Second, control and motivation systems must be effective. JIT, TQM and CI are built on the assumption that the parts of the system function well and that when disruption occurs, corrective action will be rapid. This places a considerable emphasis on workers discipline and flexibility. JIT systems are vulnerable to disruption and that this makes them dependent on worker. In response to this, management must create control and reward systems, which make workers dependent on the company and encourage them to identify with the company's goal. In Japan, the system rewards the acquisition of new competencies, commitment to grow and flexibility. Group orientation of Japanese society and unique labour related developments have often been cited as the key obstacle to the effective transfer of Japanese operating practices to other cultures like India.

Factors influencing adoption

General discussion on the workers acceptance of new technology draws heavily from the work in Industrial Relations by HR experts. Marketing specialist's on the other hand focused on `user perceptions'. Adoption of innovation primarily depends on two beliefs, *`perceived utilities'* and *`perceived ease of application'*, which determine attitudes to adopt a new technology. The attitude towards adoption depicts the prospective adopter's positive or negative orientation/ behaviour about adopting a new technology. Attitudes are determined by relevant internal beliefs. Attitude towards adoption is influenced by factors such as :

(i) perceived ease of adoption;
(ii) apprehensiveness
(iii) perceived utilities of technology (extrinsic motivation)
(iv) enjoyment (intrinsic motivation)

In addition, individual characteristics like age, qualification, their prior experiences in adopting technology; technology suppliers' commitment; compatibility with existing technology and enhanced value are important factors.

a) Perceived Ease of Adoption (EA)

EA is operationally defined as "the degree to which the prospective adopter expects the new technology adopted to be free of effort regarding its transfer and utilization". This measure reflects the potential difficulty for the adopting firm to utilize the new technology, as well as that of the individual if he is required to learn to use the new technology. Improvement in ease of adoption can be instrumental to the utilization of technology, contributing to increased profitability for the adopting firm or improve work performance of individuals. Perceived ease of adoption can also affect attitude directly. An innovation that is easy to implement and transfer can considerably reduce the time and effort a recipient needs to invest in the project. There is also a perceived probability that, the less complicated the transfer and application is, the more likely they will be successfully accomplished.

b) Apprehensiveness

It refers to the anxiety of using a new medium or technology. Even telephones in the early years of their adoption aroused apprehension. How can the firm take a chance with a new technology from an unknown source? *Observability* and *trailability* mitigate apprehensions about adopters' capability and preparedness to accept new technology. Draftsmen are worried about introduction of CAD, Bank employees about computerization of data, middle level management by talk of de-layering with BPR and ERP.

c) Comfort zone

While introducing even minor changes into the workplace, people's natural resistance to change can be in thwarting even the best intentioned and useful new ideas. Moreover, there seems to be a direct correlation between the degree of "discomfort" brought about by the change being implemented and the degree or resistance to the change. If people are asked to relate and do work in ways that are not familiar to them there is a good chance they will get pretty uncomfortable and resist the change. A concept helpful in developing a better understanding of the challenge of overcoming people's natural resistance to the kinds of shifts in thinking and behavior is the notion of " comfort zones." Comfort zone is the range of experience, behavior or performance that we perceive as consistent with our self image, which is our own perception/belief about who we are, what we believe we can do and where we belong. Our self-image is formed through our life experiences, training and conditioning. Self-image and habitual behavior/thinking patterns are two sides of the same coin. Just as our self-image is formed and reinforced through our life experience our attitudes, habits and skills are formed the same way—through conditioning and repetition. It has been said that attitudes are established ways of thinking and habits - established ways of doing. As it turns out, habits and attitudes are equally difficult to change. Changing either or both requires a healthy and sustained dose of consciousness, motivation and hard work.

d) Perceived Utilities of Technology (PU)(extrinsicl motivation)

PU is operationally defined as "the prospective adopter's subjective probability that applying the new technology from outside sources will be beneficial to his personal and/or the adopting company's well being". This construct comprises two dimensions: perceived utilities for the organization and perceived utilities for the individual. To the adopting organization, utility usually means economic benefits resulting from adopting a new technology. These benefits may consist of increases in productivity, enhancement of product quality, cost savings, improvement in market share and entry of new market. To an individual in the adopting organization, utility is most likely the result of improved job performance and the associated intrinsic and extrinsic rewards. When technology threatens earnings through corrupt practices, then utilization is perceived as negative.

e) Intrinsic motivation

It induces activities where there is no apparent reward except the activity itself. Intrinsically motivated behaviour arises from people's need to feel competent and self-determining in dealing with their environment. There is an inner drive to learn, which manifests clearly in the case of young recruits. Learning is an investment for them. This enthusiasm tapers with age, no wonder software engineers burnout by the time they reach forty.

f) Adoption experiences

Adoption experiences can be a function of the accumulated technical knowledge of the adopters and the augmented working relationships with the technology suppliers through previous experiences. Previous experiences with the technology provides an excellent opportunity for the adopting firm to collect important information regarding the technology and provides the needed personnel for similar future engagement. Moreover, the adopter is in a better position to evaluate the needs and requirements of the technology more accurately and can develop an understanding of the level of support required from the suppliers of the technology. Knowledge accumulation is cumulative for most technologies.

g) Technology Suppliers' commitment

The adoption of new technology carries a high risk. The level of perceived commitment from suppliers can help reduce this perceived risk through the transmission of adequate information from the suppliers to the adopters. Supportive commitments from suppliers are expected to be the most critical in the area of resources support. In many cases, resource commitment by suppliers can often affect the recipient's ability to absorb the technology. The more extensive the support, the more positive is the degree of perceived supplier's commitment. When technologies are changing rapidly, buyers are worried about shelf-life of the technology they are acquiring. This concern is addressed by technology suppliers with commitment to upgrade their product (software on site and hardware through buy-back) for a specific period of time.

h) Compatibility

The compatibility of a new technology is to a large extent the subjective judgement of the decision-makers. The more a new technology is perceived to

be compatible with existing technology, the higher is confidence of mastering the new technology and the more positive the attitude that can be derived. Open standards have evolved to address this concern of compatibility between various technologies. More common are the non-compatibility of the operating practices with the organization culture.

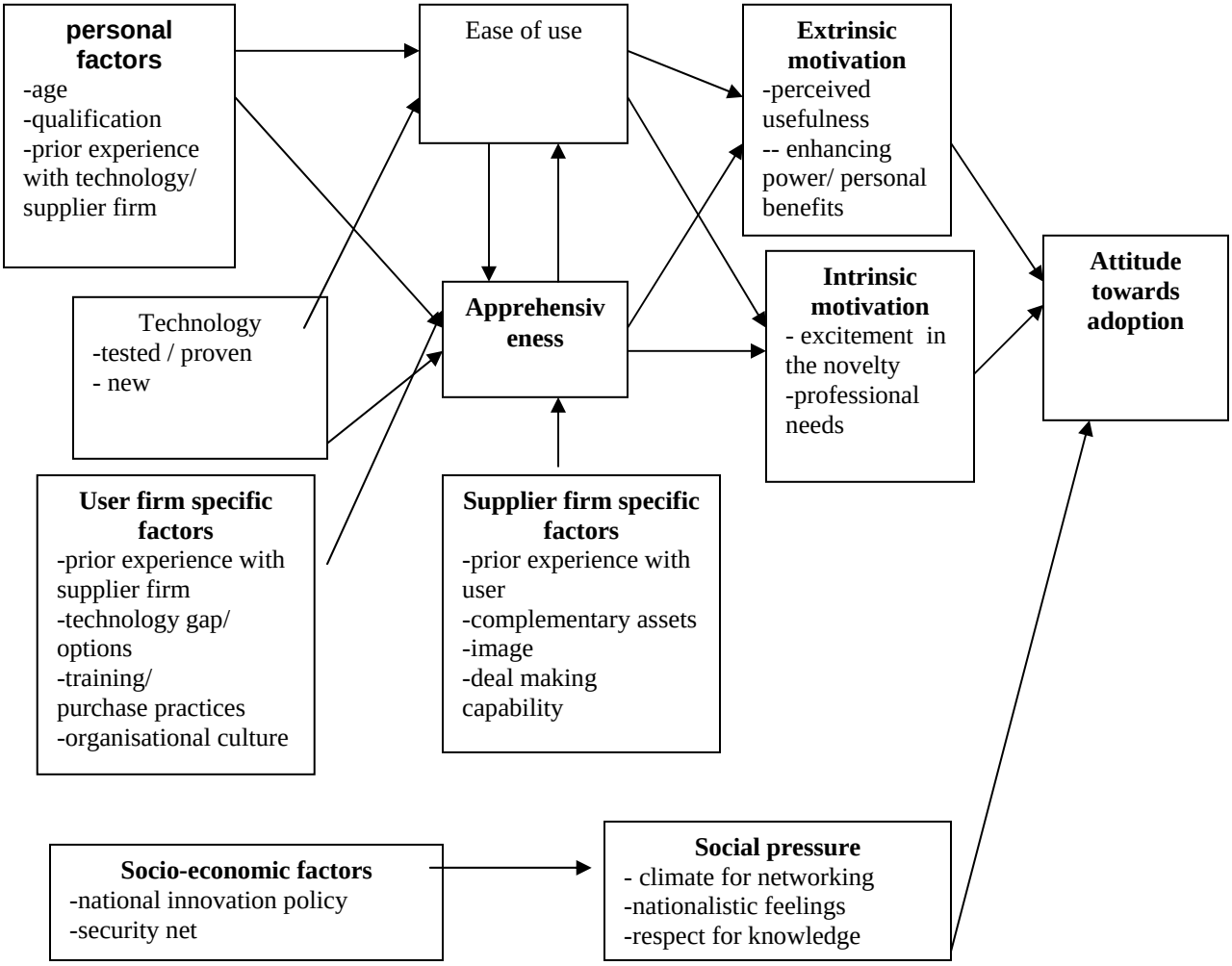


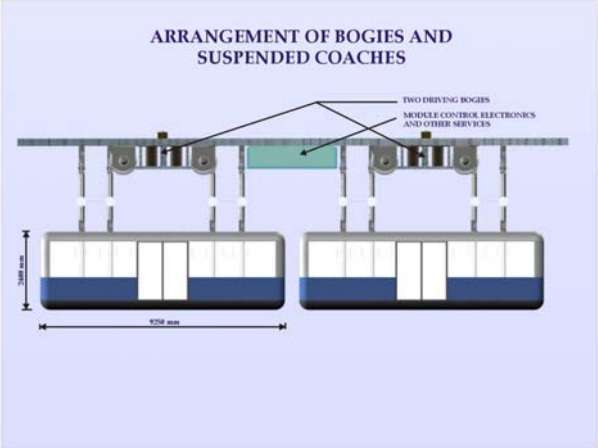
Fig 7.6 : Technology Acceptance Model

i) Enhanced value

In addition to the benefits derived directly from the technology itself, there could be some other forms of benefit relating indirectly to the adoption of the technology such as the generation or enhancement of a quality image or a novelty perception from adopting the technology. Such benefits can generate extra value as perceived from the user's point of view. Hence, the attitude towards adopting the technology may not only be related to the firm's utilisation point of view, but also incorporate the user's perception of the extra (enhanced) value carried by the new technology to the users. The more experience a perspective adopter has, the better the understanding the adopter will have of the

new technology. A better understanding of the technology will allow the adopter to better appreciate the additional value carried by the new technology.

Box 7.11
Sky bus metro system



Rajaram inventor of highly acclaimed anti-collision device is also the inventor of Sky bus metro system. Followed by success of Delhi metro, every city is getting into the act, adding a metro to their wish list. The demand for metro system has just opened and is worth billions of dollars. Inventor Rajaram was a part of the system having worked as Managing Director of Konkan railway corporation. Advantages of sky bus metro system:

- the system was patent protected in India, USA, South Africa and Europe. Patent rights vest with government of India.
- The bogies are suspended from the rail, safety certified by German experts and performance demonstrated in Goa. Hyderabad will be the first to adopt the system. Heavy 52/60 kg /m rails placed at standard gauge floating in elastic medium and damped by inertia of measured mass held in a 8 mX 2m box enclosure, supported over a 1m dia. columns spaced at 15 m and located at 15 m distance from each other, in the divider space in between lanes on a road- way, at a height of 8m above road surface- provides the support and guidance for powered bogies which can run at 100 kmph, with the coach shells suspended below , carry passengers in air conditioned comfort, can follow existing road routes, while existing traffic on roads continue.
- Existing road works, building are not required to be disturbed. This facilitates fast commissioning. The fixed structure at 8 m height above road level is aesthetically pleasing and there is no concern of claustrophobic feeling for road users. Aesthetic and eco-friendly, the Sky Bus can never derail, capsize nor collide- by design as well as by construction, hence is safer than existing rail-based system.
- At Rs 500 m or US$12m/km in India, the system is noise-free and pollution-free with 18000pphpd, scalable to 72000 pphpd as required. With no signalling and having no points and crossings, it is a unique mass-transit system, which can be put up within two years in any crowded & congested city. In addition to moving people Sky Bus system can carry standard 20ft containers, boosting its capacity utilization to double that of other existing systems.

Financials of a typical 10km route module of a Sky Bus Metro Network in a city.

1	Route length Double line		**10**	**Km**			
2	Cost /route km	Rs	500	**m**			
3	**Cost of the project**	**Rs**	**5000**	**m**			
4	Realisation		30% of designed capacity			350,000	journeys
5	Ridership	300,000	journeys local commuters				
6	Floating	50,000	day-travellers visiting/ non-monthly				
7	Only Fare Box collections considered. No other income is assumed.						
8	Incomes not considered: Advertisement, real estate leasing , city house keeping, container service						
9	Monthly card holders travel at average 50ps per km						
	9.1 Sell monthly travel cards TWO for total km					1000	(peak 500+500 non-peak)
	9.2 Both the cards can be used at any time travel, but charging rate depends on time						
	9.3 The TWIN cards issued to a family at total price of Rs 500						
10	Floating occassional travellers						
	10.1 Min journey charges	Rs	15				
	10.2 Day card of 50 km	Rs	100				
11	Est. revenues						
	11.1 Monthly cards	150,000	Rs	900	m		
	11.2 Daily journey trips	50000	Rs	262.5	m		
			Total Rs	1162.5	m		
12	**For standard 10 km route**						
	Expenses on operation and maintenance(O&M)						
	1.Fees to KRCL for management			50	m		
	2.Engineeers+staff 150 to 200			20	m		
	3. Energy costs major component			150	m		
	Repairs costs increased with age						
	O&M expenses increased with annual 1% increase						
	in volume of traffic for energy.						
13	**Assumptions to work out IRR**						
	No inflation in unit rates for fares considered.						
	Volume increase in traffic by annual 1%						
14	**Project IRR (20yrs)**	**18%**					
15	**Tax & depreciation:**		It is assumed that we should be able to				
	Depreciation at 5%	25 cr	maintain debt without redemption at				
	Then net taxable income after interest and		15% /annum comfortably over the				
	deprciation will be taxed at 30%		20 years.				
			Equity	**30%**	**Debt**	**70%**	
16	**Return on Equity :**	**24%**	**Equity**	**1500**	**m**	**3500**	m

Despite the inventive merit and business advantages, the backers of Sky bus are against a wall with strong preference by the buyer system for surface/ underground metro system. The railways have refused to certify it as railway project, it is placed under the category of tram and became a state subject.

Public transport organizations , railways or roadways, never experimented with Indian innovations before. Will the skybus get user acceptance? What type of organizational innovations are required to act as a carrier of this technological innovation?

(source: http://www.atrilab.com/)

Learning 'diffusion'

`*Diffusion is the adoption of new products or services overtime by consumers within social systems as encouraged by marketing activities'*.

`*Diffusion is the process involving acceptance over time of some innovation by individuals, groups or adopting units, linked to specific channels of communication to a social structure and to a given system of values, culture'*.

Adoption is an individual (personal) decision making process, while diffusion reflects a series of adoption decisions by individual units with in the social system. For a change to be effective, new way of doing things need to be diffused widely and speedily across the organisation and practiced to replace the old routines. Speed of diffusion thus becomes critical.

What influences the rate of adoption of an innovation? The diffusion pattern of an innovation is typically described by an `S' shaped curve. Initially the rate of adoption is low and adoption is confined to *innovators*. Next to adopt are the *early adopters* then the *late majority* and finally the curve tails off as only the *laggards* remain. The S curve represents the pattern of cumulative adoption of innovative technologies within an industrial or economic context. S curve model

does not apply to every industrial and economic context. The precise pattern of adoption of an innovation will depend on the interaction of demand side and supply side factors.

Diffusion models

Important elements of diffusion process are; *innovation*, *time*, *the units of adoption-buyer-buying centre*, *social system* and the *communication channel*. Time is an important -it is used to separate early adopters from late adopters of an innovation and to identify an innovations speed of diffusion. Social system constitutes the boundary within which the innovation diffuses, provides norms and values, defines roles and evaluates the consequence of diffusion. Diffusion can be considered a special type of communication where the information concerns new ideas. This has meant that diffusion has come to be considered as the propagation of messages related to new ideas that lead to subsequent innovations (products, processes, technology ,etc) awaiting a change in the behaviour of the receiver, which will be evident in the adoption or rejection of the innovation. Communication channels are the means by which messages proceed from the sender to the receiver.- personal selling, word of mouth communication.

Demand side models (mainly statistical)**:**

- *epidemic*, based on direct contact with or imitation of prior adopters;
- *Bass*, based on adopters consisting of innovators and imitators;
- *Probit*, based on adopters with different benefit thresh holds;
- *Bayesian*, based on adopters with different benefit perceptions of benefits and risk.

Supply side models (mainly behavioral)**:**

- *appropriability*, which emphasizes relative advantage of an innovation;
- *dissemination*, which emphasizes the availability of information;
- *utilization*, which emphasizes the reduction of barriers to use;
- *communication*, which emphasizes feedback between developers and users.

The epidemic model was the earliest and is still the most commonly used. It assumes a homogeneous population of potential adopters and that innovations spread by information transmitted by personal contact and geographical proximity of existing and potential adopters. This model suggests that the emphasis should be on communication and the provision of clear technical and economic information. However the epidemic model has been criticized, because it assumes that all potential adopters are similar and have the same needs. Software clusters at Bangalore and Hyderabad stand testimony to the efficacy of the model.

The Bass model of diffusion is a modification of epidemic model, it includes two different groups of potential adopters; innovators who are not subject to social

emulation and imitators for whom the diffusion process takes the epidemic form. This produces a skewed `S' curve because of the early adoption by innovators and suggests that different marketing processes are needed for the innovators and subsequent imitators. This model is highly influential in the economics and marketing research.

The Probit model takes a more sophisticated approach to the population of potential adopters. It assumes that potential adopters have different threshold values for costs or benefits and will only adopt beyond some critical or threshold value. In this case differences in threshold values are used to explain different rates of adoption. This suggest that the more similar potential adopters, the faster the diffusion. In the Probit model potential adopters know the value of adoption but delay adoption until the benefits are sufficient. However, it is unrealistic to assume that adopters will have perfect knowledge of the value of an innovation. Therefore Bayesian models of diffusion introduce lack of information as a constraint to diffusion. Potential adopters are allowed to hold different beliefs regarding the value of innovation, which they may revise according to the results of trials to test the innovation. Because these trails are private, imitation cannot take place and other potential adopters cannot learn from the trials. This suggests better informed potential adopters may not necessarily adopt an innovation earlier than the less well informed which was an assumption of early model.

The choice between the four models will depend on the characteristics of the innovation and nature of potential adopters. The simple epidemic model appears to provide a good fit to the diffusion of new processes, techniques and procedures. Whereas the Bass model appears to best fit the diffusion of consumer products. However the mathematical structure of epidemic and Bass models tends to overstate the importance of differences in adopter characteristics but tends to underestimate the affect of macroeconomic and supply side factors. In general both these models of diffusion work the best where the total potential market is known, that is for derivatives of existing products and services, rather than totally new innovations. All demand side models have limitations:

- adopters are assumed to be relatively homogeneous, apart from some differences in progressiveness or threshold values. They do not consider the possibility that the rationality and the profitability of adopting a particular innovation might be different for different adopters. For example local network externalities such as the availability of trained skilled users, technical assistance and maintenance or complimentary technical or organisational innovations are likely to affect the cost of adoption and use, as distinct from the cost of purchase.
- The population of potential adopters and the innovation are assumed to be the same at the beginning and at the end of the diffusion period. However, research confirms that many innovations change over the course of

diffusion and that this may change the potential population of adopters who in turn may lead to subsequent modification to the innovation.

- They focus almost exclusively on the adopters or demand side of the diffusion process and ignore supply side factors. In reality both demand side and supply side factors must be taken into account.

Sociological models place greater emphasis on the relationship between demand and supply side factors. The early appropriability models focus almost exclusively on the supply side and assume that innovations of sufficient value will be adopted. This suggest that the most important issues are the relative advantages of an innovation. The subsequent dissemination model assumes that the availability of information and communication channels are the most critical issues in diffusion. The utilisation model incorporates demand supply issues in particular problems of adoption and application both structural and perpetual. Finally there are most recent communication models of diffusion which are based on feedback between developers and potential adopters.

The communication perspective considers how individual psychological characteristics such as attitude and perception affect adoption. Individual motivations, perceptions, likes and dislikes determine what information is reacted to and how it is processed. Potential adopters will be guided and prejudiced by experience and will have `cognitive maps' which filter information and guide behaviour. Social structures and meaning systems are locally constructed and therefore highly context specific. These can distort the way in which information is perceived and acted upon. Therefore the perceived value of an innovation and its subsequent adoption is not some objective fact but instead depends on individual psychology and social context. These factors are particularly important in the later stages of diffusion.

Initially the needs of early adopters or innovators dominate and therefore the characteristics of an innovation are most important. Innovations tend to evolve over time through improvements required by these early users, which may reduce the relative cost to later adopters. Early adopters are almost by definition `atypical' for example they tend to have superior skills. As a result the preferences of early adopters can have a disproportionate impact on the subsequent development of an innovation and result in the establishment of inferior technologies or abandonment of superior alternatives.

Bandwagon may occur where an innovation is adopted because of pressure caused by the sheer number of those who have adopted an innovation, rather than by individual assessment of the benefits of an innovation. In general as soon as the number of adopters has reached a threshold level, the greater the level of ambiguity of the innovations benefits, the greater the subsequent number of adopters. This process allows technically inefficient innovations to be widely adopted or technically efficient innovations to be rejected. Examples include the QWERTY keyboard originally designed to prevent professional typists from

typing too fast and jamming typewriters; and the DOS operating system for personal computers, designed by and for computer enthusiasts. Bandwagon occur due to a combination of competitive and institutional pressures. Where competitors adopt an innovation, a firm may adopt because of the threat of lost competitiveness rather than a result of any rational evaluation of benefits. Many adopted flexible manufacturing systems in 80s in response to increased competition but most failed to achieve significant benefits. The main institutional pressure is the threat of lost legitimacy for example being considered by peers or customers as being less progressive or competent. Most leading firms established web sites in 90s because it was perceived to be progressive rather than because of any immediate commercial benefits. The critical difference between bandwagons and other types of diffusion is that they require only limited information to flow from early to later adopters. Indeed, the more ambiguous the benefits of innovation, the more significant bandwagons are on the rate of adoption.

Speed of diffusion

Technology diffusion refers to the acceptance of some specific technology over time through individuals, groups or organisations. A possible measure of diffusion is the number of adopters of the new technology or percentage of output manufactured using the new technology in the total output. Any technology status measurement has to analyse the diffusion characteristics of new technologies.

Innovation diffusion can be characterised by its speed, that is how long it takes for the innovation to be adopted by a certain number of organizations and patterns, that is, changes in the number of adopters overtime. Speed of diffusion is the relative speed with which an innovation is adopted by members of the system. Once innovation is accomplished, diffusion of the product/ process involved is started. The rate of diffusion of an innovation depends on many factors such as :

- effectiveness of the innovation in improving productivity of a process innovation and increasing market share of a product innovation,
- profit potential introduced by the innovation in terms of potential cost and price changes offered by the innovation,
- the size and composition of the industry,
- the degree of competition among industry firms,
- technology communication among industry members,
- ability of managers to intercept implications of innovation, and constraints on effective use of innovation such as work rules, government regulation, market prejudice, etc.

Box 7.12
Case of Shirke

Old technology

Casting insitu concrete is an outdated process. The executing agency erects a form-work of timber, steel or both, then places and tie-up steel bar reinforcements. The number of bars, their diameter and grade, their centre-to-centre distance and the bend of the top bars for negative stress, must be very accurate, maintaining the lever arm. This is impractical for two reasons. First, it is almost impossible to maintain accurate centre-to-centre and top-to-bottom placement of bars, because the workers put walking planks on their bars, when concreting the structure, disturbing the reinforcement. Second, the column must be concreted upward to the bottom of the beams and the results are usually shoddy. After that comes the form-work or shuttering, an invariably slip shod process that requires all sorts of timber and forest produce. As timber and plywood are becoming costly and scarce, use of detective form-work material is increasing. Finally concrete mixing is done on volumetric proportioning method, which assumes that one bag of cement contains 50kgs of good cement and it must have 1.25cu.ft in volume. This assumption gave raise to the box of 1ft x 1ft x 1.25ft – 1.25 cu.ft by volume. Ingradients are mixed in the proportion of 1:2:4, one bag of cement, two boxes of sand and four boxes of aggregate. Where mixer is not available, workers place this mixture in a heap on the ground and mix the concrete manually, water is poured slowly from buckets by young boys. Curing the slabs by watering for 21days is another hazard, who will do it in high rise building? Replacements technologies, Ready-mixed concrete or concrete weight batching and mixing plants are slowly adopted.

SIPOREX TECHNOLOGY

Siporex is a trade name derived from its ingredients- `Si` for silica, `por' for porous and the last `ex' is for ending. Siporex is an autoclaved steam cured aerated concrete, consists of the same raw materials as regular concrete, such as steel, cement, silica sand, water and some chemicals. However, there are some crucial differences. Unlike concrete, Siporex has a porous crystalline structure created by additives such as aluminium powder. It is also subjected to a steam curing process in an autoclave, at a temperature of 200 degrees centigrade and an atmospheric pressure of 15. The method originated with the basic research done by two Swedes Ivar Eklund and Lennart Forsen, who worked at the Swedish cement and concrete laboratory in Limhamn, Malmo. In 1933, they demonstrated that basic calcium silicate compounds in cement reacted with finely ground quartz sand, when subjected to steam curing. A crystalline compound, calcium monosilicate, formed during this hydro-thermal reaction had excellent properties, such as good thermal insulation, fire resistance, low shrinkage and high strength. In the following year, Siporex moved from laboratory trials to experiments on a factory scale. In mid summer 1934, the first acceptable aerated steam cured concrete product was produced in an industrial environment. In Europe the need to reconstruct houses in the shortest possible time was supreme because of aid provided under Marshall plan. About half a dozen factories were established by 1965, when Shirke arrived in Sweden to acquire this technology. Siporex was called the wonder building material of the world.

Siporex India

Siporex India was incorporated as joint sector public limited company, government of Maharashtra was a partner. Government was roped in as partner because the Swedes insisted on it as essential to sell to government departments. It took 6 months to get license by June 1966. Government restricted royalty to 5% and period for 7 years. In place of down payment, equity was offered to Siporex. This was cleared along with other proposals for manufacture of light weight blocks as slabs near Madras and Calcutta. Agreement signed with Siporex in October 1967. Siporex India had capacity of 90,000 cu.meter, which is 15% of normal size internationaly.

The company had a very bad time at start. Heaps of Siporex blocks accumulated unsold. Capacity utilisation in first 3 years was 22%, compared to break even point of 66%. By March 1975, accumulated losses were more than total equity. The plant was considered

for closure in August 1973. Fortunately In October 1974, it received an export order from Sheikh Rashid Almaktur of Dubai. It survived for few years with export orders. By 1995 ,it grew as one of the largest companies ,leader in manufacture of prefabricated components and construction of housing townships. It has 6 manufacturing units today.

Reasons for slow rate of technology diffudion

Favourable conditions existed for rapid spread of prefab technology. There was no sand available in Mumbai. In 1993. Govt banned use o timber in construction. Siporex saves 30% cement, 40% steel and 60% time. Ten percent of public works in Maharshtra is reserved for Shirke-Siporex without inviting tenders. Still the rate of adoption and diffusion was painfully slow. Shirke argues this is because of Panchsheel of civil engineering – the 5 fradulent maxims upon which Indian Civil Engineering operations are based. They are; cheat on cement, cheat on steel, cheat on measurements by recording false-hidden measurements, create fictitious extra items and do whole hog substandard work.

ORGANIZATIONAL LEARNING (OL)

Learning at the individual level can be conceptualised as the process of obtaining and retaining skills and information with relevant aptitude that leads to changes and improvements in action and decision making. The process of organizational learning is, however, less well understood than individual learning. All learning can be characterised as occurring at the individual level. The focus of a organisation should be on improving the learning, skills and hence competitive advantage of individuals. However, to ensure their effectiveness, individuals have to be able to fully integrate with and be able to maximise the benefits of learning at the organisational level. In this way, the effective organisation ensures that an individual's actions and learning are both supported by, and providing support to, the organisation as a whole. This is described as the "*creation of shared understandings*". Acting together, the individuals that make up the organisation are able to learn, work and compete better than they could on their own.

Definitions :

"*Organizational Learning occurs when the mental models, schemes or cognitive maps that guide behaviour are modified through recognition of a change in information concerning an organisation's environment*".

"*Organisational Learning occurs through shared insights, knowledge and mental models*".

"*Organizational Learning occurring when individuals, acting from their own images and maps, detect a mismatch of outcomes to expectation which confirms or disconfirms organization theory-in-use*"

"*The transformation process that translates individual learning into organizational domain is termed organizational learning*".

It is a process by which individuals share their insights, knowledge and ideas to develop a common understanding. Through this process of learning, organizations enrich their knowledge base, which helps them in knowledge generation and in the long run to face external challenges. An innovative or a product organization would strive to be a learning organization `skilled at creating, acquiring and transferring knowledge and modifying its behaviour to reflect new knowledge and insights'.

Organizational learning is the development of new knowledge and insights that have the potential to influence behavior. Organizational learning occurs when members of an organization share associations, cognitive systems, and memories. Learning by organizations relies on the people and groups to serve as agents for the transfer of knowledge. Over time, what is learned is built into the

structure, culture, and memory of the organization. Lessons (i.e., knowledge) remain within the organization even though individuals may change.

Box 7.13
EIU study

Survey

The Economic Intelligence Unit (EIU) in co-operation with IBM Consulting Group had conducted an intensive study of emerging Organisational Learning (OL) and Knowledge Management (KM) practices around the globe . Responses were received from 345 companies in 26 countries (1999).

Typical OL activities undertaken are:

- behavioural changes to improve teamwork;
- changing individual and corporate behaviour,
- facilitating ongoing, team based and collaborative management ,
- leading individual or team training activities,
- assembly of multi-disciplinary teams to solve business problems.

Organisational learning and learning organisations are used interchangeably. Learning Organisations are considered masters of managing change for financial gains. OL, in its broadest sense, refers to a variety of practices and values that enable a company to explore continually new directions and anticipate or even lead change in the market place and society at large.

Benefits

1. Learning enhances a company's *speed*, *innovative-ness* and *adaptability*. Technological change, shorter product life cycle, market shifts and global competition affect some industries more than others, but all companies need to synthesize information and generate knowledge faster. Learning addresses a company's desire to better anticipate and adapt to changing market conditions, reach the market with more innovative products faster than competitors and maximize responsiveness to customers needs. Learning organisations are effective not only at creating and/or acquiring new knowledge, buy also in applying that knowledge to continually improve their tasks and activities.
2. Learning builds shareholder value for the long term. Managerial accounting systems that currently guide investment and strategy offer little insight into the value that human know-how, creativity and experience add to products and services. Skandia and other companies now report intangible assets in their balance sheet. They recognise that learning is the key contributor to value addition , in the long run.

Enabling factors

1. Formal business procedures must be balanced with the freedom to create. Business organisations discourage people from learning all the time. Every time someone tells you to do something a certain way because that is the standard way, they are telling you not to learn. This type of over-prescription undermines learning. A Company's official chain of command and formal business procedures must co-exist with informal personal networks. Best leadership creates a balance in the organisation between reaping and sowing; production on one hand and building capacity, competence and personal relations on the other.
2. Every company has a different approach. There is no roadmap to becoming a learning organisation.
3. Culture is the key. A spirit of openness and enthusiasm for continuos learning occurs, when leaders actively and continuously promote those values.

4. Individuals must commit to personal change. Managers need to develop confidence to let go of control and accept ambiguity and uncertainty. Such attitude changes take place when individuals take personal risk and challenge themselves psychologically to see and do things differently.

Learning pathways

An organization's knowledge comes in part from the organization's employees. Each individual can be a prime source of information. Individuals have private knowledge that can be a basis for organizational knowledge. Knowledge of the organization is shared knowledge among organizational members.

Learning occurs by improving actions through better knowledge and understanding, encoding inferences from history into routines that guide behavior, and developing insights, knowledge, and associations between past actions, the effectiveness of those actions, and future actions. It involves the understanding of reasons beyond immediate events. Notably, learning is facilitated by structure and organization. Cultivating and expressly maintaining memory increases learning. Discovery and affirmation may encourage learners to employ trial-and-error experimentation or searching mechanisms in order to gain new knowledge. However, learning typically occurs in response to problems or needs that must be overcome in order to succeed.

Important organizational learning mechanisms are shown in Fig ---. The horizontal axis is frequency, infrequent tasks are low on frequency. Vertical axis is on compatibility, the degree of similarity with which the learning task presents itself each time. Repetitive tasks are homogenous, whereas exploratory tasks are heterogeneous.

Vicarious Learning

Different forms of vicarious learning are possible in various combinations of task frequency and comparability. A firm can decide at any moment to solicit the help and the advice of some specialized consulting agency, or to attempt to imitate some type of best practice developed by a successful competitor. Until this action translates into first-hand experience that leads to the accumulation of internally generated (and embedded) knowledge, however, it will be difficult to assume that the organization has been able to develop any capability or internalize any best practice. Hearing about Suzuki's successes with its lean production system will not produce any effect on Maruti's stock of productive knowledge unless and until Maruti will initiate material changes in its own systems and put its experiential learning mechanisms at work. An organizational capability can be developed only through learning processes based on the accumulation of direct experience.

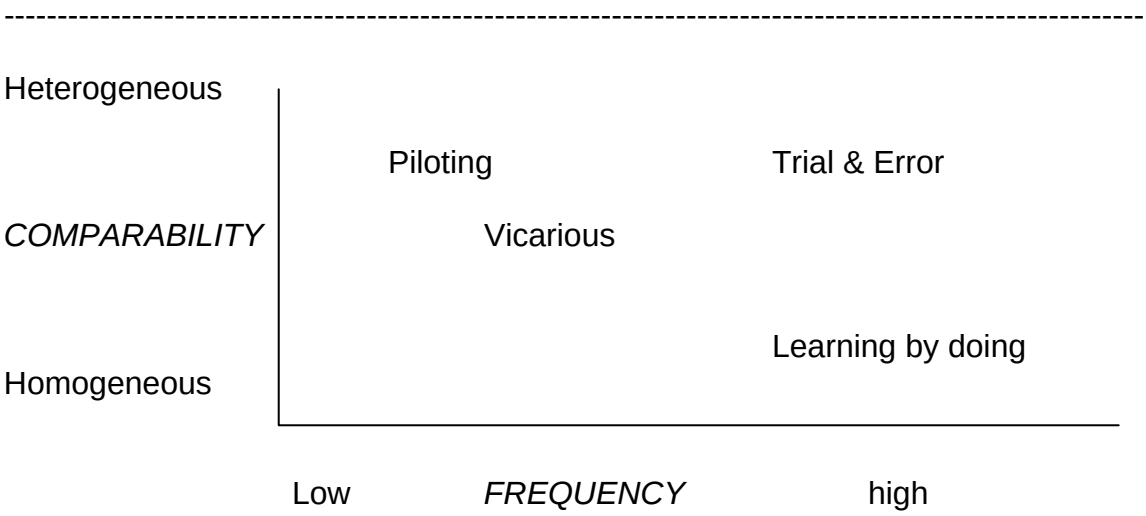


Fig 7.7: oganisational learning mechanisms

Trial and Error

Trial and error mechanisms are typically in use with exploratory learning contexts where highly frequent events can be experienced at relatively low cost for the single event (e.g. search for new chemical compounds). However, these learning mechanisms can hardly be considered viable tools, when the costs attached to the "errors" are particularly high (e.g. reorganization process), and the availability of the "trials" is also scarce.

Learning by doing

Learning by doing is probably the most frequently studied mechanism in both theoretical and empirical work. However, it is also the one mechanism that relies most on the two assumptions of high frequency and comparability of the experienced events. In traditional model of Apprentice, the student is bound to serve the expert throughout a period of indenture. The goal is not necessarily that the student become the expert but that the student learn the art or trade which serves the reproduction and reification of expertise. In Sweden vocationalism formed one part of the ideological and economic package that went to make up the post-war Swedish corporatist 'class compromise.' Except TISCO and few Public sector companies, Indian firms have preferred to take ready-to-use employees. Sandwich courses (one semester in college and next in industry) so popular in technical education in Germany and other countries have not taken root in India.

Piloting

When an infrequent task presents itself in diverse ways every time, and requires significant investments to be experienced, a more efficient way to accumulate knowledge might be provided by the execution of a pilot project or the in-depth analysis of a prototypical event. These particular arrangements seem to be able

to combine the tacit knowledge accumulation component necessary with even such a rare (i.e. unique) experience, with some type of cognitive activity aimed at the analysis and extraction of all the possible experiential value from the few events at one's disposal.

Task characteristics and effectiveness of learning mechanism

At high frequency levels, capabilities are created mainly through tacit knowledge. Accumulation mechanisms and codified knowledge is either non-influential, because operators just do not use the manuals and other codified supports and prefer to rely on their own experience. At low frequency levels, however, the relationship between the two mechanisms could be inverted with respect to their relative ability to facilitate learning and create organizational capabilities. The difference in their effectiveness for explaining the evolution of organizational competence is a matter of degree, as they both co-exist within the firm at any point in time.

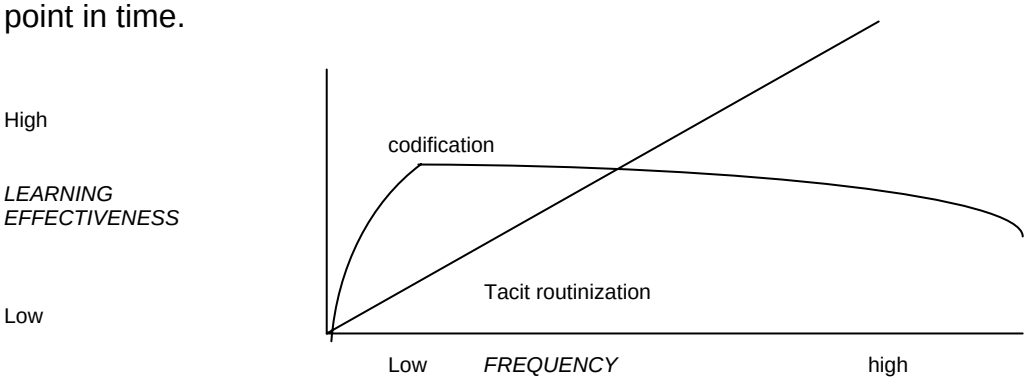


Fig 7.8: task characteristics

Transaction cost and path dependency

As organizations develop routines for enhancing competencies, the cost of learning via a particular method will tend to decrease when the organization regularly uses the same method. When an organization looks at adding a new competence or enhancing a current one, it will consider the total costs involved with a particular method of learning. This total cost will include both transaction costs and direct costs. The direct costs are those that can be assigned specifically to the knowledge acquired like price of patent, payments in a technology transfer contract. The transaction costs reflect the cost associated with the process of learning and should decline over time. In the case of a market procurement of the rights to a patent, transaction costs would include the costs of searching among potential related patents, negotiating a price and monitoring the completeness of the patent information provided. An orgnisation regularly purchasing patented rights to enhance a competence would become familiar with the likely sources of the relevant patents, have experience in valuing and negotiating agreement and have established procedures for facilitating and

monitoring the flow of information from patent holders to the appropriate people in its organization. Thus an organization, with an expertise in the market procurement of patents is likely to have lower transaction for obtaining the patent rights and is less likely to overpay or fail to learn from a purchased patent right. Similarly, using same external source again and again has the advantage of lowering transaction cost but there is risk that consultant would become very knowledgeable about the organization, which he could leak. The leakage may be unintentional, but cannot be avoided. Also importance is understanding the strengths and limitations of established routines. It is routines that allow organizations to lower costs of processing information. Hence existence of consistent pattern of learning should be recognized for the strengths and benefits this consistency provides.

Focus on Mindset

"Cultural lock-in" the inability to change the corporate culture even in the face of clear market threats, explains why corporations find it difficult to respond to the messages of the marketplace. Cultural lock-in is the last in a series of "emotional" phases in a corporation's life, a series that mirrors, remarkably, that of human beings. In the early years of a corporation, just after its founding, the dominant emotion is passion—the sheer energy to make things happen. When passion rules, information and analysis are ignored in the name of vision: "We know the right answer; we do not need analysis." As the corporation ages, the bureaucracy begins to settle in. Passions cool and are replaced by "rational decision making," often simply the codification of what has worked in the past. Data are gathered, analysis is performed, alternatives are postulated, and scenarios are developed. Rational decision making is triumphant, at least for a while. This stage is often pictured as the normal state of the corporation. Eventually, rational decision making reveals that the future potential of the business is limited. Often, at this point, threatened by the prospect of a bleak future, the corporation falls back on defensive routines to protect the organization from its fate, just as defensive emotions emerge in our lives when we sense impending trauma. Management now sees the future filled more with trouble than with promise. Decisions are made to protect existing businesses. The fear of discarding the old for the new , paralyse acts of creative destruction and often effectively shield the corporation from the perception of future trouble—as well as the need to act—for a long time. Cultural lock-in is established, thwarting the emergence of a leader or team that might save the day.

Why does cultural lock-in occur? The heart of the problem is the formation of hidden sets of rules, or mental models, that once formed are extremely difficult to change. Mental models are the core concepts of the corporation, the beliefs and assumptions, the cause-and-effect relationships, the guidelines for interpreting language and signals, the stories repeated within the corporate walls. Mental models are invisible in the corporation. They are neither explicit nor examined, but they are pervasive. When well crafted, mental models allow management to anticipate the future and solve problems. But once constructed, mental models

become self-reinforcing, self-sustaining, and self-limiting. And, when mental models are out of sync with reality, they cause management to make forecasting errors and poor decisions. The assumption of continuity, in fact, is precisely the kind of disconnect with reality that leads corporations into flawed forecasting and poor decisions.

Mental models

The idea of a mental model is not new, the concept was cited as early as 1943 with the publication of *The Nature of Explanatio*n, by Craik, who recognised that knowledge and understanding operate through the application of "working models" of particular phenomena in an individual's mind. Johnson-Laird who used and developed this concept saw mental model at its simplest level as a small-scale model of reality, which while not necessarily wholly accurate, nor a complete match for what it models, was still useful as an aid to understanding. For example, for hundreds of years the substantive mental model of the solar system was that the sun, moon and other planets all revolved around the earth. This model, in no way accurate according to current under-standing, was a function of, and appropriate to the beliefs and understanding of its time. It was only changed when new knowledge came to light which ultimately changed people's beliefs and understanding.

Senge, describes mental models as "deeply ingrained assumptions, generalizations or even pictures or images that influence how we understand the world". He goes on to assert that, in this way individuals' understanding of their environment (or any part of it) is made up of their knowledge, beliefs, experiences and perceptions, and as such is affected by that person's political, economic, social and cultural back-grounds. Individuals process data through their mental models, consequently mental models can be seen as "deeply ingrained assumptions, generalisations, and images that shape our thinking and influence our actions". In short, mental models determine how we use data to make decisions. Many of these definitions of mental models are highly context-specific.

A model can be seen as a representation or simplification of a physical reality: "*an approximate copy or image*", is the dictionary definition *(Webster'*s). An effective, if broad definition of a mental model is to see it as a simplification or representation of understanding. In this way a mental model can vary from a simple image or picture in the mind to a more complex abstract or conceptual archetype built through more detailed understanding. One example of how this operates, taken from the organisational learning literature, is Kim's characterisation of a mental model consisting of two types of knowledge: "*conceptual (know-'why')* and *operational (know-'how'*)". Kim's own understanding of how mental models operate is enhanced through his development of the concept. It is possible to see a mental model as providing a framework, which directs and controls an individual's decision-making process, a framework which, under Kim's terminology, would be contingent on that individual's perception of "*why*" and "*how*".

For example, mental models of the concept of “television” will be different for a housewife watching TV, for a TV service mechanic and very different for producer of TV programs. Remember story of blind men and an elephant ? This means that two people with different mental models can observe the same event and describe it differently because they’ve noticed different details. This is known as “*selective perception*”.

Concepts that proceed through the development process change as they cycle through the model. They become more defined, refined, detailed and formalised in the process”. Three forms of (increasingly complex) mental models are: intuitive models, metaphors, and formal models, which are operationalised and tested through “action” and are challenged and developed through “physical articulation”.

Defensive routines

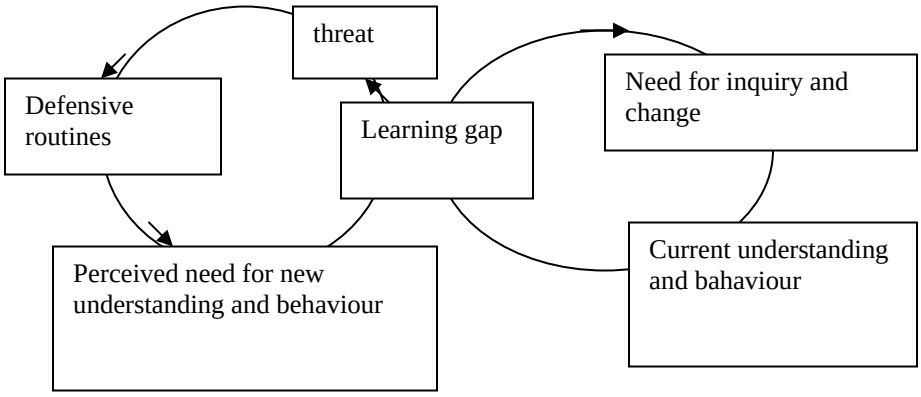


Fig 7.9: defensive routines

Defensive routines are a response to a problem, here the problem is the need to learn, arising from a `learning gap’ between what is known and what needs to be known. The fundamental solution is inquiry that results eventually in new understanding and new behaviour-that is learning. Learning teams need practice fields. Example are Creative teams in advertisement , they are made up of have accounts supervisor, art director and copywriter working together closely. They brainstorm ideas, test them in storyboards and mock-up before presenting to seniors and client.

Box 7.14

CHANGE MANAGEMENT BY PATANJALI

Yoga Sutras, are a collection of aphorisms, offered more than 2000 years ago by the Indian sage, Pattanjali . They are the among the earliest study of human behaviour. He is not only the

celebrated author of the *Yoga Sutras* but also of treatises on Ayurveda (Indian medical practices) and grammar (of Sanskrit). His treatise on *Yoga* is called *Yoga Darshana*; darshana means 'visions of the soul'. In the *yoga sutras*, he described the ways of overcoming the afflictions of body and fluctuations of the mind. Patanjali's 196 aphorisms (*sutras*) cover all aspects of life, beginning with a prescribed code of conduct and ending with man's vision of his true self. The four *padas* (Chapters) of *yoga sutras* are:

Samdhi pada	(on contemplation)
Sadhana pada	(on practice)
Vibhuti pada	(on properties and power)
Kaivalya pada	(on emancipation and freedom)

In the first chapter, *Samadhi Pada*, Patanjali defines consciousness (*chitta*) and its movements (*vritti*). *Chitta* has 3 components, mind (*manas*), intelligence *(buddihi*) and ego (*ahamkara*), which combine into one composite whole.

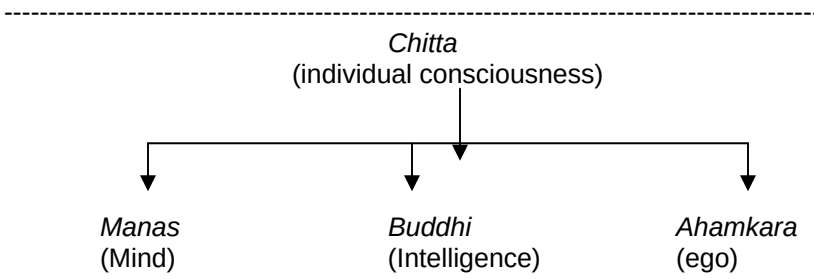


Fig 7.10: *Chitta* constitution

The process of shaping *chitta* begins with awareness of external world through our experiences from the organs of actions (*karmandriyas*); the arm, legs, mouth and the organs of generation and excretion. It proceeds through the senses of perception (*jnanendriyas*); the ears, eyes, nose, tongue and skin). All biological entities foray into the external world for Food, Sleep, Fear and Sex. Human being is special, he is blessed with intelligence. His interaction with external world is deeper; he needs emotional channels to interact with external world. They are *Kama* (desire), *Krodha* (anger), *Lobha* (greed), *Moha* (infatuation), *Mada* (pride) and *Matsaraya* (malice). That awareness begins to penetrate the mind, the intelligence, the ego and the consciousness.

Ahamkara (ego), the sense of 'I (me)' is the knot that binds the consciousness and the body through the inner sense, the mind. According to Indian thought, though Mind, Intelligence and Ego are parts of Consciousness, Mind acts as the outer cover of Intelligence and Ego and is considered to be the 11th sense organ. It senses, desires, wills, remembers, perceives, recollects and experiences emotional sensations such as pain and pleasure, heat and cold, honour and dishonour.

Citta comes into contact with the external world, which leaves imprints on Intelligence of the brain and Mind. The discriminating faculties of Brain and Mind screens these imprints, discard or retaining them. If discriminating power is lacking, then these imprints, like quivering leaves, creates fluctuations in words, thoughts and deeds and restless in the self. The endless cycles of fluctuations are known as *vrittis*; changes, movements in the consciousness. *Vrittis* are thought waves, part of brain, mind and consciousness, as waves are part of the sea. Commentators visualised *Asmita* (the individual self -personality), sprouting from soul(*jivatman*). Soul is formless while self is assumed form. If soul is the seed, *chitta* is the sprouted consciousness, mind the stem and *vrittis* , thought waves, the leaves. The verb *cit* means to perceive, to notice, to know, to understand. Patajali explains that the painful and painless imprints (*samskaras*) are gathered by 5 means:

Pramana, Viparyaya, Vikalpa, Nedra and Smriti.

Pramana *is direct perception, derived from ones own experience, through inference or perusal of content from authoritative texts, teaching of masters.*
Viparyaya is wrong perception based on misconception.
Vikalpa is based on imagination, remains at verbal or visual levels and may consist of ideas without a factual basis.
Nidra- sleep is a state of inactivity.
Smriti- memory is the faculty of retaining and reviving past impressions and experience of correct perceptions, misperceptions, imagination and even of sleep. It carries millions of remnants of past experiences.

What is the problem?
Chitta is only a store house, a mere self, working on behalf of self, it is the known aspect of the individual. When conscious effort is not made by the soul to assert itself, *chitta* takes over control of brain and mind. The true self gets blocked by *chitta* and thought becomes a projection of *chitta.*

What is the solution?
Yoga, defined as **yogah *citta vritti nirodhah***- restraint through discipline. The effect of yoga is to reflect the thoughts and actions of the aspirants as in a mirror. The practitioner observes the reflections of his thoughts, mind, consciousness and actions and corrects himself. When consciousness is in a serene state, its interior components, intelligence, ego, mind and the felling of 'I' also experience tranquillity. At that point, there is no room for thought waves to arise either in the mind or in consciousness. Correctness of perceptions should be ventured by reasoned doubt, logic and reason.

Patanjali shows how to refine consciousness by means of practice (*abhyasa*) and detachment (*vairaygya*). *Abhyasa* is a dedicated, unswerving, constant and vigilant search into a chosen subject, pursued against all odds in the face of repeated failures, for indefinitely long periods of time. Practice must be pursued with trust, confidence, vigour, keen memory and power of absorption (*Samadhi*) not to lapse into complacency. *Vairagya* is the cultivation of discriminating faculty between real and the unreal, Intensity of practice and renunciation transforms the scattered consciousness into a focussed one. The individual begins to see the objects in the right perspective (*vitarka*). Then he mediates on them to know and understand fully the subtle aspects of matter (*vicara*). *Vitarka* is an act of involvement by deliberate thinking and study, which leads to the final point or root cause. Intellectual analysis, being a function of brain produces relative and conditioned knowledge. It is gross and lacks refinement. *Vikara* means differentiating knowledge, it is a process of investigation, reflection and consideration through which the wandering conjectural brain is stilled and person develops mental depth, acuteness, refinement and subtle subjects.

The sage offers several techniques, to be adopted by aspirant depending on his level of development. A simple one is on behaviour, he asks us to rejoice with the happy, to be compassionate to the sorrowful, friendly to the victorious and indifferent to those who continue to live in vice despite attempts to change them.

SUMMERY

- Technical innovations are visible in knowledge embodied in equipment design, manufacturing process sheets, whereas organisational innovations are embodied in organisational processes. Both are

important from the external user perspective and also internal user perspective.

- Like acquisition of embedded forms of technical innovation, organistaional innovations in the form of best practices can be benchmarked and acquired. And this often calls for diffusion of routines. Routines are learned patterns of behaviour, which become embodied in structure and procedures overtime. As such they are hard to copy and are highly firm specific. Different firms use different routines with greater or lesser degree of success. These are general recipes from which general suggestion for effective routines can be derived but they must be customised to particular organisation and related to particular technologies and products.
- In the first stage of the diffusion process, the new product is discovered and adopted by a small group of innovative users, who within short time begin to influence others, the imitators. This social interaction between the adopting pioneers and the different potentials of the innovation explains the phase of rapid expansion in the diffusion process.
- Differences in the adoption processes and in the diffusion parameters may be explained by specific factors in each country that are beyond the companies' control; income levels, openness of the economy, national technology climate, education level of workers, trade unionism etc as well as the time lag that always exists between the moment an innovation is introduced in a pioneering country and later introduction in India.
- Influence of external factors and the experience of previous adopters are basic factors in reducing uncertainty in new adopters with regard to the innovation.
- Slight cultural differences that exist among European countries or East Asian countries may not lead to significant difference in the diffusion process of their member states, but significant cultural differences between India and Europe and also between India and China may lead to different time frames for technology diffusion in India.
- Indian manufacturing industry is seized with challenges in providing consistent quality with low defects and developing capability to introduce new products and flexibility in terms of design changes, managing changing volumes or product mix. The focus has shifted from acquiring big ticket items (automated equipment) to more mundane and earthly things like, transforming organisational culture.
- Since the collective culture of an organisation is an aggregate of what is common to all of its group and individual mindsets, organisation transformation entails changing the minds of hundreds or thousands of people. Employees need to be trained to adopt to new environment and apart from top management, 'role models' at every level also need to embrace the new dogma.

- The heart of the problem is the formation of hidden sets of rules, or “Mental models”, that once formed are extremely difficult to change. “Mental models” are invisible in the corporation, they are neither explicit nor examined, yet they are pervasive.
- The solution is in realising the fears of the people affected. They are operating from a much smaller knowledge base than those involved in the decision to acquire the technology. The people affected must be involved early. Ideally some of them should be involved in technology acquisition. In return for early communication, the company has the right to expect commitment from its employees.
- While assimilating western management thoughts, Indian management can also benefit from relearning – the sages have left behind a treasure, westerns have found it useful as a health tonic, Indian managers can use it as a tool to change the mindset in organisations with least external intrusion

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Case

Reliance Jamnagar refinery

Reliance's Jamnagar refinery is the most profitable in the world. It achieves a refining margin of $9-10/barrel, one and a half times as much as most global refineries. Singapore's famed refineries today get a margin of just $3/barrel.

The Jamnagar Complex is the first manufacturing complex of its kind, having a fully integrated petroleum refinery, petrochemicals complex, captive power plants, and a captive port, with related infrastructure. It represents the largest single investment at a single site in India. The refinery project required a total investment of Rs 9,700 crore ($207 million) which was a fraction of the total project cost of Rs 20,400 crore ($437 million). Construction of the plant commenced in 1996 and had an initial construction period of 29-30 months. However Reliance pushed contractors to work on a two shift-24hr basis so as to have the site finished within a 24-month period. On completion the refinery at the complex had a capacity to produce 15 million tonnes per year of refined crude.

With a refining capacity of over 27 million tons per year and paraxylene production of 1.5 millions tons per year, Reliance Jamnagar is the world's largest grassroots refinery and aromatics complex. Reliance Petroleum's parent company, Reliance Industries Ltd., is the largest private sector company in India. The original construction of the complex, which included the refinery, was lead by Bechtel, which worked in close collaboration with Reliance throughout. Construction was carried out by a number of Indian companies such as Larsen & Toubro (L&T), Dodsal, Punj Lloyd, Trafalgar House and Simplex. The Foxboro Company led the installation of the automation system, both in 1997 when the complex was in phase one of construction and in 1999 with the refinery's most recent upgrade. Approximately 155 miles of fibre optic control network link the five major I/A Series systems within the complex. Systems controlled include the refinery and marine terminal, the aromatics plant, the polypropylene plant, the complex’s captive power plant and port operations. A fibre optic carrier band LAN also connects all five control systems, plus other plant systems, onto a common Plant Information Network (PIN). The PIN provides authorised users throughout the complex with access to any real time process display or historical information across the five control systems. This network is almost 13 miles in length and is composed almost entirely of commercial fibre optic components.

Adoption of Technical innovations- Nelson's Complexity Factor

Reliance is the only refinery in the country which can process any type of crude from any part of the world. Nelson Complexity Index is a measure of secondary conversion capacity in comparison to the primary distillation capacity of any refinery. It is an indicator of not only the investment intensity or cost index of the refinery but also the value addition potential of a refinery. The index was developed by Wilbur L Nelson in 1960 to originally quantify the relative costs of the components that constitute the refinery. Nelson assigned a factor of one to

the primary distillation unit. All other units are rated in terms of their costs relative to the primary distillation unit also known as the atmospheric distillation unit.

The Nelson Complexity Index method uses only the Refinery Processing Units or the " Inside Battery Limits " (ISBL) Units, and does not account for the costs of Off-sites and Utilities or the " Outside Battery Limits " (OSBL) Costs, such as Land, Storage tanks, terminals, utilities required etc. The Nelson Complexity Index provides insight into refinery complexity, replacement costs and the relative value addition ability and allows different refineries to be ranked. The Nelson Complexity Index for the Reliance refinery is 9.93 and for the overall Jamnagar Complex is over 14.0. Essentially a high Nelson Complexity Index as the Reliance Jamnagar Refinery is, points to the following characteristics .

- Ability to process inferior quality crude or heavy sour crudes. For example the Jamnagar Refinery generally processes crudes which are 5?API lower and 0.7wt% sulphur higher compared to Indian peers.

- Ability to have a superior refinery product slate comprising of high percentage of LPG, light distillates and middle distillates and low percentage of heavies and fuel oil. For example the Jamnagar Refinery produces no fuel oil which is unmatched by the Indian peers.

- Ability to make high quality refinery products such as Bharat 3 gasoline or diesel. For example the Jamnagar Refinery can make Euro 3 grade gasoline unmatched by the Indian peers.

Organisational innovation- short term contracts

Most refining companies sign long-term contracts covering all their crude needs, and tailor their refinery's technology capacity to the contracted crude varieties, to optimise output. Long-term contracts provide supply security (fixed quantities per year), but no price security (the price for each consignment depends on the current market quotation). Still, security of supply has, traditionally, been viewed as an important consideration.

Reliance has discarded the conventional wisdom about ensuring security of supply for crude oil. Instead, it has proved that short-term opportunism in contracting oil supplies can be far more profitable than long-term security. Trading margins to security of supply was a risky proposition and Reliance famed for its foresight learned its lessons from history.

Arabs placed an embargo on crude supplies to the US and its allies in 1973-74, a dramatic use of oil as a strategic weapon. However, the Arab embargo did not actually work. The US got all the crude it needed, for two reasons. First, when Arab countries switched oil supply to non-embargoed countries, those countries stopped buying from other sources, which were then free to supply the US. Second, some of the crude originally sold to other countries was

diverted to the US. In 1973, Japan had the highest import-dependence of any country on oil, and was really worried about security of supply. It wanted to create giant oil companies that would buy big oilfields for security of supply. But it failed: no big fields were available for purchase. Happily, this proved irrelevant. Oil was always available at a price. Japan ended up with as much oil security as the US despite its lack of oil giants like Exxon or Chevron. However, talk of oil security remained high fashion among diplomats and politicians everywhere. Rule bound public sector managers found it simpler and safer to contract long-term supplies than seek bargains in short-term markets.

When Reliance entered the scene, Dhirubhai Ambani asked his managers to explore all possible refinery configurations. They considered 2,300 different configurations. Eventually, Reliance opted for a highly complex refinery, because of two potential advantages. One, a complex refinery could crack all low-value fractions (such as fuel oil) into higher value products in a fluid catalytic cracker. Two, a complex refinery could refine a wide variety of crude. However, this flexibility came at a price: a complex refinery cost much more than a standard one. How did Reliance justify an expensive, complex refinery of the sort that Singapore and other traditional refining centers had avoided? First, it took a huge bet on the composition of future oil supplies in the world. It bet that the availability of low-quality crude would outstrip that of high-quality crude, creating a widening price discount for low-quality varieties. This would make it profitable to buy low-quality crude that could not be processed efficiently in a simple refinery, but could be cracked in a complex refinery. Second, Reliance bet that profit opportunities would constantly arise because of volatile price changes for crude and refined products (such as petrol, diesel and kerosene).

Every crude variety yielded a different mixture of refined products. By tracking the prices of different crudes and products, Reliance could constantly spot opportunities to buy a crude variety that was cheap relative to the products it could yield. A simple refinery lacked the flexibility to switch from one crude to another. But a complex refinery could switch not only from one crude to another but also from one product-mix to another. For instance, Jamnagar could increase petrol output at the expense of diesel and vice versa, depending on which was most profitable at the time. Reliance bet that this flexibility would more than justify the high cost of a complex refinery. It has been vindicated in spades.

However, its emphasis on flexibility has a corollary. Its strategy is based on opportunism in selecting the most profitable crude to import at any point of time. This means it does not emphasise security in supply. Reliance has firm contracts for only half its capacity. For the rest, it trawls the markets in search of short-term bargains. Diplomats and politicians would regard this as insecurity of supply. But Reliance has proved that such insecurity of supply can translate into security of high profits!

(Source: Oil security can be high-cost folly , Swaminathan S Anklesaria Aiyar, Saturday, March 25, 2006 08:39:34 pm TIMES NEWS NETWORK)

case
TATA RYERSON LTD

Steel is produced by melting iron ore, scrap metal, and other additives in furnaces. The molten metal output is then solidified into semi finished shapes before it is rolled, drawn, cast, and extruded to make sheet, rod, bar, tubing, and wire. Other establishments in the industry make finished steel products directly from purchased steel.

Steel mills employ sophisticated technology. Taking several forms, this technology has improved both product quality and worker productivity. Computers are essential to most technological advances in steel production, from production scheduling and machine control to metallurgical analysis. Computerized systems change the nature of many jobs, while they eliminate or reduce the numbers of others. At integrated mills, production begins when *material-moving workers* use robots and cranes to load iron ore, coke, and limestone into the top of a blast furnace. As the materials are heated, a chemical reaction frees the iron from other elements in the ore. *Metal-refining furnace operators and tenders*, also known as *blowers* and *melters*, use automated and computer controls to manage the overall operation of the furnace to melt and refine metal before casting or to produce specific types of steel. They gather information on the characteristics of the raw materials they will use and the type and quality of steel they are expected to produce. They direct the loading of the furnace with raw materials and supervise the taking of samples, to ensure that the steel has the desired qualities. They may also coordinate the loading and melting of raw materials with the steel molding or casting operation to avoid delays in production.

Metal pourers and casters tend machines that release the molten steel from the ladle at a controlled rate into water-cooled molds, where it solidifies into semi finished shapes. This process is called “continuous casting.” These shapes are then cut to desired lengths as they emerge from the caster. During this process, operators monitor the flow of raw steel and the supply of water to the mold. The “rolling” method is used to shape most steel processed in steel mills. In this method, hot steel is squeezed between two cylinders, or “rollers,” which flatten or shape the steel. *Rolling machine operators* operate the rolling mills that produce the finished product; the quality of the product and the speed at which the work is completed depend on the operator’s skills. Placing the steel and positioning the rollers are very important, for they control the product’s final shape. Improperly adjusted equipment may damage the rolling mill or gears. *Extruding and drawing machine operators* control equipment that extrudes, or draws, metal materials into tubes, rods, hoses, wire, bars, or structural shapes. *Cutting, punching, and press machine operators* operate machines that saw, cut, shear, slit, punch, crimp, notch, bend, or straighten metal. *Welding, soldering, and brazing workers* join metal components or fill holes, indentations, or seams of fabricated metal

products. *Multiple machine tool operators* are skilled in the operation of more than one type of cutting or forming machine tool or robot.

Tata steel

The Tata Iron and Steel Company (now Tata Steel) was established to set up India's first iron and steel plant in Jamshedpur. The plant started production in 1912. It was founded by Jamsetji Nusserwanji Tata, a visionary, It had an initial capacity of 160,000 tonnes of pig iron, 100,000 tonnes of ingot steel, 70,000 tonnes of rails, beams and shapes and 20,000 tonnes of bars, hoops and rods. It also had a powerhouse, auxiliary facilities and a laboratory. In 1917, the company increased its steel production capacity to 500,000 tonnes and introduced the modern Duplex process of making steel.

Since then the company has continued to add new units and increase capacity. It was in 1955 that Tata Steel began its two million-tonne expansion programme, the largest project in the private sector at that time. The project was completed in December 1958. Beginning in the 1980s, the company undertook in various phases an ambitious modernisation programme. The first phase, between 1981 and 1985, involved a total project cost of Rs.223 crores. This phase, among other things, saw the installation of two 130 tonne LD converters, two 250 tonne a day oxygen plants, a bar forging machine, two vertical twin-shaft lime kilns and a tar-dolo brick plant. Significantly, a six-strand billet caster and a 130-tonne vacuum arc refining unit were installed, that too in the integrated steel plant.

The second phase (1985-1992), involving a project cost of Rs.780 crores, saw for the first time in India coal injection in blast furnaces and coke oven battery with 54 ovens using stamp-charging technology. Apart from this, a 0.3 mtpa (million tonne per annum) wire rod mill, a 2.5 mtpa sinter plant, a bedding and blending plant and a waste recycling plant of 1 mtpa were installed.

The cost of the third phase (1992-1996) of the project was Rs.3,600 crores, and that of the fourth phase (1996-2000) Rs.1,300 crores. The company commissioned its 1.2 mt (million tonne) capacity Cold Rolling Mill Complex at a project cost of Rs.1,600 crores. This four-phase modernisation programme has enabled Tata Steel to be equipped with the most modern steel-making facilities in the world. As on 2004, the Tata Steel facility has a hot metal capacity of 3.8 mtpa and a crude steel capacity of 3.5 mtpa, corresponding to a salable steel capacity of 3.4 mtpa.

Tata Steel has continuously upgraded technology and capacity like other steel producers, but in 1997 they looked beyond technical innovations and decided to offer value by bringing in organizational innovation in the out bound supply chain. They established joint venture with Ryerson Tull to establish Steel Service Centres.

Steel service center

A Steel Service Center buys steel products in large quantities from producing mills and holds the material in inventory until sold to a customer. When a service center sells steel it will perform any processing the customer requests, load the steel and deliver it to the user. Service Centers usually offer varying degrees of material "pre-processing." Pre-processing involves basic cutting services, such as sawing, shearing, and shape burning to cut material to a size and/or shape that is either immediately usable by the customer, or greatly reduces the customer's time to make the steel usable.

The type, quantity, and sophistication of pre-processing services offered by a particular Service Center are determined by the Service Center's product and customer mix. But about seventy percent of the metal passing through Service Centers undergoes some form of pre-production processing, such as slitting, shearing, sawing, grinding, flame cutting, coil coating, and cutting-to-length.

The existence of Steel Service Centers allows the steel user to have huge inventories readily available while only paying for the steel they need, when they need it. This reduces or eliminates the need for end users to tie up capital in inventory, pre-processing equipment, processing personnel, and trucks.

Collaboration with Ryerson

Ryerson Inc is a 160 year old steel distribution firm in USA. With 150 service centres in USA, Maxico and Canada, it had a turnover of $5 billion. They do not offer any technology to make better steel but deliver value to the users by giving them exact quantities and exact form at the exact time.

Considering that steel in India is sold through stock yards, this is a radical innovation in delivery of value to user. To facilitate transfer of best practices in outbound supply, Tata Ryerson was incorporated in 1997 as a 50:50 joint venture with a vision to proactively shape the business of processing and distribution of industrial materials in India.

In 1997 hundred percent of mill produce is sold direct to user through stock yards and this has come down to 58% in 2005 and Tata steel has taken a target of converting 70% of mill produce at service center. The benefits of JV are:

- Helped Tata Steel to capture 80% of Auto market.
- Helped Tata Steel to be the first to introduce new products (Roll formed coated sheets, steelium etc).
- Increase customer satisfaction index by more than 10 points.
- Increase of slaes volume and addition of large number of small customers.
- Implementation of vendor servcing model.
- Be the first to introduce steel service centre facility in the country for large and small customers.

This latest innovation adopted by Tata steel was not technical but a new organizational process to add value in the outbound supply chain.