NATIONAL PRODUCTIVITY COUNCIL

Productivity

Vol. 49 April - June 2008 No. 1

Focus : Knowledge Management

Guidelines for Contributors

Scope and Coverage

PRODUCTIVITY is the principal journal of the National Productivity Council of India. The Journal aims at disseminating information on concepts of and data on productivity and its growth in India and elsewhere. It also aims at disseminating knowledge on techniques and methods of productivity improvement through effective management of all types of resources. Thus, contributions from a large spectrum of disciplines are accepted for publication. Only those manuscripts that present the results of original research and analysis are acceptable to the Journal. The managerial/policy implications of the study should be highlighted separately towards the end of the paper.

Format of Manuscript

Contributions should be of about 5,000 words length. Tables, illustrations, charts, figures, exhibits, etc. should be serially numbered and typed in separate pages and should not be mixed with the main text. The text should be addressed to the Editor, PRODUCTIVITY, National Productivity Council, Utpadakata Bhawan, Lodi Road, New Delhi - 110 003

About the References

Only those references which are actually utilised in the text should be included in the reference list. In the text, references should be cited with the surname of the author(s) alongwith the year of publication and the page number, all in brackets. If there are more than one reference by the same author during any year, the year may be subscripted with 'a' or 'b'. For instance, reference may be given at the end of the sentence as : (Szendrovits, 1998a, p. 337). Sources of data need to be given below each table unless otherwise mentioned in the text. Reference list should be alphabetically arranged. Each reference should carry the surname of the author, followed by other names, the title of the paper in quotes, the name of the journal underlined, volume and issue numbers and the year of publication. In the event of a book, the title should be followed by the publisher's name and year of publication. In the event of a report from an organisation, the name of the organisation may be cited in the place of the author.

Accompanying Material

The manuscripts should be accompanied by :

1. An abstract of the paper not exceeding 100 words.
2. A declaration that the paper is original and has not been submitted elsewhere for publication.
3. A note about the author(s) not exceeding 50 words.

Subscription :

Subscription and orders for the journal should be sent to the publisher: **MD Publications Pvt Ltd,** New Delhi.

Annual Subscription rates for subscribers are :

In India (Rs.)		In Other Countries (US$)	
Print	1200.00	Print	120.00
Online	1000.00	Online	100.00
Print + Online	1500.00	Print + Online	150.00

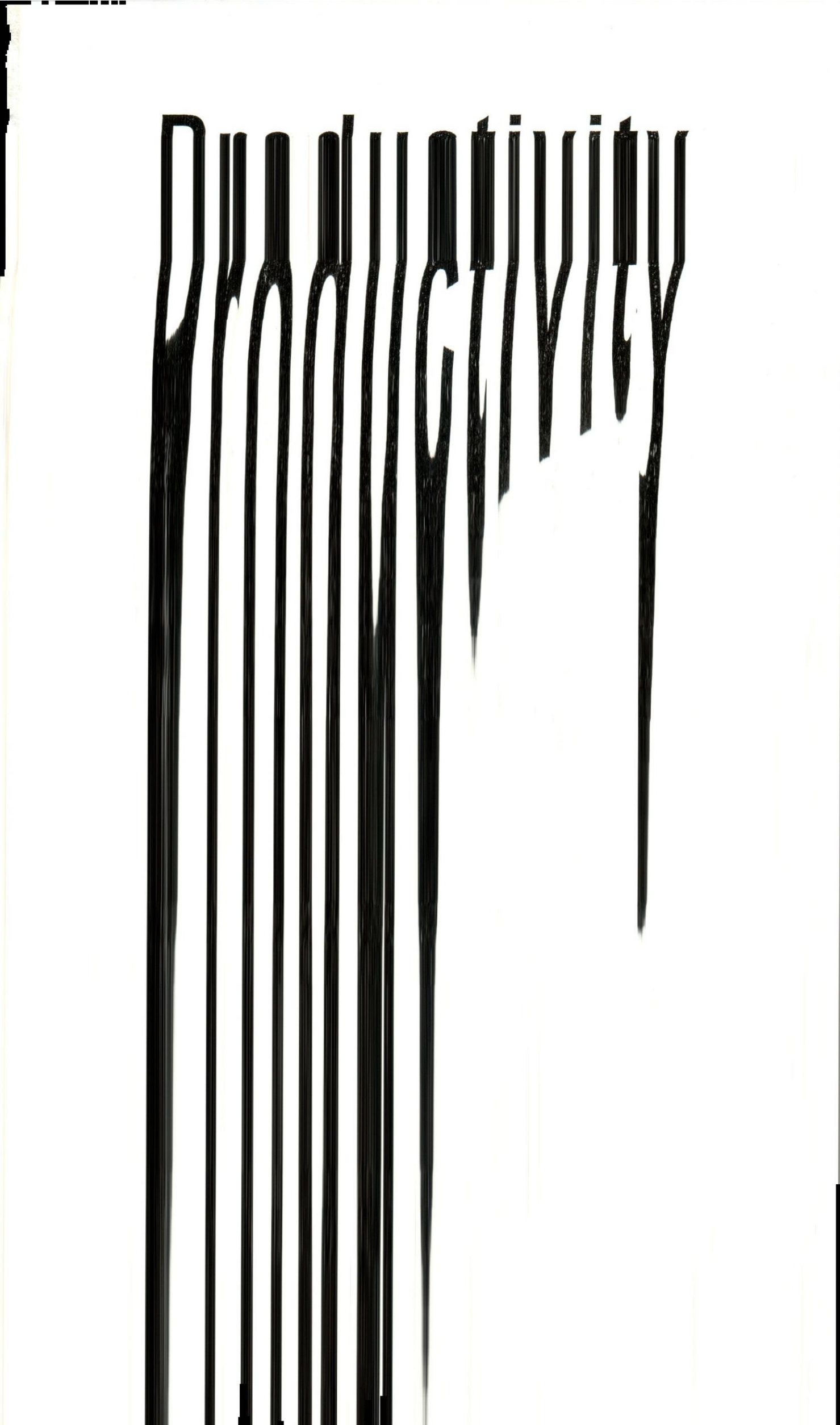
Postal Charges : **(Rs. 150.00 (In India)**
(US$ 40 (Rest of the World)

All remittance must be paid in favour of :
MD Publications Pvt Ltd,
payable at New Delhi, India

All business correspondence to be addressed to:

MD Publications Pvt Ltd
"MD House", 11, Darya Ganj,
New Delhi-110 002
Phone :+91-11-41563325 (Customer Service)
+91-11-41562846 (Editorial)
E-mail (orders) : order@mdppl.com
Website : www.mdppl.com

ISSN 0032-9924


Productivity

Productivity

A QUARTERLY JOURNAL OF THE NATIONAL PRODUCTIVITY COUNCIL

Vol. 49 • April - June 2008 • No. 1

MD Publications Pvt Ltd
New Delhi
www.mdppl.com

Publishers & Distributors :

MD Publications Pvt Ltd
"MD House", 11, Darya Ganj,
New Delhi-110 002
Phone : +91-11-41563325 (Customer Service)
+91-11-41562846 (Editorial)
E-mail (orders) : order@mdppl.com
Website : www.mdppl.com

ISSN : 0032-9924

Published and Printed on behalf of National Productivity Council,
by Mrs. Rajni Gupta, **MD Publications Pvt Ltd,**
at Printext, New Delhi, India

Contents

Technology and Innovation for Knowledge Management Conference Theme Paper

G S Krishnan, Arundhati Chattopadhyay & Avadh Yadav

The Second International Conference on Knowledge Management for Productivity and Competitiveness organized recently by the National Productivity Council, focused on the role of technology and innovation towards achieving a knowledge-oriented society.

G S Krishnan is Director IT, Arundhati Chattopadhyay is Deputy Director and Avadh Yadav is Assistant Director, National Productivity Council

In this new economy that is propelled by knowledge, the capacity of firms to use innovative technology and to adapt to new organizational changes or methods, plays a key role in establishing its industrial leadership and enhancing the competitiveness of nations. Although there is no dispute on the role of knowledge management, the relationship between competitiveness and its enablers like scientific research, industrial innovation as well as technological and organizational change is a debatable issue. Therefore, establishing an operational linkage among the enablers of competitiveness and integration into the existing national system through effective knowledge management, has become not only a focus area in academic research but also a priority In the agenda of policymakers across the globe. In this worldwide phenomenon, India cannot afford to be a mere spectator but needs to be an active participant in evolving innovative technique(s) or model(s) for knowledge management.

The first International Conference on "Knowledge Management for Productivity and Competitiveness" organized by the National Productivity Council (NPC) held during January, 2007 at New Delhi, has already created the base for further research by identifying the issues that need to be addressed for managing knowledge for the nation's welfare. Some of the issues that require urgent attention are:

- Need for a coherent theory to integrate the philosophical, economic and technological perspectives;
- Developing innovative organizations;
- Human factors in KM;
- Establishing university-industry-government alliances to develop national innovation systems;
- Enabling rural people to utilize the rural knowledge centers set up for their skill building and information empowerment;
- Deploying GIS-based data collection for rural policy planning;

- Incorporating KM in governmental processes and in project-based organizations;
- Harnessing knowledge for innovation;
- Establishing an Internet portal on KM;
- Publishing a KM journal;
- Training knowledge officers;
- Creating enabling ambiences for knowledge generation and protection;
- Intellectual property rights protection.

All policy recommendations need to be evolved keeping India's current socio-economic scenario and future mega trends in mind.

India's Economic Performance Scorecard

The level of economic growth of a nation plays a significant role in providing a favorable environment for innovation and technological development.

An effort has been made in Table (1) to compare India's economic performance with China (its nearest competitor) and USA (a developed nation). India's overall competitiveness rank is twenty-seventh out of 55

Table 1: India's Economic Performance Scorecard *vis-à-vis* China and USA

Indicators	India	China	USA
Overall Competitiveness Ranking (2007)	27	15	1
Ranking in Economic Performance	10	2	1
Ranking in Government Efficiency	33	8	19
Ranking in Business Efficiency	19	26	6
Ranking in Infrastructure	50	28	1
Gross Domestic Product (PPP) *(US$ billions)* (2006)	4127	9758	12826
Gross Fixed Capital Formation *(GFCF as % of GDP)*	37.1	43.3	19.6
Real GDP Growth *(%)*	9.2	10.7	3.3
Real GDP Growth per Capita *(%)*	7.46	10.12	2.31
GDP Growth per Capita *(US$)*	726	2040	44255
GDP Growth per Capita *(PPP)*	3652	7424	42857
Current Account Balance *(% of GDP)*	-1.42	8.47	-6.47
Balance of Trade *(% of GDP)*	-6.61	6.62	-6.66
Export of Goods *(% of GDP)*	14.65	36.14	7.83
Growth in Export of Goods *(US$)(%)*	20.81	27.18	14.50
Import of Goods & Services *(% of GDP)*	29.7	33.2	16.8
Trade to GDP Ratio *[(Export + Import)/2GDP]*	26.62	36.30	13.78
Direct Investment Flows Abroad *(% of GDP)*	0.19	0.50	-0.10
Investment Flows Inward *(% of GDP)*	0.90	3.53	0.80
Govt. Budget Surplus/Deficit *(% of GDP)*	-4.00	-0.41	-1.58

Source: World Competitiveness Yearbook, IMD (2007)

economies ranked by the Institute for Management Development (IMD) in the World Competitiveness Yearbook (WCY, 2007). The USA is number one and China, with its fifteenth rank in overall competitiveness, is way ahead of India. Inadequate and low maintenance of infrastructure is mainly responsible for India's low competitiveness. However, in business efficiency, India has been outperforming China in recent years.

The Indian economy is already experiencing the outcome of the economic liberalization process that was initiated in 1991. The country has no doubt benefited from trade deregulation, high FDI inflows, falling transportation and communication costs and an increasing rate of technological change. The planning and implementation of economic reforms is nothing but effective knowledge management by our policy makers.

The positive impact of the economic reforms can be seen across all sectors *viz.*, Agriculture, Industry, especially manufacturing and services that have experienced a growth rate of 2.7%, 10% and 11.2 respectively during the year 2006-07. The Gross Domestic Product (GDP) of the country for the past four years (2003-04 to 2006-07) has grown at an impressive rate of 8 to 9%. In the year 2006-07, the contributions of Agriculture,

Industry and services to GDP has been 18.5%, 26.4% and 55.1% respectively (Economic Survey, 2006-07). The growth of India's manufacturing sector increased from 9.1% in 2005-06 to 11.3% in the year 2006-07. However, the second and third quarters of 2007-08 have shown a marginal decline in the growth of the manufacturing sector, which may slightly bring down the rate of growth in GDP for the current year (2007-08). However, one need not be pessimistic about India's future prospects as the fundamentals of Indian economy are quite strong.

India's Preparedness towards Innovation and Technological Development – Education and Research

Reviewing India's preparedness towards innovation and technological development is essential before discussing in detail the significance of innovation and technology for knowledge management. An attempt has been made in Table 2 to depict India's preparedness towards innovation and technological development in comparison with that of China.

Table 2: Preparedness towards Innovation & Technological Development: India *Vs* China

Indicators	India	China
Education System		
Public Expenditure on Education (% of GDP) (2005)	3.2	3.1
Public Expenditure on Education per capita (2005) (US$ per capita)	20.9	45.6
Pupil Teacher Ratio in Primary Education (2004) (Ratio of students to teaching staff)	40.20	19.98
Pupil Teacher Ratio in Secondary Education (2004) (Ratio of students to teaching staff)	32.43	18.65
Educational System *(2007) (IMD Survey: Meets the needs of a competitive economy)*	5.73(16)	4.73(27)
University Education (2007) (IMD Survey: Meets the needs of a competitive economy)	6.07(20)	4.98(28)
Language Skills (2007) (IMD Survey: Meets the needs of Enterprise)	6.93(14)	4.65(37)
Qualified Engineers *(2007) (IMD Survey: Availability in the labour market)*	7.57(3)	3.7(53)
Knowledge Transfer (2007) (IMD Survey: Between companies and university)	4.70(27)	3.98(38)
ICT System		
Investment in telecommunications *(2005)(% of GDP)*	0.56	1.14
Fixed telephone lines *(2005)(per 1000 inhabitants)*	45	266
Mobile Phone Subscribers *(2005)(per 1000 inhabitants)*	81.6	299.0
Computers per 1000 people *(2006)*	19	56
Internet users per 1000 people *(2006)*	61.70	103.59
Broad band Subscribers per 1000 people *(2005)*	1.17	28.68
Communication Technology both voice & data (2007) *(IMD Survey: Meets business requirements)*	7.67(32)	7.74(31)
Information Technology Skills (2007) *(IMD Survey: Readily available)*	8.75(7)	5.81(51)
Public and Private ventures supporting technological development *(IMD Survey, 2007)*	5.73(30)	6.43(20)
Development and Application of Technology *(2007) (IMD Survey: Supported by legal environment)*	6.57(27)	6.44(29)
Funding for Technological Development *(2007)(IMD Survey: Readily Available)*	6.37(19)	4.12(42)
Technological Regulation (2007) *(IMD Survey: Supports business development & innovation)*	6.60(23)	6.25(29)
Innovation System		
Total Expenditure on R & D *(% of GDP) (2005)*	0.84	1.33
Business Expenditure on R & D (% of GDP) *(2005)*	0.19	0.91
R&D Personnel per million population *(2004)*	119	708
Scientific & Technical Journal Articles/ Million population *(2003)*	12.00	22.65
Patents Granted to Residents, average for 2003—05	695	16700
Science Degrees *(% of total first university degree)(2002)*	23.47	57.40
Science in School *(2007) (IMD Survey: Emphasis of Science in schools)*	6.63(4)	5.98(8)
Youth Interest in Science *(2007)(IMD Survey)*	6.73(3)	5.94(7)
Intellectual Property Rights *(2007)(IMD Survey: Adequately enforced)*	5.29(32)	5.40(31)
Scientific Research *(2007)(IMD Survey: Supported by legislation)*	5.73(28)	6.08(23)
Basic Research *(2007)(IMD Survey: enhance long-term economic development)*	5.30(31)	6.58(17)

Source: World Competitiveness Yearbook, IMD (2007) & KAM (2006) World Bank
Note: In case of survey findings the factor ranking of the country is given in brackets

The tremendous growth in Indian information and communication technology (ICT) has further provided an impetus to growing India's integration with the rest of the world. This has not only enabled quick access to information by knowledge workers but also reduced the time and space for global, social and economic networking. However, it is interesting to note from the IMD survey that IT skilled people are readily available in India but that the number of communication technology workers (both voice and data) is not sufficient to meet the business requirement. Although funds are available for technological development, the technological regulations need to be more supportive towards business development and innovations. The legal environment for development and application of technology also needs to be improved.

It is encouraging to note that the Indian youth is very much interested in science which is also emphasized in schools. But as one goes up the ladder of higher education the country's performance is not as satisfactory. Around 24% of university degrees are given in the science stream. This clearly shows that our education system is not able to cater to the requirements of the country. This may be due to either a lack of adequate higher education institutions, or a lack of qualified faculty members or because the opportunities available after receiving a degree in science is not as lucrative as other degrees for example, MBA. Many times, they are combinations of more than one specific cause. This is also reflected in the attitude of Indians towards basic research, which is quite poor as compared to those of developed economies like Switzerland (8.27, rank 1), Singapore (8.12, rank 2), USA (7.67, rank 3), Germany (7.21, rank 5), Malaysia (6.96, rank 8) and Japan (6.77, rank 13) (WCY, 2007). The result is an acute shortage of R&D personnel and a low level of research in the country. Further, as intellectual property rights are not adequately enforced, the number of patents granted to residents is as low as 695 against 16700 in China during the period 2003—05.

It is not possible to develop the nation's innovation system without bringing necessary changes in the present educational system. The public expenditure on education needs to be substantially increased to finance higher education. The university-industry linkage needs to be strengthened to bring the innovations from the laboratory to market. Unless the knowledge of our researchers is utilized for the nation's welfare, India's competitive advantages would remain confined within the four walls of the research centers.

Technology for Knowledge Management

Information and Communication Technology (ICT) has been the career and the binding force, which has enabled knowledge to reach all parts of society. Whereas in earlier times, ICT was considered to be an exclusive asset of the privileged in society, the developments in I&C Technology over the past two decades have been tremendous and the penetration to the grassroots levels can be gauged from the magnitude of mobile phone users in the country. The knowledge management process and its uses have made significant changes in the way technology is designed and utilized by different cross sections of the people from various fields of life.

The impact of knowledge management technology varies enormously from situation to situation. Several technologies recur in many knowledge management programs, partly because they are generic and pervade many core activities and processes. Some of these technologies are well established over a sufficiently long period of time whereas new ones are appearing continuously giving a wide choice to the implementer.

With the market demanding much of knowledge management solutions, some software firms get into re-labelling their products and approaches, *e.g.*, information management as knowledge management, databases as knowledge bases and data warehouses as knowledge repositories. However, true knowledge management solutions are not simply new labels, but add knowledge-enriching features, which include adding contextual information to data: Where was this information used? What factors need to be considered when using it? Some other knowledge friendly options of such software technology should be:

- Using multimedia, *e.g.*, adding video clips or voices to databases of best practice or problem solution databases;
- Providing annotation — adding informal notes to individual data items; using MAPI-enabled software, where a document or file can be sent with a forwarding note by email;
- Qualifying information — giving details of originator, users adding comments about the quality of information;
- Providing links to experts — a 'click' button to contact an expert (either by email or phone). GIGA, for example, lets its client access global experts through its website.

Information and communications technologies are an important ingredient of virtually every successful knowledge management program. An ever wider range of highly effective solutions are coming to market, including a new generation of artificial intelligence solutions, new types of document management systems and various collaborative technologies such as the Internet.

The successful implementation of these technologies would depend upon, as always, giving appropriate focus to the non-technical factors such as human factors, organizational processes and culture, the multi-disciplinary skills of hybrid teams and managers, and the already existing knowledge repository of prior learning — providing, of course, that it is well structured, accessible and gives access to critical expertise.

Innovation for Knowledge Management

Human beings have evolved as the sole managers of the global destiny by their sheer ability to be creative, which is their only differentiating quality from other living species. Creativity has been the hallmark of competitiveness of the knowledge-centered corporate firms.

When information is ubiquitous and is no longer a source of competitive advantage, it is the innovative use of that information (via knowledge) that differentiates the people, companies and nations. Innovation may become the basis of all competitions in the future.

According to Peter Drucker, 'innovation is the means by which the entrepreneur either creates new wealth producing resources or endows existing resources with enhanced potential for creating wealth' (Drucker, 1985). Most innovations result from a conscious purposeful search for opportunities, which are found in unexpected occurrences, incongruities, process needs, and industry and market changes.

When growth is associated with innovations, it leads to higher living standards and reduction in poverty. In India, where a still large part of the economy is contributed by the informal sector, innovative activities are by and large concentrated around small islands of excellence. There is a dire need to spread the innovative spirit across all the sectors and workforce for larger benefits.

A recent World Bank study (2007) has suggested that India's innovation strategy should encompass the following:

- Focus on increasing competition as part of improving its investment climate, supported by stronger skills, better information infrastructure and more financing – public and private;
- Strengthening of its efforts to create and commercialize knowledge, as well as better diffusing of existing global and local knowledge and increasing the capacity of smaller enterprises to absorb it — if all enterprises could, with least cost, achieve national best practices based on knowledge already used in India, the output of the economy could increase more than fivefold;
- Fostering more inclusive innovation—by promoting more formal R&D efforts for poor people and more creative grassroots efforts by them and by improving the ability of informal enterprises to exploit existing knowledge.

The importance and practices of innovation for knowledge management, through three relevant types, namely, strategy innovation, democratic innovation and inclusive innovation are discussed below.

Strategy Innovation

All businesses are vulnerable, to some degree, to competitive pressures in the dynamic market place, making their future uncertain. A start up company with a website and access to cheap manufacturing capabilities overseas, could replicate products at lower prices and steal a large market share, whereas a global Goliath could apply its considerable resources and technologies to offer the customers more than anyone else.

Corporations which mould their business strategy to have innovation as the baseline have been able to provide greater shareholder value and sustain the business over longer periods despite disruptive technologies posing major challenges. When the digital photography technology tried to disrupt the traditional market supremacy of the Kodak Company, its corporate managers took innovative steps for strategizing the smooth change over from their traditional film-based market leadership to digital products and services, thus sustaining their business relevance and competitiveness.

According to Michael Porter, "Strategic fit among many activities is fundamental not only to competitive advantage but also to the sustainability of that advantage. Positions built on systems of activities are far more sustainable than those built on individual activities."

Strategy innovation is a process of applying innovative thinking to the entire business model of a company, not just to its products or inventions. It is the process of finding a way to "change the rules of the game" so that a company's products, competencies and assets provide it with a competitive advantage in the marketplace.

The strategy innovation process starts with the future scenario and then plans backwards. To be successful, the search for new business opportunities cannot be constrained by today's corporate conditions or today's market conditions. A strategy innovation is always future-oriented. It must be able to transcend today's conditions and imagine what is possible in the future. After identifying potential new business opportunities of the future, the planning process works backwards to identify the key strategic milestones to get there. If India wishes to enter

the league of global economic giants in the coming decades, it has to innovate its strategies by identifying future mega trends that would guide the competitiveness of knowledge economies.

Democratic Innovation

Innovation has often been cited as the predominant property of the manufacturers of goods and services. It is a fact that many large corporations like IBM, Motorola, 3M and others have been carrying out research and development to identify innovative products and markets and in the process improve the productivity of their corporate performance and provide cost effectiveness to their customers. However, of late, the sheer magnitude of size and scope of the world markets make it impossible to identify all customer needs in advance and hence even giant multi-nationals have failed to make their innovations satisfy all customer desires. An alternative mechanism of democratic innovation is emerging where the customers at the grassroots level, who do not have high purchasing powers, can bring in innovations on the use of existing products or force large companies to innovate and produce low cost products for their consumption due to their sheer size and volume. The much-reported conversion of washing machines into 'Lassi Churning machines' is a noteworthy example of such democratic innovation processes. Similarly, many fast moving consumer goods (FMCG) are produced and sold in low quantity sachets to cater to the low purchasing powers of the village consumers.

As consumers and lead users develop and test their innovations in their own user environments, they learn more about the real nature of their needs. They then often freely reveal information about these innovations. Other users also adopt these innovations, comment, modify or improve on them, and freely reveal what they have done in turn. All of these freely-revealed activities by lead users offer manufacturers a great deal of useful information about both needs embodied in solutions and the nature of their markets. Thus the user-developed prototyped greatly simplifies the manufacturer's developmental process because they no longer need to understand customers' needs accurately. Instead, they have the much easier task of replicating the function of user prototypes that users have already demonstrated as being responsive to their needs. For example, a manufacturer seeking to commercialize a new type of farm equipment and coming upon a prototype machine developed by a local farming community need not understand precisely why those innovators want this product or even precisely how it is used; the manufacturer need only understand that many farmers are willing to pay for it and then reproduce the important features of the user developed prototypes in a commercial product.

Inclusive Innovation

As more than sixty per cent of the Indian population belong to the lower income groups, the fruits of high-end innovations many times do not filter down to their level. Hence, there is an important need to promote 'inclusive innovation' so that they are brought into the fold of beneficiaries of the changing economies. The Government's objective of promoting inclusive growth as a national agenda also points to the dire need of inclusive innovation to be promoted as a national strategy. There is also a need to consciously promote inclusive innovations by harnessing, increasing and redirecting formal innovation creation efforts. One such example is the National Innovation Foundation Repository and the Honey Bee Network, which has captured more than 50000 grassroot level innovations and traditional knowledge practices from over 400 districts of India. There is also the requirement of promotion of grassroot level entrepreneurs who can promote and diffuse innovations for commercial gains. The Rural Business Hubs promoted by the Ministry of Panchayati Raj is an example in this direction. Finally, mechanisms need to be evolved to help informal enterprises and institutions absorb innovative capabilities already established and practiced elsewhere.

Unleashing India's Innovation Potential

The recent study by the World Bank (2007) has identified the structures and processes to unleash the innovation potential of India (*see* figure 1).

It has been well established that human, organizational and cultural factors are the ultimate determinants of success. ICT solutions for knowledge management are, in essence, social computing and therefore need such an approach. Various studies have identified that knowledge management implementations that are successful are typically found to share the following characteristics:

- Clear vision and leadership — a solid appreciation of the contribution of knowledge to the achievement of strategic objectives and how IT can help;
- Coordinated working through multi-disciplinary teams — including information managers, facilitators, business experts as well as technologists;
- Active User Involvement — Users are actively engaged in developing solutions that enhance knowledge activities;
- Well-designed processes that engage humans where they are best and allow them to interact

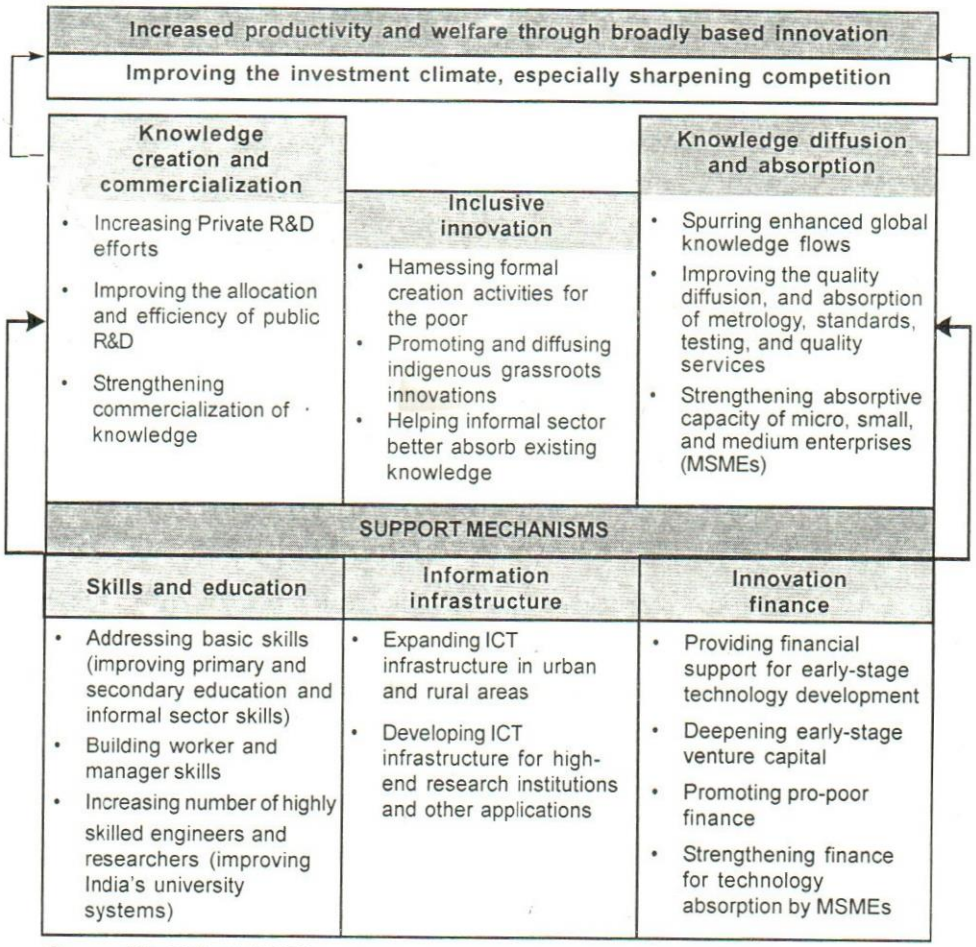
with technology where it can complement the human efforts. An organizational process that does not consider applying best knowledge (and updating it) is an incomplete process;

be harnessed in the fast changing and growing Indian economy. Technology and innovation would be the crucial players in the knowledge economy for achieving the national objectives. The enabling factors and precautions to be adopted while using the emerging knowledge technologies have been discussed. The

with technology where it can complement the human efforts. An organizational process that does not consider applying best knowledge (and updating it) is an incomplete process;

- Active learning and experimentation — As knowledge is always dynamic, there is no such thing as a finished requirement specification; solutions continuously evolve and adapt;
- A knowledge sharing culture — People fundamentally want to share information and their experience and the organizational systems are managed to motivate such behaviour.

In this paper, an attempt has been made to bring out the major knowledge management issues that would need to be harnessed in the fast changing and growing Indian economy. Technology and innovation would be the crucial players in the knowledge economy for achieving the national objectives. The enabling factors and precautions to be adopted while using the emerging knowledge management technologies have been discussed. The importance of innovation as the basic enabler to utilize human creativity for economic prosperity has been discussed. The different types of innovations like strategy innovation, democratic innovation and inclusive innovation that would need to be encouraged in India have also been delved upon. Finally, the enabling factors that would help achieve the benefits from technology and innovation adoption for knowledge management have also been described.



Source: World Bank (2007)

Fig. 1

References

Beyond Productivity — Information Technology, Innovation and Creativity. National Research Council of the National Academies, The National Academies Press, 2001.

Drucker, Peter F. (1985) "The Discipline of Innovation" Harvard Business Review.

Economic Survey (2006-07). Government of India.

Hippel, Eric Von (2005). "Democratising Innovation", MIT Press.

IMD (2007). World Competitiveness Yearbook.

National Knowledge Commission, Government of India (2006). "Report to the Nation".

Proceedings of NPC's First International Conference on "Knowledge Management for Productivity and Competitiveness".

Johnston Junior, Robert E & J. Douglas Bate (2003). "The Power of Strategy Innovation" AMACOM.

World Bank (2006). "Knowledge Assessment Methodology".

World Bank (2007). "Unleashing India's Innovation — Toward Sustainable and Inclusive Growth" Mark A. Dutz (ed).

Before printing was discovered, a century was equal to a thousand years.

—Henry David Thorean

Status of Knowledge Management in Asia: Results of an APO Survey of Nine Member-Countries

Serafin D Talisayon

A survey of the status of knowledge management in nine APO member countries that APO started in the last quarter of 2006, when a team of nine national experts was identified and met in Bangkok. Here is a summary of the results of the survey. Insights are also provided into the International Productivity Conference, 2007.

Serafin D Talisayon is Director for R&D, CCLFI, Philippines.

KM Development across Asia: Uneven

What are the findings of these KM surveys? The first observation is that among APO member countries, the GDP of six are predominantly in services, namely, Japan, India, Korea, Hong Kong, Taiwan and Singapore. The services sector is knowledge-intensive and these are the more advanced countries among the APO member countries. We can see that services, to be more specific, knowledge-intensive services, will become more and more important for the APO member countries. In fact, the winners of the MAKE Asia Award come mostly from three of these countries, namely: Japan, India and Korea. In Asia, the global MAKE winners have caught up with their counterparts in Europe, although both Europe and Asia are still behind North America.

Another observation is that there are a number of APO member countries where professional KM associations had been started. This is an indicator of the extent of interest of a group of people who are concerned and dedicated to KM and, to my knowledge, these associations exist in Japan, Hong Kong, Singapore, Philippines, Malaysia and Indonesia. Thailand has a government-supported KM institute and Taiwan has a KM research center.

A few of the Asian governments have adopted a national strategy or a national policy towards a knowledge economy (KBE) or knowledge-based development (KBD). Government KBE or KBD policy can push forward the development of KM in that country. But so far, only Japan, India, Korea, Malaysia, Thailand and Singapore have adopted a national KM roadmap or strategy. My own country, the Philippines, has not and one of the things that we are doing is pushing our government to do what countries like India have done. Of course, the other side

of the coin is, there are a number of APO member countries which have not really started KM as much as the others.

Specific KM Strengths of Some Asian Countries

There were originally ten member countries APO wanted to include in the survey but for some reason APO could not find a national expert for Japan and so we had to proceed without Japan. While we have only nine countries, it is very noteworthy that each of them has specific strengths.

India is definitely the leader in ICT support systems for KM. KM practice is most prevalent especially in ICT companies, like INFOSYS and WIPRO. India has a National Knowledge Commission. It has a governance model on how to bring a nation towards becoming a knowledge-based economy or nation.

KM is extensively practiced in **Korea**. I was told by our Korean national expert that in Korean firms it is no longer a question whether or not to do KM. The question for them now is how to do KM. KM has been embedded in business processes in many companies and of course, we know that Korea is a leader in e-governance.

Singapore is also a leader in e-governance and in fact, Dr. Praba Nair, is one of the experts in e-governance. KM practice in the Singapore government is ahead of KM practice in the corporate sector. Singapore is one of the early adaptors of a national knowledge economy strategy and KM is applied both for productivity as well as innovation. The NPO of Singapore has the word "innovation", telling everybody that they are no longer just into productivity. They are also concerned with increasing innovation nationwide.

In **Taiwan**, KM is widely accepted and just like India, they have very good ICT support systems for KM. What is also very noticeable in Taiwan is that they have very active KM support from the government, particularly KM support for SMEs.

Malaysia exemplifies support from a national leader; KM development and KBD is leadership-driven: KM from the very top. The Multi-media Super Corridor would not have been there were it not for the push given by the former Prime Minister Mahathir. E-commerce and e-governance for the social sector are quite advanced in Malaysia.

It is very interesting that **Thailand** issued a royal decree about three or four years ago that requires all government agencies to do KM and become learning organizations. Thailand has set up the Office of KM and Development and they have supported the KM Institute.

In the **Philippines**, KM in government and in NGOs are driven by support from development funding institutions. KM development is largely donor-driven. There are advantages and there are disadvantages in that situation. One of the leading promoters of KM in the Philippines is the NPO of the Philippines, the Development Academy of the Philippines.

Vietnam has government-led initiatives to transform itself into a knowledge-based economy with knowledge-based development. Vietnam exhibited very rapid adoption of productivity and quality management tools. I would expect that from that base, they will also move on very rapidly to knowledge management. If there is an order from the top it will go very quickly down below.

In **Indonesia**, KM has been disseminated by the academe and the private sector. One of the things that is very interesting in Indonesia is that they have MAKE Indonesia. The franchisee, Dunamis, informs that introduction of MAKE Indonesia helped promote the appreciation and awareness of KM nationwide in that country.

Some Issues in the Development of KM in Asia

However, in all of these, there are some important issues to note. One issue is that there are very different and various interpretations and understanding of "knowledge management" or just the word "knowledge". This is going to lead to a lot of confusion. One of the things that APO may have to do is to develop a basic course in KM among NPOs. Thus, there must be a basic course for NPOs, specifically for practitioners. There must also be a common language. APO has a P-Glossary. I think APO should also develop a K-Glossary for KM so that we will have a common understanding of words and terms.

Another issue is the absence of explicit alignment of knowledge management initiatives to organizational goals. It is often only implicit. I think that there is a need for a tool or a methodology that will explicitly link KM and organizational goals and value creation. In fact, this is one way to convince the CEO to adopt KM because if the CEO, the president of the corporation or organization, does not see the direct connection of KM to organizational goals, he is unlikely to support KM. So this will be very useful. There are some APO member countries where KM is not yet as popular and widely practiced as in the others. Here

is where we need special assistance. APO has what they call BCBN, bilateral cooperation between NPOs. Maybe it is time to have an MBCN or a multi-lateral cooperation between NPOs. Such a program can address the need for a KM glossary and a training course on KM.

There are many approaches observed in the area of KM measurement, partly due to the fact that there is no common, agreed-upon framework. Thus the framework project that has been started by APO will be useful for this purpose. There are many gaps in measurement as well as different kinds of measurement. If we can have a very good framework then the measurements can follow. If there are no measures of KM impact, people will not be convinced about KM.

An interesting issue is the relationship between productivity or quality management and KM. This is something that is not very clear to many people. We need a way to be able to understand the linkage between productivity and quality management on the one hand and KM on the other hand. Since APO as a matter of policy has moved to KM and innovation, how do you link the framework of productivity and quality management to a larger framework that will include KM?

Setting up a network of KM practitioners in and outside NPOs can further stimulate the development of KM. After study meetings in APO are attended by different people most of whom want to learn about KM. However, their interests are so different that it becomes very difficult to have a continuing network which can be sustained after the event. But if we network the KM practitioners from NPOs who will be staying within these organizations, who have the interest to learn KM and to apply KM, there will be a greater chance that the network will continue to exist. It should be a self-sustaining network but it has to be supported, especially at the beginning. Through the network of KM practitioners among the NPOs, those NPOs that are not yet fully into KM can gain opportunities to learn from those NPOs which have gone ahead. This will be good for all because there are many countries in Asia that are good in certain things and which can transfer the knowledge to those who are willing to learn.

Motivating Knowledge Workers

An interesting pattern can be discerned from the case studies: Many of the good or best KM practice organizations employ various motivational approaches.

For example, setting up an intranet does not ensure that people will use it. In a voluntary network or e-group, participation varies according to interest. People may know how to do their job well but they may not want or be willing to do it. In addition to managing knowledge assets, motivating knowledge workers must also be given attention in KM.

Here are some examples.

Motivating Knowledge Workers: Examples from Asian Case Studies

Rewards and recognition	Rewards and recognition: Knowledge Dollar (K$), Joint President's and CEO's KM Award at Airtel, India; Learning Award for knowledge transfer and Enterprise Award for intrapreneurship at Unilever Indonesia; 10 different awards at Wika, Indonesia.
Measurable returns	Measurable returns from KM initiatives at Infosys, India; positive feedback on outputs/benefits of KM at Goldsun, Vietnam.
Mix of communication modes	Mix of informal and formal communication modes to get employee and customer buy-in at Qian Hu, Singapore.
Design of physical spaces	Physical spaces for interactions at SCG Paper, Thailand; redesigning library furniture and interior at Bank Negara Malaysia.
Caring leadership	A caring leadership is important in promoting a motivational organizational culture at JTC Corporation (Singapore). A survey of KM success factors revealed that senior management commitment ranked highest in Thailand and second in Malaysia.
Training and professional growth	Employees are motivated when they learn, receive training or get support for their professional growth. CAPCO (Taiwan) set up a Multimedia Cyber College and included on-line training and certification as part of its employee evaluation and promotion processes.

Peer-to-peer public compliments	SAIT's "Praise Ground" is a notable venue in the company intranet for peer-to-peer public compliments of exemplary KM behavior.
Honor and recognition as an expert or mentor	The honor of being a coach/mentor or an acknowledged expert or knowledge champion is good for motivation and getting "buy-in" at SCG Paper (Thailand) and Airtel (India). Wika and Bank Indonesia created the title of "begawan" or (sage) for mentors.
Overlap between personal and organizational goals	A workshop process for optimizing overlap between personal and organizational goals was tried among the KM Team of the Department of Health, Philippines.
Face-to-face interaction, socialization and learning	Face-to-face interaction, socialization and learning in communities of practice (CoP) was found effective Unilever Indonesia, SCG Paper and Siriraj Hospital in Thailand and SAIT in Korea. To sustain employee interest in KM, Bank Negara Malaysia uses study visits or attachments, benchmarking projects and cross-functional teams.

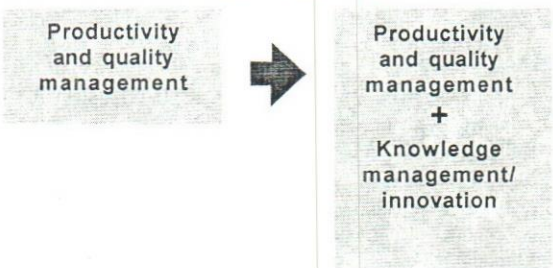
We have the knowledge dollar for rewards and recognition in Airtel; we have the learning award and enterprise award in Unilever Indonesia and other different awards in other companies. Measurement tools are also important because when everyone sees the numbers go up, of course, the good performers become more motivated. This is done in Infosys in India and Goldsun in Vietnam. Qian Hu in Singapore uses a mix of informal and formal means of communications to arrive at customer and employee buy-in.

The word "buy-in" is not in the English language but in KM, this is a common and important word. This aspect is very essential for the success of KM initiatives: we have to have buy-in, starting from the top and all the way down to the bottom of the organization. How do we do that? How do we motivate people to have buy-in?

There is also the solution of providing physical spaces to encourage interactions and knowledge exchange. A caring leadership, a leader who understands KM, models KM and lives and breathes KM can be a strong motivating factor. If the lower level people can see that their leader is an exemplar in KM, it becomes very easy for them to follow. But if there is just a formal directive from the CEO without a corresponding visible personal action, it may be counter-productive. So, support or sponsorship from senior management is really essential. The support can include budgetary allocation to support the KM initiative. Training and continuing opportunities for professional growth can motivate a knowledge worker to stay longer in a company. In CAPCO in Taiwan, they have a Multi-Media Cyber College that provides e-learning among the employees. The Samsung Advanced Institute of Technology (SAIT) has a very interesting mechanism. They called it "Praise Ground". Praise Ground is where someone will write a paragraph in the intranet about someone who has shown exemplary KM behavior. Then, that person praised will pass it on and praise another person. The praising process goes around. This is an interesting process applicable to many Asian cultures: Peer to peer public compliments for exemplary KM behavior. Acknowledging, recognizing and bestowing the honor of being a mentor or expert works well, too. In Indonesia, they use a title of great honor, "begawan". Begawan means sage or mentor. In the Philippines, there are workshop processes to maximize the overlap between personal goals and organizational goals. This is one way to `generate the personal energy or interest for organizational KM. Many case studies describe the efficacy of face-to-face interaction, socialization and learning. There are many case studies about this in Thailand, Korea and Indonesia.

Studying the case studies and the national reports, one could see that there is a shift going on among the case study organizations from concern with just productivity and quality management, to one of continuing interest in productivity and quality management, plus a new and additional concern for KM and innovation.

A Sift is Going On



Now we get back to the question: What is a coherent framework that can embrace both? How do organizations move towards KM or towards productivity-plus-innovation

in a smooth coherent fashion, because they see the inter-relationship of the two? This is very important because there are already many experts in productivity and quality management. If they can see that what they are doing is very much related to KM in this or that fashion, it will become so easy for them to move to becoming KM experts. This is not really a difficult thing to do as demonstrated by organizations which are undergoing this shift.

APO Secretary General Takenaka said that APO is going through a paradigm shift, from productivity alone to productivity-plus-innovation.

"The days when incremental or continuous improvement preoccupied corporate managers are over. It is to innovation and breakthroughs that those managers have turned their attention. For achieving innovation, the most relevant tool is no longer quality control or quality management. It is KM in its broadest sense, which includes value creation or knowledge creation that is the most relevant."

Learn everything you can, anytime you can, from anyone you can — there will always come a time when you will be grateful you did.

—Sarah Caldwell

Back to Basics: Strategies for Identifying, Creating, Storing, Sharing and Using Knowledge

Ron Young

New technologies can be effectively used to implement knowledge management at all levels, for individuals, teams, organizations and communities, locally, nationally, regionally and even across the globe. This paper presents the case for going Back to Basics, provides some simple strategies and looks at the future of knowledge management.

Ron Young is Chief Knowledge Officer, Knowledge Associates International, U.K.

"Knowledge Management is the discipline of enabling individuals, teams and entire organizations to collectively and systematically capture, store, create, share and apply knowledge to better achieve their objectives."

Although there is nothing new in managing knowledge *per se*, there is something totally new about doing this 'collectively' and 'systematically' by using new strategies, knowledge processes, knowledge communities/networks coupled with supporting and enabling technologies. This has never been possible before and for those organizations that implement effective knowledge management strategies, the benefits can be substantial. The benefits to the organization can be highly strategic and transformational, as well as operational.

So what are these new strategies, processes, networks and technologies that have enabled a new and much better way of knowledge working?

First of all, the new technologies have provided us with tremendous potential. Web-based technologies, especially the new Web 2.0 Social Computing technologies, now enables us to search the world and better know what the world is searching for; self-publish, through blogs and websites and share knowledge with the world; and enable mass collaboration through wikis, as inspired by pioneers like Wikipedia. Through the blogsphere, we can now capture our new learnings, insights, ideas and opinions and much better know and influence what the world is thinking and feeling.

In many ways this is simply stupendous! Add mobile and permanently attached wireless working technologies and we have the 'potential' to dramatically increase knowledge working and fulfil Peter Drucker's productivity challenge.

But are we doing that now? Is knowledge management simply about using these new communication, collaboration and knowledge sharing tools and technologies?

Over the last thirty years, we find that knowledge workers are even more confused, even more stressed and less pro-active in achieving objectives, and are in fact, probably totally reactive to the incessant daily demands. People are suffering even more so from email overload, information overload, attention overload, new application and new initiative overload!

As remarkable as the new technologies are, they only provide potential. They need to be enabling new knowledge processes and knowledge communities. These new knowledge processes and knowledge communities need to be strategically aligned to the objectives of the organization. Most importantly, they need to be aligned to the principles of organizational success. We need to go 'back to basics'. We need to remind ourselves, from time to time, and to teach each new management generation what these 'principles' are. Technologies change over time. The principles are timeless. Timeless business principles are to my mind 'business wisdom'.

For an effective 21st century knowledge working is to restate the timeless and changeless business principles in the modern context and then align and apply the best of the emerging and changing strategies, methods, processes, tools and technologies. This will result in extraordinary performance and value.

Our problem seems to be that we immediately seize on the new technologies too fast. This is like putting the 'cart before the horse'.

Timeless Business Principles

A principle should be equally applicable to an individual, team, organization or community. In other words, it should apply to all sizes of organizations, all types of organizations and be applied anywhere. Principles are beyond time and space.

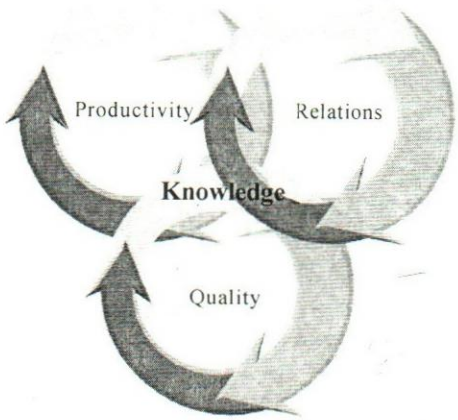
Claus Moller, an international management guru from Time Manager International, in Europe, said that there are at least three 'evergreens' for organizations – productivity, relations and quality.

He said *"For how long do you think senior management will be interested and absorbed in finding better ways to increase productivity? The answer is, forever, of course. Productivity is an evergreen."*

"For how long do you think senior management will be interested and absorbed in improving relations, that is, relations with customers, employees, suppliers, partners, in fact all the key stakeholders? The answer is, forever, of course. Relations is an evergreen."

"For how long do you think senior management will be interested and absorbed in developing quality, that is, product quality, service quality, team quality and even personal quality? The answer is, forever, of course. Quality is an evergreen."

Productivity, relations and quality are timeless principles or "evergreens" and must be perennials in board room agendas around the world.

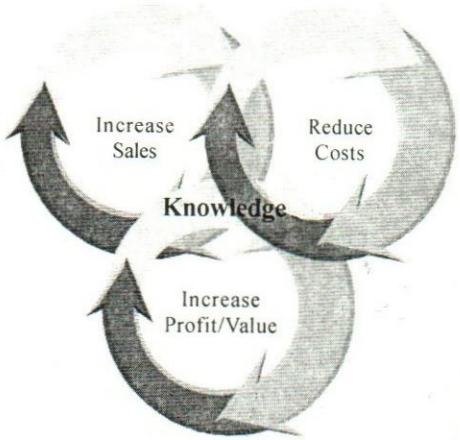


Timeless Business Principles

But what underpins these evergreens? Fundamentally, it is knowledge.

It is strategic and operational knowledge, for increasing productivity, improving relations and developing quality that underpins everything that the organization does.

Knowledge management strategies must be aligned to productivity, relations and quality. Why? It is because all senior management are ultimately interested in increasing sales and/or service, reducing costs and optimizing the delivery of value and/or profit. This is what effective productivity, improved relations, developing quality and knowledge management delivers.



KM Aligned to Productivity, Relations and Quality

Identifying Knowledge

I remember working with a container port in Asia. They certainly had the best operational knowledge, the best logistics knowledge in Asia. They were world class. They thought that codifying this logistics knowledge was all that they needed to do to practice effective knowledge management.

But when we worked together, they realized that effective knowledge management is also about transforming themselves to meet future customer needs. Although they were the best in moving containers on/off ships and this had served them well in the past, this was not good enough for surviving for the future. They needed to know why customers would wish to use containers and what they would put in them. They needed to transform from operational to customer-focused knowledge management.

The key question to ask when embarking on a knowledge management initiative is:

*"What key areas and types of knowledge, if they could be much better managed, would make a **big difference** towards achieving and/or exceeding the organizational objectives over the next few years?"*

Identifying key knowledge for the future is critical to successful knowledge management.

Creating Knowledge

People often say to me, "we would like to be a more creative and innovative organisation".

The problem is not so much a shortage of new learnings, ideas or insights, but a shortage of 'collective and systematic' methods, processes and tools that are needed to capture them or to do anything meaningful with them. Most organizations practice what we call 'episodic learning' and 'episodic innovation'. What is the point in trying to review a project six or twelve months down the line? By then, most of the best ideas and learnings that always tend to happen at the beginning of the project, are already forgotten!

Effective knowledge management can provide new and innovative continuous daily and weekly processes that take the organization from episodic learning and innovation to continuous learning and innovation. Learning or regular after-action reviews can answer the questions:

- What were the objectives?
- What did we actually achieve?
- *Why were there differences?*
- *What can we learn from this?*
- What can we do better next time?
- What actions could we take?
- Can we celebrate progress and successes?

Storing and Sharing Knowledge

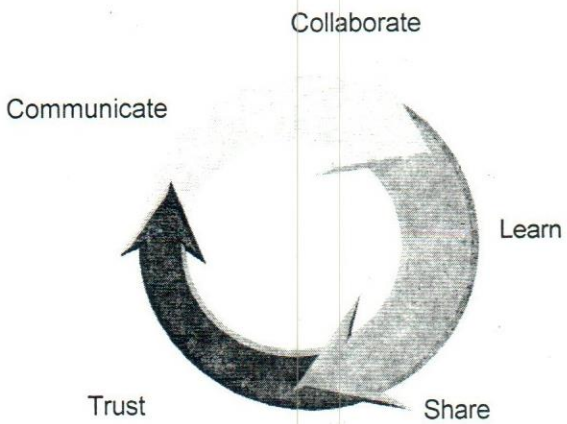
The Web has radically and fundamentally changed the economics, processes and tools of knowledge. Storing is easy. In fact, too easy. What is more difficult is deciding, from all the choices, the best strategy for storing knowledge.

Sharing knowledge is more difficult. We are told that 70% of the knowledge management effort is culture. That is not to say that the strategies, processes and technologies are less important. It is simply to say that they are relatively easy to implement.

There are several strategies for bringing about a naturally flourishing knowledge sharing culture.

- **Trust** is the lifeblood of any organization. People *naturally* work together at their best when they trust one another;
- When there is sufficient trust, people will *naturally* **communicate** and naturally **collaborate;**
- This leads to an increased *natural* **learning**, at all levels;
- Learning increases confidence and competence and this leads to *natural* **knowledge sharing.**

I call this the natural Trust-Communicate-Collaborate-Learn and Share Knowledge model:



Virtuous Cycle

But beware, the other side of the coin is that there is no trust or not sufficient trust. If unattended to, this leads to a vicious downward spiral of doubt and fear.

Fear *vs.* Trust	
Protective of ideas and knowledge	Open and sharing ideas and knowledge
No loyalty	High loyalty
Short term and impatient	Long Term and patient
Disrespect and political	Respect and supportive
Individual and isolated	Inter-connected by networks and teams
Independent	Inter-dependent
Non communicative	Open, frequent communications
- and 'one way'	- and 'two way' feedback
Uninformed	Informed
Feel no responsibility	Feel responsible
Disempowered	Empowered
Scarcity mentality	Abundance mentality

So, if we apply all the best strategies, processes and tools to identify, create, store, share and apply knowledge, are we practising effective knowledge management? Unfortunately, not!

What is the point of being more knowledgeable, if we never use it? Or, if we do not apply our knowledge effectively? I do know some very knowledgeable people, but unless new knowledge acquisition is your business, like academics, it will not help.

The most important step is to effectively apply the best knowledge to achieve your objectives. This is where effective and highly productive knowledge working really pays off.

The Future of Knowledge Management

Although there are some who believe knowledge management is a fad, I firmly know that senior management will always be interested and absorbed in better ways to create and apply knowledge. Maybe the term or label knowledge management may be misleading or may even go out of fashion in certain parts of the world. However, knowledge always has been and always will be, the most critical resource and can be the most strategic asset for any individual, organization, region and of course, for the entire planet Earth. Knowledge working is also very eco-friendly and provides the opportunity for everyone on this planet to improve their quality of life.

I am one of those individuals who agree with the global knowledge evangelists and knowledge capitalists and who see knowledge as THE wealth creator for the 21st century. To survive and to succeed, we need to become, as quickly as possible, knowledge-driven organizations in a knowledge-based society, in order to be able to develop and grow in a sustainable global knowledge economy.

Semantic Technology and the Meaningful Web 3.0

I started my presentation by quoting the late Professor Peter Drucker and his challenge to substantially increase the productivity of knowledge working.

I now find myself coming towards the end of my presentation by quoting his grandson, Nova Spivak, CEO of Radar Networks in San Francisco. He says:

> *"Semantic Web 3.0 is about making all this technology and content (on the Web) smarter — by adding semantics to the data and by adding more smarts to applications so that they can do a better job of helping humans."*

I do like the notion of the Web becoming increasingly more helpful, as an intelligent assistant, to humans, so that we can spend more time doing what only humans can do best – being more creative and innovative. Effective creativity and innovation promise true sustainability. The source is infinite. Our challenge is to make knowledge management one of the key drivers of creativity and innovation.

Even NASA, in their twenty-five-year knowledge management roadmap, has recognized the importance of making knowledge management principles as part of their culture now and are looking for the development of knowledge systems to collaborate with experts by 2025!

The Next Ten Years – Key Challenges

May I respectfully build on the words of Peter Drucker, Claus Moller and Nova Spivak and suggest the following key challenges for the next ten years:

- substantially increase the **productivity** of knowledge working by at least, fifty times;
- exponentially develop global knowledge sharing networks and **relations;**
- dramatically improve **quality;**
- enable continuous radical **knowledge creation** and **innovation;**
- provide leadership aligned to the **timeless principles;**
- applying **the best** principle-driven strategies, tools and technologies.

You may wish to read my knowledge management consulting blog and visit my website that is committed to Open Source Knowledge Management at:

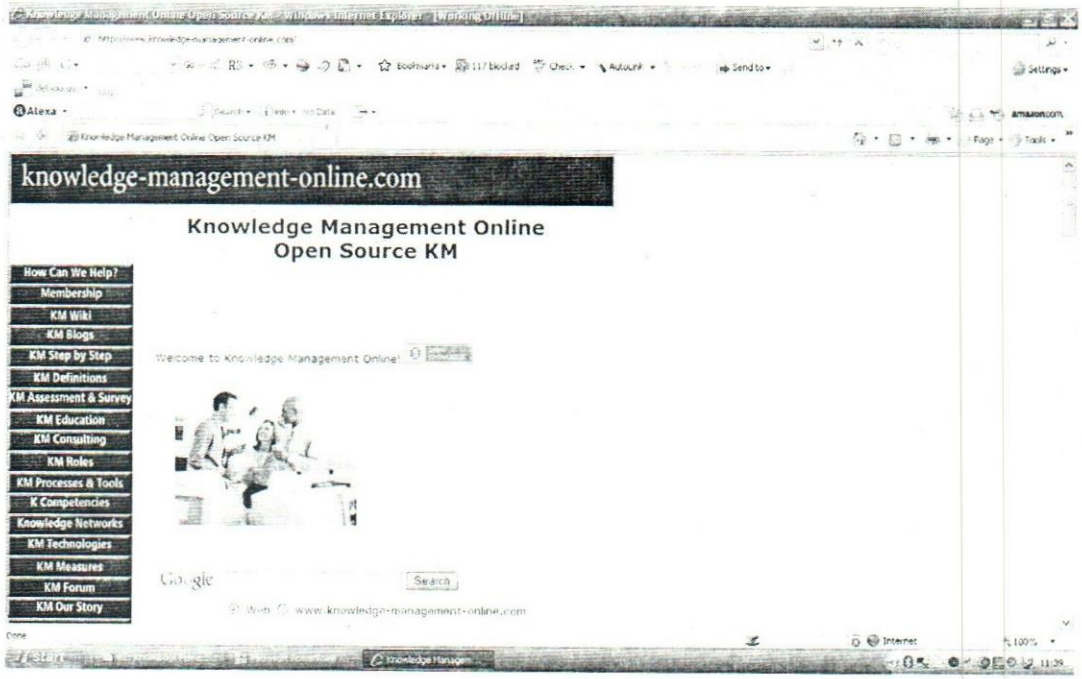
Blog: http://km-consulting.blogspot.com

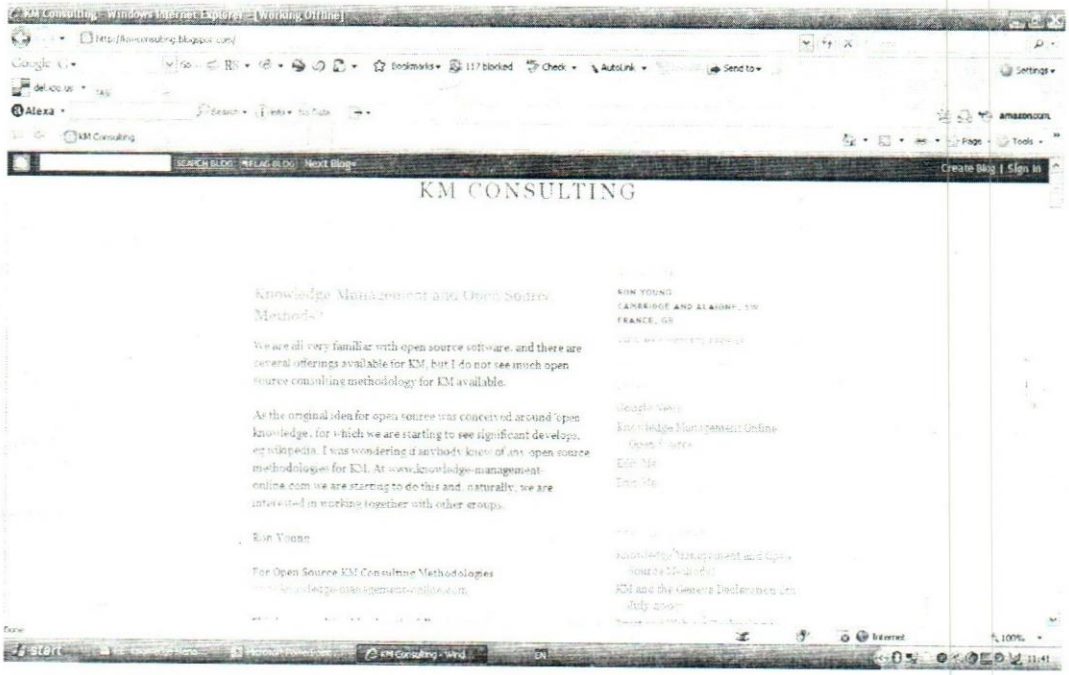
Web: www.knowledge-management-online.com

Wikipedia: http://en.wikipedia.org/wiki/Knowledge Asset Management

Book: Knowledge Asset Management, Springer 2003

Email: ronyoung@young-int.com





Knowledge Management in Wipro

Ved Prakash

What drives the Wipro's KM initiative is the aligning of knowledge strength to its key business drivers.

Ved Prakash is General Manager and Head, KM Wipro Technologies

Wipro Technologies, the technology services division of Wipro Limited (NYSE: WIT), is a global provider of consulting, IT services, outsourced R&D, infrastructure outsourcing and business process services. Wipro delivers technology-driven business solutions that meet the strategic objectives of Fortune 1000 customers. With over 27 years in the Information Technology business, Wipro is the world's largest outsourced R&D service provider and one of the pioneers in the remote delivery of software services. Wipro's key differentiators include end-to-end services, an adaptive, knowledge-driven engagement model and an obsessive focus on quality in every aspect of service delivery.

Wipro delivers high business value to its customers through a combination of process excellence, quality frameworks, knowledge leverage and service delivery innovations. Wipro is the world's first PCMM, CMM and CMMi Level five certified software services company and the first outside the USA to receive the IEEE software process award. Wipro is the first service company to embrace the Six Sigma, the lean manufacturing and the factory model concepts to software engineering.

The company employs over 80,000 people belonging to 49 nationalities worldwide serving over 690 customers through 52 development centers and 12 near shore centers spread across India, Japan, China, Eastern Europe, France, Austria, Sweden, Germany, UK, Brazil and USA.

Over the last five years, Wipro Technologies has experienced impressive growth in revenue, profitability and market capitalization. Over the last decade, the company has grown its revenues at the compounded annual growth rate (CAGR) of 25% and PAT at the CAGR of 46%. In the fiscal year 2007 (ending March 2007) Wipro's revenues stood at approximately $3.4 billion. Wipro's growth is the result of a single-minded focus on customer satisfaction, quality, developing people and providing innovative value-for-money knowledge-enabled software solutions.

Wipro's philosophy in dealing with its stakeholders is based on a foundation of enduring values. Over the years, the core values have not changed, even though the company has constantly rearticulated them to keep them relevant to the changing times. These values guide Wipro in all its

transactions and relations. These values define what Wipro is and what it means to its stakeholders. Wipro calls this the Spirit of Wipro.

The Spirit of Wipro is the core of Wipro. It is rooted within the company and it is aspirational thus making it futuristic. The Spirit of Wipro means manifesting an **intensity to win**, **acting with sensitivity** and being **unyielding about integrity** all the time.

Knowledge Strategy

Wipro Technologies launched a corporate knowledge strategy in September 2000. Earlier, it had KM initiatives in isolated pockets—mainly collaboration, re-use and knowledge sharing in smaller groups within the business units or project teams. One of the main drivers behind an organization-wide knowledge strategy was that Wipro grew rapidly between the years 1998 and 2000. During those years, the company doubled its number of employees.

During this same period, customer projects were becoming increasingly more complex. Simultaneously, customers were demanding shorter time delivery periods. In addition, the project life cycles were shrinking. With this rapid growth, the demand for access to information increased rapidly. Wipro realized that unless it adopted a formal approach to its enterprise-wide collaboration and knowledge sharing needs, it might start falling behind its competitors.

What drives the Wipro's KM initiative is the aligning of knowledge strategy to its key business drivers. The company identified the business drivers by talking to people within the organization and by trying to understand the most critical problems that it wanted KM to address. They were:

- Competitive Responsiveness—Wipro's ability to respond quickly to market opportunities by leveraging its collective knowledge;
- Collaborative Work culture—Working as a collaborative team, sharing best practices and avoiding reinvention or repeating mistakes;
- Shorter Time-to-Market—Shortened product and project life cycles;
- Capturing Tacit Knowledge—Minimizing losses due to attrition and mobility.

This effort evolved into Wipro's initial KM vision—*To be an organization where knowledge capture and sharing is the way we work, offering customers speed-to-deploy as well as innovative products and services focused on their needs and offering employees an environment of continuous learning and productivity improvements.*

The articulation of its KM vision led to the formation of a core team to plan and develop the vision. A core KM team consisting of 12 knowledge managers representing core business units (verticals) and specialist expertise groups (horizontals) was established. The knowledge managers helped develop KM processes, procedures and applications. They implemented these applications in their own work environments. They also evangelized KM, by lecturing on KM and conducting training programs within their own business groups in line with the specific needs of the group.

Another dedicated team comprising of a project manager and four programmers supported the knowledge managers by developing, customizing and implementing KM applications.

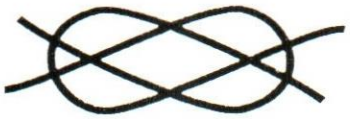
The core KM team began by creating the logical building blocks that could be used to address the KM needs of Wipro. Next, the KM team addressed the technology and people-related issues. Wipro's KM strategy framework consisted of the following three pillars:

- Infrastructure (an IT infrastructure that includes technologies, tools and applications);
- Business processes (through which the knowledge life cycle is managed); and
- Extended KM team (people who evangelize, develop and support KM initiatives).

The extended KM team includes contributors (subject matter experts and authors), editors, reviewers and users.

In keeping with the culture of continuous improvement, Wipro recently revisited its Knowledge Management vision given the changing overall business environment. Wipro was prepared for both re-formulating the existing vision in a slightly new form as well as starting out on a brand new path. The visioning exercise *per se* involved bringing together senior managers and KM champions to look at how KM could help achieve Wipro's business and operational objectives. The exercise was facilitated by a senior organizational behaviour and development consultant and led to the framing up of a new KM vision. The new KM vision retains some of the old vision's flavor while at the same time giving it an inspirational tinge and adding focus on the exchange of knowledge and the inclusion of entities (customers and partners) associated with Wipro. The new KM vision reads thus: **"Be a globally admired learning organization that enables the seamless exchange of knowledge across our diverse workforce, partners and customers, thereby fostering innovation and efficiency".**

The KM Identity



the limit is imagination[km]

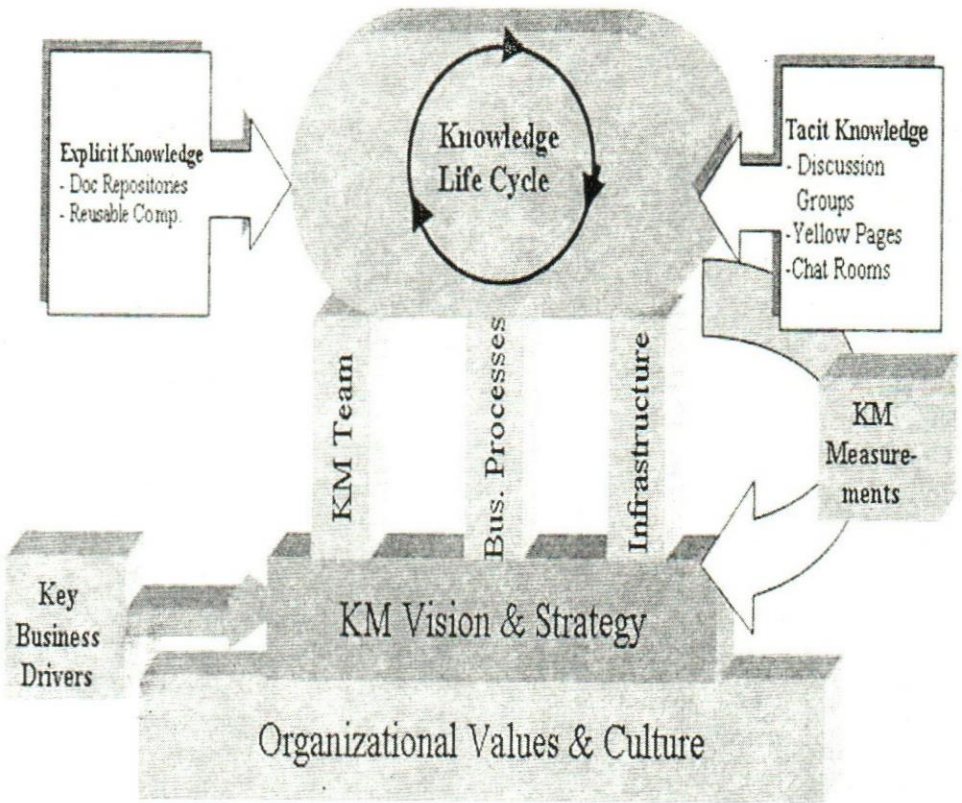
Today Wipro has a dedicated core team of 34 knowledge managers at a central level aligned with different business units and functions and a team of five to support the technology platform. In addition, each business unit has dedicated or part-time knowledge officers at different levels to further facilitate KM activities.

Knowledge Approach

After Wipro identified the business drivers and started evaluating tools and technologies, it created a roadmap of milestones to implement the KM vision. The first steps were focused towards getting the basic KM strategy, its framework (see figure) and infrastructure in place. The KM vision was further developed into more manageable objectives:

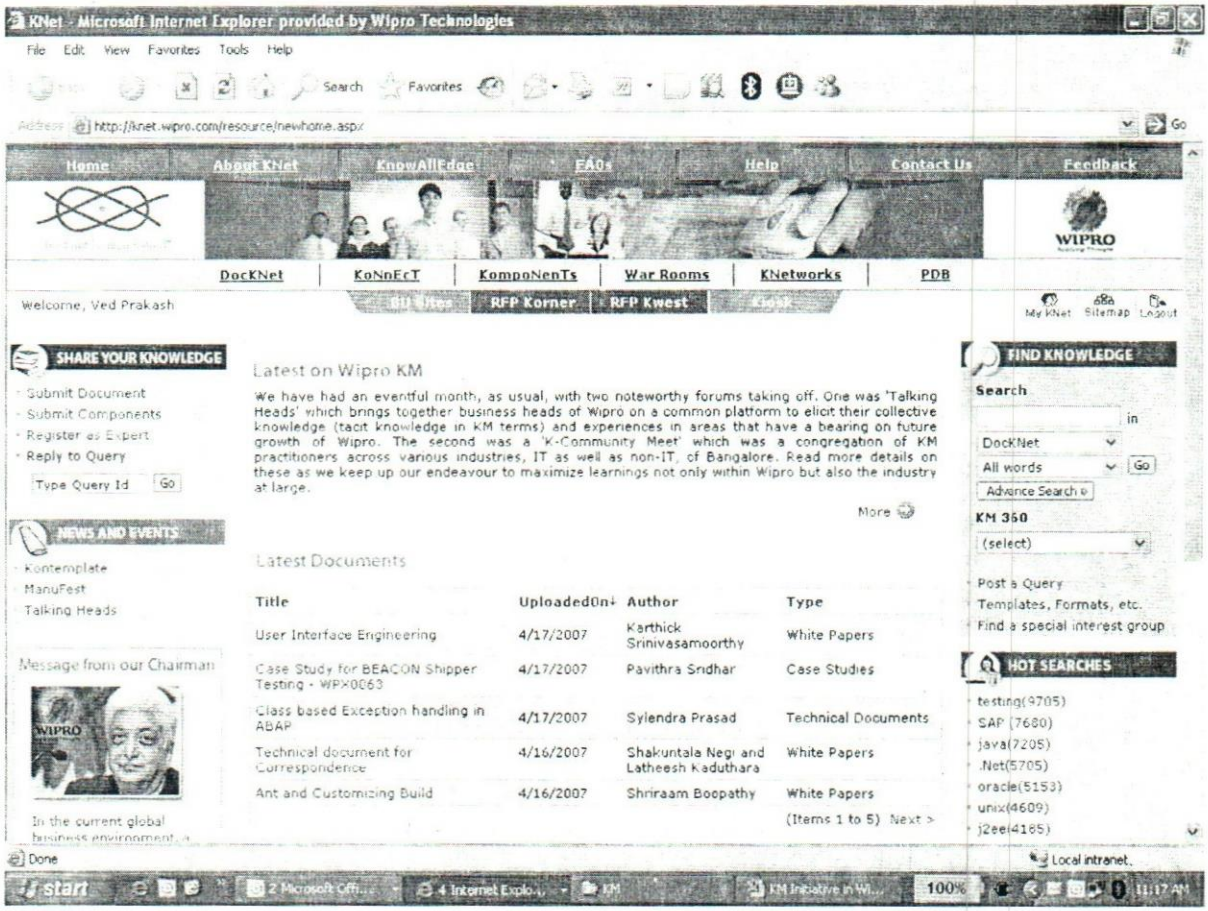
- People are the primary assets and it is necessary to capture and leverage people know-how and know-what;
- Increase the transfer of individual knowledge to the organization;
- Link people who have the requisite tacit and explicit knowledge with those who need it;
- Leverage organizational knowledge—bring the right information to the right people in a context that addresses their challenges;
- Increase collaboration opportunities—enrich the exchange of tacit and explicit knowledge among people;
- Share best-known practices across the enterprise, to be able to learn from failed efforts and to provide a platform for knowledge re-use and innovation;
- The upfront investments should be limited and existing infrastructure should be put into use.

KM Framework at WIPRO



Over the years, Wipro has implemented several applications to institutionalize KM in meeting these objectives through the KNet, Wipro's Knowledge Network platform.

KNet - the Knowledge Net



Connecting People to Content

Induction. When people join the organization, they undergo a comprehensive induction program. Part of this program includes a compulsory module on knowledge management. Topics include the basics of KM, the need for KM and how the organization benefits from KM, etc. The company also has application-specific programs, training programs and orientation programs, during which the KM team conducts sessions for people on how to use the various KM applications.

DocKNet. DocKNet is a repository that houses documents of Various types (case studies, white papers, training materials, templates, etc) that pertain to every conceivable technology and domain that Wipro works with and also various process documents. This repository is one of the most convenient ways to communicate and talk about technical matters with the rest of the technical community in Wipro. Thousands of Wiproites visit this portal every month and contribute/use information from there. There is a plethora of instances wherein sales support components from the repository are used to cut down on the time it takes to respond to proposals. In general, the time saved has been in excess of 30% of the total time taken to prepare the proposal.

War rooms. These virtual workspaces are used for time-bound and task-oriented activities like proposal preparation, framework conceptualization, etc. Almost all proposals that involve the participation of geographically dispersed employees go through the virtual workspace way to become more efficient. Learning gained from the activity is captured and categorized before the activity is wrapped up, enabling the sharing of knowledge gained through its life time.

Re-usable Components. The re-usable components repository aims to eliminate redundant development of functionalities and hence contributes

towards the realizatrion of business benefits. The repository allows employees to share components developed to ensure a shorter time to market periods for subsequent similar projects.

Project Knowledge Database. The project knowledge bank provides access to historical project information captured since the time Wipro embarked on its quality journey. Using this, project managers are able to locate similar projects that have already been executed and learn from previous experience.

Process Knowledge Base. Wipro's deep knowledge and expertise in quality processes and techniques have been captured and made available in a centralized knowledge base called VelociQ. This is the place to go for all the project management related procedures, templates and guidelines. This repository also defines the project level KM related activities (re-use, use of best practices and expertise etc. supported by audits, checklists, reviews, templates and deliverables.

Customer Knowledge. In order to manage customer knowledge, the business development group and business units have restricted sites within the Knet as well as a CRM application that allows globally dispersed teams to function collaboratively.

Connecting People to People

Communities. KNetworks, Wipro's communities application facilitates the setting up of special interest groups that promote and fuel the common passions among the employees across technical, domain and functional areas. Also, this allows a free exchange of experience and expertise within the groups enabling a tacit knowledge exchange system.

Expert Locator. KonNect, Wipro's expert yellow pages has profiled a list of self registered experts across the organization. Employees in need of help are able to resolve issues in a time bound manner by looking up experts from the repository and contacting them. It has helped build bridges between people in need of expertise and people who have the expertise to share.

There is a an additional feature that helps knowledge seekers broadcast their needs to the wider audience across the organization in case there are no experts listed or they cannot find a satisfactory resolution.

Building a KM culture at WIPRO consists of:

1. KM as part of process
    - KM orientation module in new joinee induction;
    - KM in goals and objectives/progressions for specialist roles;
    - Embedded in different phases of SDLC (or systems development life cycle);
    - Re-use measured and reported in a project dashboard;
    - KM and customer IP
2. Evangelization
    - Newsletters;
    - Contests/Quizzes;
    - KM roadshows.
3. Reward and recognition programs
4. Tacit knowledge exchange forums
    - Expert talks/panel discussions;
    - Web-based chats;
    - Best practice sharing sessions;
    - Success stories.

Measurements

Wipro's KM framework has been evolved to ensure the continuous feedback of results into the system. This allows Wipro to continuously refocus the KM strategy, the key business processes and the infrastructure. The Six Sigma tools are being used to gauge the effectiveness and engagement of all KM Initiatives. The objective here is to continuously enhance the quality of user experience. An important aspect of the knowledge management initiative is the continuous support for the KM initiatives and the solutions that have been deployed.

Wipro has created a KM Measurement Framework consisting of four key indices:

- KM Contribution Index—Measures overall rate of addition to Wipro's knowledge capital;
- KM Users Index - Measures the number of overall users of knowledge assets;
- Engagement Index—Measures the number of unique users of knowledge assets;
- Usage Index—Measures the level of usage of knowledge assets.

In addition, KM Effectiveness is measured as a standard part of metrics at the individual project level where productivity improvements and re-use percentage are measured.

The information is published on a monthly KM Dashboard, providing top management with a clear view of activities, both at the organizational level as well as at each of the business unit level.

Wipro's KM initiative, in addition to building internal successes, has gathered international acclaim along the way such as:

- The Global, Asian and Indian MAKE Awards 2007; Induction into Global MAKE Hall of Fame;
- The Asian and Indian MAKE Awards 2006;
- The Global, Asian and Indian MAKE Awards 2005;
- The Asian MAKE Award 2003;
- The KM Reality Award 2002.

Wipro has also gained good recognition for its KM initiatives in various external communities:

- Indian Institute of Management (IIM) Bangalore has a regular Case Study on knowledge management in Wipro for its MBA programs;
- Wipro's KM implemented on SharePoint has been highlighted as a Case Study on Microsoft's website;
- Wipro has presented its thoughts, ideas and KM best practices in a number of national and international conferences;
- Wipro is the industry representative on a National Panel (under the Bureau of Indian Standards) for framing standards on KM.

Roadmap

Wipro has outlined a three-year roadmap (2007-2009) for taking KM to the next higher level of maturity. Various aspects of KM have been studied for other KM best-in-call consulting and IT service organizations and analyzed across multiple dimensions. Some of the recommendations that are being implemented in the roadmap include:

- Embedding KM into critical business processes (The new KM vision's reference to creating a learning organization that seamlessly exchanges knowledge can be directly linked to this aspect of the KM roadmap);
- Migrating to the next generation KM platform that also enables personal KM;
- Consolidating KM across multiple businesses of Wipro, both for the IT and non-IT sectors;
- Linking KM with its customers and partners (The new KM vision brings this out explicitly).

KM Consulting Services

For the last three years, Wipro has been providing its customers with end-to-end knowledge management and collaboration services to reap the benefits of KM based on its own success and its deep expertise in the areas of technology and processes. These services include:

- Knowledge audits and mapping;
- Taxonomy and metadata development;
- KM measurements and metrics;
- Knowledge integration across partners (customers, acquired organizations, vendors, regulatory agencies);
- Best practices management;
- Expertise location and management;
- Enterprise re-use;
- KM portals and collaborative solutions;
- Innovation and idea management.

Knowledge Management for Competitive Advantage in the Steel Industry

Bhaskara Rao Y & Sarma J V S

Knowledge Management at Visakhapatnam Steel Plant aims at providing a platform for an employee to share his experience and knowledge and in devloping a culture of learning from each other.

Bhaskara Rao Y and Sarma J V S, Visakhapatnam Steel Plant, Visakhapatnam

Most organizations pursue knowledge sharing in order to innovate faster, speed up their response to workplace demands, customer demands, increase productivity and workforce competence. Knowledge sharing is not merely a simple exchange of information but it affects relationships and helps in establishing a culture of sharing and learning from each other. Knowledge management can be the answer to several organizational problems, be it employee turnover, culture clashes or innovation stagnation. At the Visakhapatnam Steel Plant (VSP or Vizag) the operations, technologies, practices and problems are many. Several similar equipment are used at different corners of the company. Similar problems exist at different corners of the plant and a solution available can be adapted to avoid the loss of time in reinventing the wheel.

Need for Knowledge Management

Knowledge Management has been used and understood in different ways by different people. Many times people do not distinguish between data, information or knowledge. Based on the type of industry and processes involved, every industry has developed systems and procedures as a part of their process requirements. While these standards, systems and tools form a part of the basic business tools required for the improvement of the process, in some other industries they are the tools used to leverage the knowledge base of the company. So it depends on the business need, what the purpose of the knowledge is, who is the target population and what are the means of managing the identified knowledge?

What then is knowledge management? As mentioned above it can be defined in several ways. One widely accepted definition as given in the compilation "Classic and Contemporary Works" by Daryl Morey is "KM is a systematic process of identifying, capturing and transferring information and knowledge to help make best decisions, exploit business opportunities and innovate".

What made Visakhapatnam Steel Plant (VSP) go for KM?

To be a continuously growing world class company, VSP has clearly laid down objectives to meets its corporate

vision and mission. The introduction of KM at VSP is in line with the objective of "instilling the right attitude among employees and enabling them to excel in their professional, personal and social life". KM at VSP aims at providing a platform for an employee to share his experience and knowledge and in developing a culture of learning from each other.

Having identified the need, the next most important thing is to understand what sort of knowledge we require with respect to achieving our business goals and what will give the company a competitive advantage. The volume of operations, problems, issues, that confront the company dictates its efficiency thereby affecting the profitability of the company. To take care of these issues, VSP has various systems and tools that are in place. What is the most important and unique feature that can be exploited and built upon at VSP is the vast and varied experiential knowledge of its employees. This tacit knowledge can be tapped and effectively utilized to boost the organizational knowledge.

KM at VSP

While the concept of IT-based KM has assumed greater importance recently, Knowledge Management has been implemented within the organization in some form or another. Developing standard procedures, job protocols, operating procedures for maintenance and operations, policies, computerization of processes, training and developmental activities and the like have been practiced as part of the ISO quality system before the KM concept came in vogue. In addition at VSP (Figure 1) we have suggestion scheme, quality circles, QIPs, samalochana and departmental safety committee meetings that helped the company realize a lot of cash savings. It also helped develop good group learning habits.

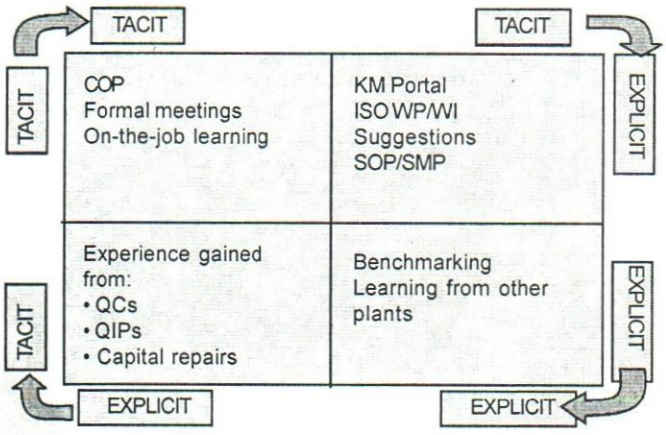


Fig. 1

Quality Circles. Many of the critical and long-standing problems were solved by small groups through the sharing of knowledge among the members. The QC movement at VSP is a process of synergy in small groups, which lead to better inter-personal relationships, better leadership and better communications, a high level of enthusiasm and morale of team members which ultimately result in better organizational harmony, a commitment to a new work culture and a sense of belongingness to the organization. In addition, there were huge savings from operations year after year.

Quality Improvement Projects. While Quality circles involved all the employees, the QIP involved only the executives. The group works on identified projects for upgrading the quality/condition of the process/ equipment. This is a forum where the knowledge of the group is leveraged to arrive at an optimal solution to the problem. In the process of finding the solution, the group members explore various opportunities available in VSP and elsewhere. At the end of the project, every member gains knowledge from his colleagues as well as from other areas.

Suggestion Scheme. The suggestion scheme at VSP aims at providing an opportunity for creative thinking among employees so as to utilize their full potential for advancement and to bring about improvements in their day to day work through the application of their experience and knowledge. Many improvements that were suggested by employees were recognized and rewarded. The suggestion scheme has provided an additional forum for mutual co-operation and leveraging of individual knowledge for collective initiatives in fostering production/productivity, reducing costs and improving quality.

Samalochana. This is a forum unique to VSP where people from different disciplines sit together to discuss the problems and issues they were confronted with during the given period. Sharing and learning from the experiences of other members is the key outcome of these meetings. It is at this forum where the operations of a department are discussed in one place to review the difficulties that surfaced and the solutions that have been worked out.

Departmental Safety Committee Meetings. Every incident provides several opportunities to improve and avert future accidents. The DSC meetings discuss all the near-miss incidents during the period so that preventive/corrective action can be taken to avert accidents. The objective is to learn or know about the problems faced by others in the company and not to repeat the same mistake.

KM Cells. In an attempt to overcome the recurring production problems at SMS, a formal knowledge

management system was established within the SMS department. Besides the SMS, KM Cells were formed in a few other departments like Mills, Sinter Plant and Central Maintenance, etc. All these efforts have resulted in developing a knowledge base and a culture of sharing and learning from mistakes. But they have remained local to those departments.

All these schemes have no doubt helped VSP in creating an environment of learning and thus help the organization to enrich its knowledge base. However, there were some missing links like capturing the judgmental/ tacit knowledge based on an employee's experience and codifying them through a robust system for easy retrieval and accessibility by all employees across the organization. Many times, a problem encountered in one area, has already been solved elsewhere in the organisation and people are not aware of it. Thus, the need to integrate the knowledge base across the organisation is vital.

GNANA: the KM system at VSP

Based on the confidence gained from the initial projects, a full-fledged knowledge management program called "GNANA" has been launched as an organization-wide initiative in 2004. Since KM is a relatively new subject and its application varies from organization to organization, a literature survey has been done and the necessary information collected through internet. Some interactions have been held with some of the prominent organizations who have already implemented KM in their organizations.

GNANA at VSP essentially encompasses the following three features:

- Capturing the tacit knowledge of employees for bringing improvements, saving costs, minimizing chances of repeated mistakes etc., within the organization;
- Providing a platform for the employees to learn from the explicit knowledge available from different sources in the world;
- Creating a culture in the organization where knowledge sharing becomes a habit of the employees by encouraging and motivating them appropriatey.

The whole process (Figure 2) is based on a "bottom-up" approach and there are no fixed targets to drive it. A phased approach has been adopted and initially the executives have been given exposure and coverage. Also, an apex level structure has been put in place to monitor and guide the KM activities in the company. The entire efforts in this direction envisages giving more emphasis

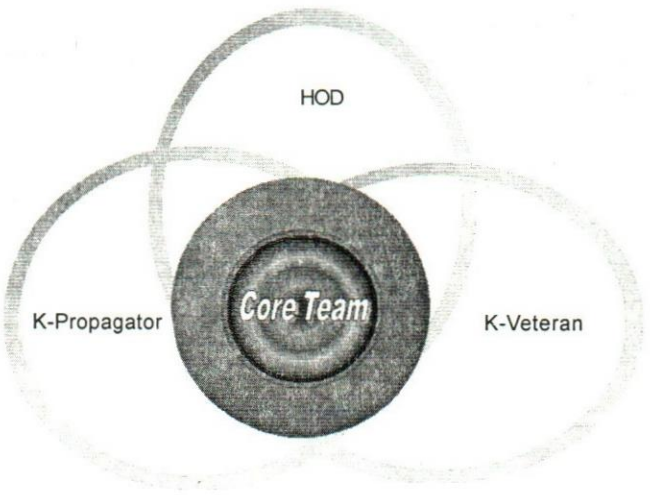


Fig. 2

to the quality of the content rather than only on the quantity.

GNANA is an expert evaluation based system (Figure 3). The knowledge piece is called a K-Chip submitted by an employee is automatically sent to the K-Veteran (knowledge expert) for an evaluation of its quality depending on the category/sub-category chosen. The entire gamut of Vizag steel processes are divided into more than sixty categories with four to five sub-categories under each. If after the evaluation the K-Veteran approves the submission, it gets integrated into the database as a K-Asset. If it is not approved, it will become an I-Piece.

Recognition is given to the K-Author for preparing the I-Piece and resubmitting the same per the guidance/ comments of the K-Veteran (Figure 4). The K-Veteran gives it a rating on a ten point scale depending on the contents and its value to the readers. Only K-Assets can be viewed by all; not the K-Chips or the I-pieces. The users of this K-Asset are provided with a facility to rate the item only once depending on its usefulness/ worthiness. The readers are free to discuss or give their feedback on the K-Asset.

It is always difficult to part with one's knowledge. Add to this the busy and tight production schedules which make it difficult to find the time to share or learn from others. Efforts are required to tap this knowledge and to make employees see the benefits of sharing and learning. Encouragement in the form of monetary and non-monetary awards has been considered. The names of the significant contributors are published in the in-house magazine "Ukkuvani" to encourage employee participation.

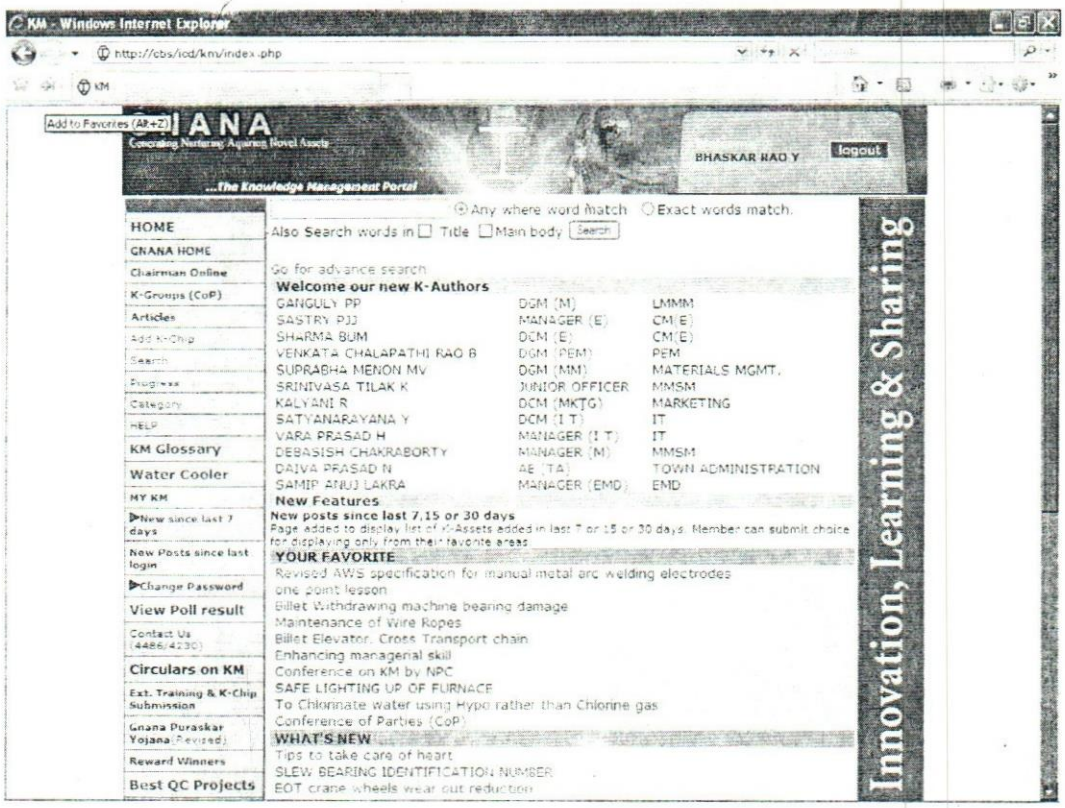


Fig. 3. GNANA home page

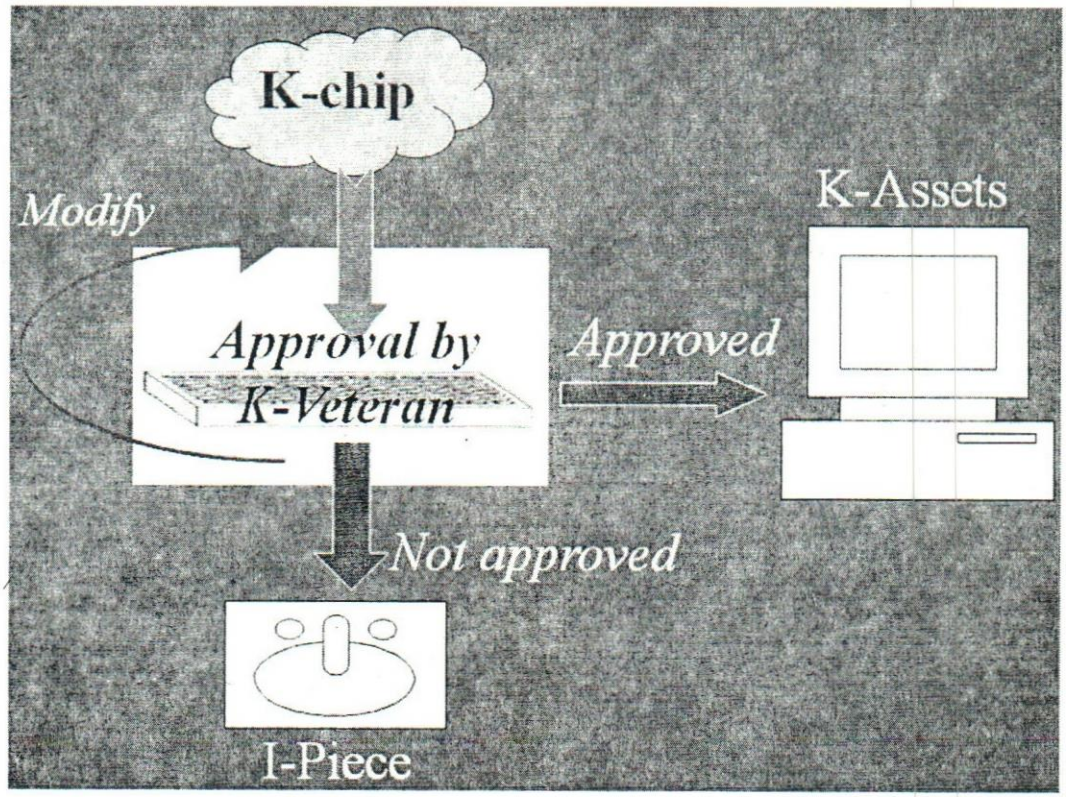


Fig. 4. Evaluation System

To recognize and reward the quality contributors, "GNANA Puraskar Yojana" a reward and recognition system has been launched in 2005. As a part of the reward scheme, people who have contributed significantly are rewarded by the Chairman/Director of the company in an exclusively held function.

The awardees are also invited along with their spouse to a dinner hosted by a Director or CMD. Every month, monetary rewards are also given out under the scheme to encourage people make their submissions and encourage a wider participation.

The progress of GNANA can be seen from:

- More than 6500 K-chips have been submitted;
- More than 5500 K-assets have been approved;
- On an average, 100 log-ins per day (approx.) have been achieved;
- More than 400 average hits/day have been recorded;
- Nearly 33% of the executives have contributed to the KM portal, so far.

Other Initiatives under GNANA

Although GNANA caters to the needs of VSP employees by capturing knowledge from employees through the KM portal, it lacks the interaction and instant transfer of knowledge. To address this area we have started "K-Groups" (Communities of Practice). Communities of practice are groups of people who share a passion for something and who know how to do it. They interact regularly to learn how to do it even better.

This is a voluntary effort of people driven by the passion to excel in their work. People with similar interests and concerns come together with the support of management/superiors to enrich their knowledge through face-to-face interactions, conversations and communications. This helps the organization to create business value by breaking the silos of knowledge and developing group knowledge. The whole effort is directed towards establishing a network of people and a network of knowledge through them. Seventeen communities of practice (CoPs) have been formed in the plant areas and are functioning regularly.

Learning from KM Implementation Efforts

1. Finding time—Typically the executives are mainly pre-occupied with their basic job of production or maintenance, KM is sometimes seen as another one of the many initiatives floating. They often feel that they cannot spare the time to record their experience.
2. There is no single tool to meet all the functional, departmental or cultural needs within VSP.
3. Technology is only an enabler for effective knowledge management. It is not the solution in itself. CoPs are organized to bring about direct interactions among the employees.
4. Having a proper measurement/monitoring system helps in tracking the progress of KM so that suitable interventions can be done for possible improvement.
5. "Why should I share?" "What is the benefit to me?" These are some of the questions that come to the minds of many. People should be encouraged to participate voluntarily if the quality is to be ensured.
6. Addressing people-related issues should be the main KM concern and not the systems or tools.
7. KM delivers over a longer time frame and requires patience and perseverance. People should not be oriented towards short-term gains only.
8. Rewards and recognition can only motivate some people. The benefits of sharing and using the system for the individual should also be visible.

Conclusion

In the context of the organization, it is important to identify the kind of knowledge that is to be managed. This should be the starting point when launching the KM initiative. There should not be any doubt that the initiative is in line with the organizational goals and priorities. A common problem in most KM programs is that individuals do not share their knowledge. People willingly share what they know, if they think that it is important for their work, if they are encouraged to do so. The biggest challenge in KM implementation is how to change the organizational culture from "knowledge is power" to "knowledge sharing is power". For knowledge management initiatives to succeed, the participation of the employees is the key issue. The process and the technology only play supportive roles.

Organizations are striving to become learning organizations by institutionalizing knowledge management. They are doing this as the benefits of KM are clearly visible. The effective utilization of resources, reduction of costs, customer satisfaction, improving on the products and services, developing a culture of sharing and encouraging team work are only a few of the benefits. While we find some benefits of KM at organizational level, the opportunities for sharing across the organizations in the country and across the globe should be explored. This helps the companies to not only improve their business but also contributes towards the effective utilization of scarce resources which have far-reaching implications on the prospects of humanity.

References

Daryl Morey, Mark Maybury and Bhavani Thuraisingham (2000). Knowledge Management: Classic and Contemporary Works. The MIT Press.

GNANA the KM Portal of Vizag Steel

Quality Costing System – An effective way to implement TQM in Industry

Arvind Chopra & Dixit Garg

An efficient and effective Quality Costing System undoubtedly paves the way for a sound TQM and excellent corporate health. This paper shows how an effective quality costing system in an industry is helpful in implementing TQM.

Arvind Chopra is lecturer in mechanical Engineering in the Technical Education Department, Punjab, and Dixit Garg is Assistant Professor at the National Institute of Technology, Kurukshetra.

In today's market, customers are becoming increasingly more vigorous and their expectations of the product/service in terms of its conformance, reliability, durability, interchangeability, performance, features, appearance, serviceability, user friendliness and safety are increasing. Thus, the role of quality management becomes essential. Several tools and techniques are available for the efficient Total Quality Management (TQM). Cost of quality is considered by the management as one of the important techniques of TQM especially when an organization changes its approach from detection to prevention as a part of its exercise towards inspection and quality control.

One potentially critical facet of an organization's TQM is its ability to measure costs related to quality (Yasin et al, 1999). To maintain/sustain competitive edge, streamline processes, cut down costs, ability to meet customer needs and ability to reduce waste have been considered most important in their quality improvement journey (Wali et al, 2000). It is found that focus of total quality management is on achieving enhanced customer satisfaction, improved cost effectiveness and speedier inroduction of new products (Pai et al, 2003). Relationship of quality costs is considered with the various measures of performance of the organization such as market share, sales, profit and return on investment (Jaju et al, 2004).It is found that for implementation of TQM sustained commitment of top and middle level management is essential (Mahadevappa et al,2004). Any reduction of cost such as scrap, rework etc. will have beneficial results. Thus, quality cost directly relates to return on investment (Jaju et al,2007). It is observed that to increase profitability and competitiveness companies are struggling to improve quality and productivity using TQM (Kandan, 2007).

Quality costs

The term quality costs had a different meaning to different people. Some equated quality costs with the costs

of attaining quality. Other equated the term with the costs of running the Quality Department. However the emerging interpretation of the quality specialists is to equate quality costs with the cost of poor quality (mainly the costs of finding and correcting defective work).

The term "The cost of quality" is widely used and widely misunderstood. The "cost of quality" isn't the price of creating a quality product or service. It's the cost of NOT creating a quality product or service. Every time work is redone, the cost of quality increases. The various types of quality costs (see in Figure 1) are described below:—

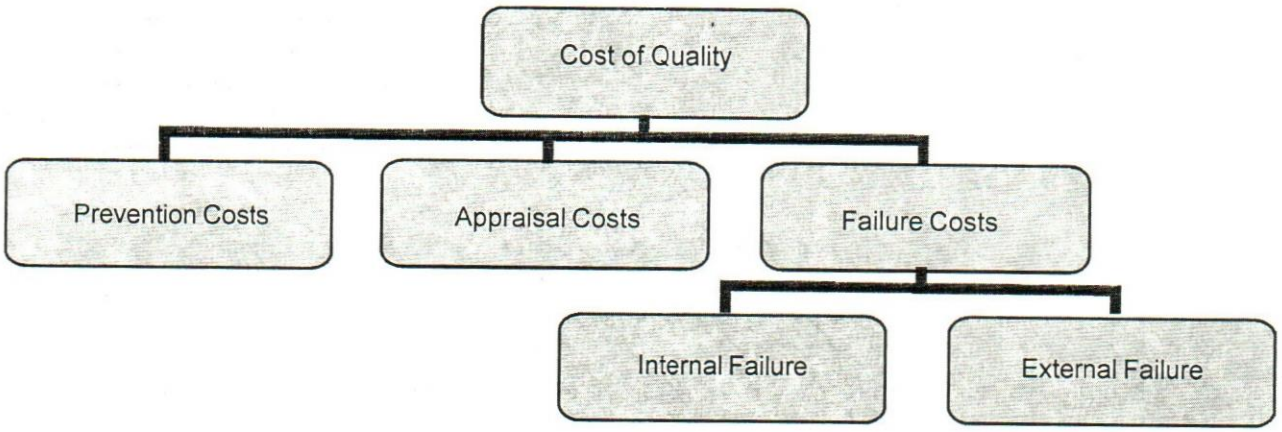


Fig. 1

(a) Prevention costs:

These are the costs occurred to prevent occurrence of defects and non-conformities and include the quality expenditure to keep unsatisfactory products from coming about in the first place.

(b) Appraisal costs:

Appraisal costs are associated with measuring, evaluating or auditing products, components and purchased materials to assure conformance with quality standards and performance requirements.

(c) Internal failure cost:

Internal failure costs occur when products, components and material fail to meet quality requirements prior to transfer of ownership. These are costs that would disappear if there were no defects in the product.

(d) External failure cost:

External failure costs occur when the product does not perform satisfactorily after transfer of ownership to the customer. These costs would also disappear if there were no defects in the product.

Thus, total quality costs =

Prevention costs + Appraisal costs + Internal failure costs+ External failure costs. Different quality costs are shown in Table 1 and Table 2.

Table 1

PREVENTION COSTS	APPRAISAL COSTS
Design Review	In coming material inspection & Test
Supplier Review	In Process material inspection & Test
Supplier Rating	Final material inspection & Test
Quality Planning	Maintenance of Inspection & Test equipments
Quality Training	Calibration of Inspection & Test equipments
Quality Audits	Laboratory support
Quality Administration	Outside Endorsement & Certification

Table 2

INTERNAL FAILURE COSTS	EXTERNAL FAILURE COSTS
Repair	Complaint Investigations
Scrap	Returned Goods
Rework	Recall Costs
Re-inspection	Liability Costs
Extra Operations	Warranty Claims
Downgraded end Product	Penalties

Measurement of Costs of Quality & Establishing quality costs reporting System

The development of an adequate quality cost collection and measurement system is a central theme of a quality cost program. The credibility of data and ease of data extraction from various sources are important aspects in collecting and measuring quality cost.

Quality costs measurement focuses on areas of high expenditure and wastage and identifies potential problem areas and cost reduction and improvement opportunities. Measure of quality cost can be used as a business parameter along with marketing etc. Figure 2 shows different factors and measures of quality cost implementation. It clearly shows that for successful implementation of quality cost program, top management support is a highly crucial factor.

Quality costing allows measurement of performance and provides a basis for internal comparison between products, processes and departments. Measurements of quality related costs also reveal queries and anomalies in cost allocation, standards and procedures which may remain undetected by the more commonly used production/operation and labors based analyses.

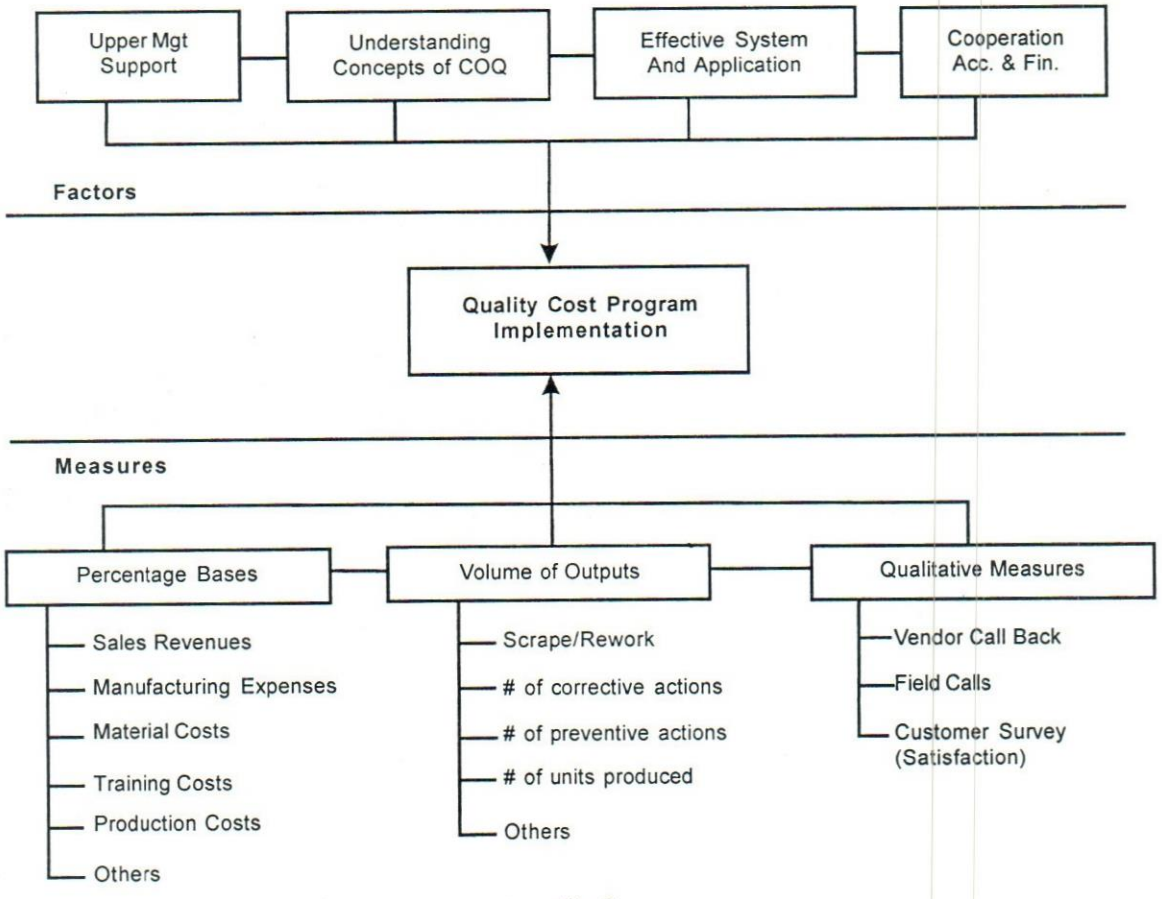


Fig. 2

Total Quality management

If we break up the words by its meaning then

"Total" means made up of the whole, **"Quality"** means degree of excellence a product or service provides and **"Management"** means Act, art or manner of handling, controlling, directing, etc.

Therefore, TQM is the art of managing the whole to achieve excellence. The Philosophy of TQM revolves around customer driven management. Its major emphasis is on determining customer need or expectation from the product. Total Quality is the culture of the organization; it is the attitude of people, how they perform their assigned work with aims to provide its customers with products and services that satisfy their needs. The culture change means all members of the organization participate in the improvement of process products and services.

There are a number of different approaches to TQM but they have several characteristics in common. They all require organizations to:

- ❖ Focus on satisfying customers needs
- ❖ Develop and tap the full potential of all employees
- ❖ Involve everyone in efforts to find better ways
- ❖ Manage business processes, not just functions or departments
- ❖ Manage by fact, using reliable data and information

The four key elements of total quality management, shown in figure 3, are:—

Customer Focus:

The TQM Company is very sensitive to customer requirements and responds quickly to them. In the TQM context, being sensitive to customer requirements goes beyond defect and error reduction and merely meeting specifications or reducing customer complaints.

Process Management:

TQM philosophy emphasis is to develop a production process that can reduce the product variations. Applying the same process the same product should be produced with the same level of quality every time.

Human Side of Quality:

A successful TQM environment requires a committed and well-trained work force that participates fully in quality improvement activities. Such participation is reinforced by reward and recognition systems that emphasize the achievement of quality objectives.

Continuous improvement (Measurement & Analysis):

Continuous improvement of all operations and activities is the true strength of TQM. Once it is recognized that customer satisfaction can only be obtained by providing a high-quality product, continuous improvement of the quality of the product is seen as the only way to maintain a high level of customer satisfaction

Cost of Quality & TQM Interface

Cost of quality is one of several management tools and techniques which an organization can use in the introduction and development of a sound practice of TQM. When an organization starts changing its approach from detection to prevention, quality costing is considered an important necessity by the senior management team. This awareness of quality costs begin to surface especially when management becomes aware that its current quality management is deficient.

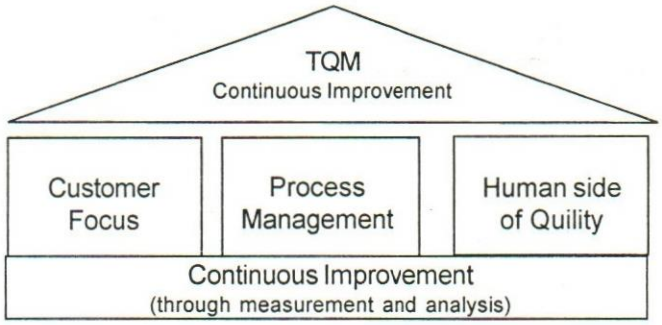


Fig. 3

An efficient and effective quality costing undoubtedly paves the way for a sound TQM and for an excellent corporate health. Quality costing, therefore, ensures a smooth journey towards TQM.

Table 3 shows that quality cost reduction program is interrelated with TQM objectives and further that the TQM objectives are fulfilled while implementing quality costing program.

Table 3

QUALITY COST REDUCTION PROGAMME	ACHIEVING TQM OBJECTIVES
By targeting customer complaints & warranty claims	Customer focused: targets to delight him
By focusing on scrap reduction	Do it right every time
By focusing on rework reduction	Quality is built into the products and services
Needs top management support	TQM implementation also needs top management support
Quality administration	Effective use of leadership
By regularly finding ways and means to optimize quality costs	Continuous Improvement
By stressing the need of regular training programs to achieve quality targets	Human side of quality like team building and employee involvement
By focusing on quality planning and manufacturing planning	Use of Statistical process Control

Conclusion

Customer is the king in today's world. Satisfying and delighting customers is the key to achieving success in the competitive business environment. There is a need to reorient and refocus the efforts of an organization towards achieving total customer satisfaction. The quality cost program cut down the poor quality expenses thereby

providing a better quality product at competitive price to customer and in the process satisfying and delighting the customer. This way the quality cost program fulfills the TQM objectives. A quality conscious manufacturer aims ultimately for achieving Total Quality Management (TQM) in all operations. Quality has become the watchword, which is destined to give a company an edge over its competitive rivals both in domestic and global markets. Quality costing as a technique of TQM ensures making and selling of quality products and services. With a large number of companies in India going global in their trade activities, there is an inevitable need for upgrading and improving the quality of production. The TQM can contribute greatly in this field. In conclusion, it may be stated that expending money for maintaining and improving the quality leads definitely to the path of and the ultimately to the goal of TQM. Quality costs can become a driving force in a TQM program; they advance the TQM theme in three ways: (1) establishing effective controls; (2) developing improvement goals; and (3) providing executive direction.

References

Ahmed Wali, Ayoob et al , "Quality Initiatives In a Manufacturing Unit: A Case Study", *Productivity Journal,* Vol 41, No.2, 2000. pp. 210-216.

Jaju S.B., R.R. Lakhe and R.L. Shrivastava, "Performance analysis through quality costs: A case study", *Industrial engineering journal,* Vol XXXIII, No. 6, 2004, pp. 15-20.

Jaju,S.B. et al, "Mathematical interrelationships among quality cost categories for a manufacturing sector" *Industrial Engineering Journal,*Vol. XXXVI No. 3, March, 2007, pp. 32-43.

Kandan Vladimir., "Why Quality, Cost and Buisness Excellence are inseparable", *Total Quality Management,*Vol.18, Nos. 1-2, 2007, pp. 147-152.

M.Yasin, Mahmoud et al," In search of an optimal cost of quality: an integrated framework of operational efficiency and strategic effectiveness",*Journal of Engineering and technology Management,* Vol. 16, No. 2, 1999, pp. 171 – 189.

Mahadevapp, B. and Kotreshwar, G., "Quality Management Practices in iNdian ISO 9000 certified companies: an Empirical Evalution", Total Quality Management,Vol.15, No. 3, May 2004, pp. 295-305.

Pai, P.Srinivasa et al, "Total Quality Management—A Movement to wards total customer satisfaction," *Industrial Engineering Journal,*Vol. XXXII No. 5, May, 2003, pp. 8-11.

"Quality costs Principles, implementation and use", Campanella J. 1999.

"Quality, productivity and compititive position", Deming, W.E., 1982.

"Total quality control", Feigenbaum, A. V. 1983.

□

Television has done much for psychiatry by spreading information about it, as well as contributing to the need for it.

—Alfred Hitchcock

Feature

Developing Business Productivity & Value through Corporate Portals

Bibhuti B Mahapatro

A firm's ability to leverage knowledge held by members in the organization is dependent on first, the ability of the firm to create an infrastructure to access this knowledge, transfer it and make it available to others. Enterprise Information Portals have emerged as gateways to streamline information access in firms. This paper focused on knowledge portal (KP) as a significant component of an enterprise information portal and analyses how it can contribute to a firm's competitive advantage.

Bibhuti B Mahapatro is Reader, Fakir Mohan University, Balasore, Orissa.

Effectiveness is an organizational dynamic that haunts managers. The issue of organizational effectiveness or OE has been one of the most sought out yet elusive research subjects since the early development of organizational theory. We know effectiveness when we see it and more often, when we don't. We use speed of service, friendliness of employees, cleanliness, value, quality, performance and other measures to judge effectiveness. It seems organizational effectiveness is about doing everything you know well.

The universals of management—planning, organizing, leading, direction and controlling—have not changed. Organizational effectiveness(OE) relates to the capacity of an organization to sustain the people, strategies, learning, infrastructure and resources it needs to continue to achieve its mission. It is a long-term outcome that some capacity building strategies may affect, while others may not (and this is acceptable in the continuum of management support service strategies needed to build capacity). There are many definitions and characterizations of effectiveness, taking into consideration elements such as organizational structure, culture, leadership, governance, strategy, human resources, etc. The various frameworks for measuring organizational effectiveness can be helpful in defining indicators for the success of capacity-building initiatives.

Daniel Bell and Peter F. Drucker, the management gurus, suggested that knowledge is the only meaningful economic resource. Knowledge management (KM) has recently emerged as an important area of management thought and practice. Its emergence stems from the firm's growing recognition of knowledge as the quintessential resource in its quest for continuous competitiveness. An organization's capacity to improve its skills and learn new ones, say CK. Prahallad and Hamel "offers the most defensive competitive advantage of all". Knowledge management is the process of coordinating organization-wide activities of acquiring creating storing, diffusing, developing and deploying knowledge by individuals and groups within and outside, in the pursuit of major organizational goals. Much effort is involved and a great amount of money is also invested in attaining this ultimate,

organizational effectiveness through effective utilization of information in management activities. In this information age, there exists a widespread belief that attaining OE is closely related to the organizations' ability to using timely, accurate and relevant information for making business decisions. To this effect, organizations have deployed information technology like the internet, intranet, Corporate Portals, MIS and ERP etc. These technologies were widely adopted throughout the corporate environment because they have the potential to solve many problems of information access and integration, while increasing organizational effectiveness in term of efficiency and productivity.

Business Portals/Corporate Portals/knowledge portals and a selection of business data are important aspects of any business information and are necessary for any organization to compete and survive. To meet this requirement portals are developed in this direction to create content, database and building libraries for the future. To stay competitive in the changing global scenario, an organization must be able to modify its policies, processes and operations at short-notice. Automating business rules can help the company adapt more quickly to changing markets. Efficient knowledge management tools will enable an organization to manage during fast movements of changes where it can help the organization to centralize information. This core knowledge pertains to a firm's perception, interpretation and understanding of the pace and the magnitude of various demographic, social, economic, technological, geographical, policy changes, monitoring and appraisal of global and domestic trends, events and developments in the firm and the sectors, systematic coverage of the competitors, suppliers, partners or alliance members and other relevant areas of interest.

This new world of instant information and global communication technology has overturned our thinking and overthrown the old social and economic order: All around us we see enterprises and organizations transforming themselves, sometimes virtually overnight. We are plunged headlong in a scramble to keep up, to learn, to adapt and to change. We feel that if we can learn fast enough and acquire the knowledge we need, we will succeed.

Corporate Portals

The term Corporate Portal or "Enterprise Information Portal" (EIP) or "Business Portals" was first coined by Shilakes and Tylman (1998) as: "Enterprise Information Portals are applications that enable companies to unlock internally and externally stored information and provide users a single gateway to personalized information needed to make informed business decisions". The authors further described EIP as "... an amalgamation of software applications that consolidate, manage, analyze and distribute information across and outside of an enterprise (including Business Intelligence, Content Management, Data Warehouse/Mart and Data Management Applications)".

The term "portal" is quickly becoming a standard, though changing, part of our Internet and Intranet lexicon. When thinking about the term portal, we easily make the leap to Netscape, AOL and others. In this quickly developing arena, corporate portals have now become the hot topic and are being heralded as an efficient method for employees to access mission-critical information online. As we move ever deeper into the era of information abundance, corporate decision-makers and workers alike are swamped with data, which, contrary to being helpful, is like a life preserver just out of reach. Information needed to make efficient and timely decisions, at any level, lies within the organization's information architecture, but is often outside easy reach. The corporate portal is, in many corners, proclaimed as a panacea for the information glut facing so many enterprises today. Even though corporate portals are a hot topic, there is considerable confusion about them. You've probably heard terms such as business portal, intranet portal, enterprise portal and reporting portal, among others. These describe everything from simple online job postings on a company intranet to highly advanced enterprise-wide applications. A corporate portal is a secure, browser-based gateway to internal and external data. It typically offers these elements:

1. A single point of access to personal information, benefits, content, web-based applications and legacy systems.
2. Sophisticated search capabilities.
3. Integrated workflow across multiple databases.
4. Role-based information delivery. (Content and access privileges are automatically managed depending on the employee's role in the organization).
5. Single sign-on with unified password for easy, secure system use.

Think of the corporate portal as providing a dramatic new level of sophistication in corporate intranets. Speed, efficiency, reach and an unprecedented level of collaborative interaction all flow from a well-designed portal, making possible dramatic gains in productivity. A portal is an application of information technology that facilitates complex business interactions by presenting them in an easy to use Web-based interface. The real value in a portal is its ability to create an efficient environment that allows

users to collaborate, perform task and obtain information from a single customizable source. Remember that a portal is not the product of a single technology; it is a synthesis of many applications. In today's market, there are a number of "portal players" such as Plumtree, Lotus, Yahoo! and iPlanet. The major enterprise resource planning (ERP) companies such as PeopleSoft, SAP and Oracle also have extensive portal offerings. Product types vary widely. Those with a vertical focus deliver information to a particular type of user such as sales, marketing, project managers or HR. Transactional products are designed to provide employee and manager self-service, e-business transactional support and workflow integration. More complex products provide knowledge management and business intelligence functions to enable sophisticated data search and analysis. Comprehensive products include all of these elements.

In defining the model of the corporate portal we need to look at differing classifications of corporate portals, which range from a simple networked desktop interface to specific software programs designed especially to gather, organize and distribute a rich set of content to a relatively narrow community of users. Perhaps the most important terms, conceptually, are a personalized single point of access to a corporate knowledge base and to assets residing outside the organization's firewall. The system brings together sets of structured information from database systems and unstructured data from document management systems, e-mail and web pages.

Another important aspect of corporate portals is their ability to automate the classification of enterprise resources and deliver this data to individuals in the organization. In turn, this information becomes the highly focused knowledge base enabling workers and decision-makers to make sound and timely decisions. Portal deployments are becoming an important part of many companies' attempts to harness the knowledge that resides within the company's information architecture. Corporate portals have an integrated suite of server capabilities that can help improve organizational effectiveness by providing comprehensive content management and enterprise search, accelerating shared business processes and facilitating information-sharing across boundaries for better business insight. Corporate portals support all intranets, extranet and Web applications across an enterprise within one integrated platform, instead of relying on separate fragmented systems. The benefits of portal deployment for large, fast-moving organizations would seem self-evident: Greater access to corporate knowledge, personalization and a single point of access to information resources. The corollary to this is increased productivity and effectiveness and in the long term, lower information delivery costs.

- Streamline processes—Portals can be used as collaboration tools to improve communications and work processes.
- Improve Decision-making—a portal can be used to provide "just-in-time" information. A portal can provide a facility for agents to log on commonly asked questions resulting in efficient customer service. Supervisors can publish and deploy new procedures to many divisions and sites to improve speed to market and training.
- Build Intellectual Capital—a portal can be used to better manage critical business and technical knowledge; users can manage this information through a centralized, secure interface.
- Improve Employee Retention—portals allow employees to work more effectively. A portal can streamline necessary functions, allowing employees to find the information they need, when and where they need it. Portals can provide consistent information on policies and procedures.

Portals also enhance a corporate community by improving physical and virtual relationships between employees. While encouraging portal use for seemingly unrelated personal matters might not appear to be in the organization's interest, enabling people to simplify their lives and reduce stress can provide significant boosts to effectiveness and productivity. As a natural part of the development process, we have now seen a divergence of the portal concept to embrace, not just worldwide resources but those assets that reside within the corporation. In this quickly developing arena, corporate portals have now become the hot topic and are being heralded as an efficient method for employees to access mission-critical information online. As we move ever deeper into the era of information abundance, corporate decision-makers and workers alike are swamped in data, which, contrary to being helpful, is like a life preserver just out of reach. Information needed to make efficient and timely decisions, at any level, lies within the organization's information architecture but is often outside easy reach. The corporate portal is, in many corners, proclaimed as a panacea for the information glut facing so many enterprises today. Remember that a portal is not the product of a single technology; it is a synthesis of many applications.

Connecting Portals to Productivity

The world is becoming more interconnected and organizations that want to succeed in this new environment need to become more connected as well. This is not simply an information technology (IT) architecture issue, but a

challenge to individuals, teams, businesses and the wider world. The critical factor for organizational success is empowering people, specifically those people that create, analyze, distribute or consume information as part of their jobs—the information workers. In a time of rapid change, agility depends on the ability to adapt and align quickly. Rigid, centrally managed systems cannot do that. Neither can organizations use yesterday's technology as if were "good enough" for today's challenges. Once you give information workers powerful tools that put them in control of their business environment, tools that make working together as natural as working alone and as familiar as the basic applications they already know, then you have the kind of agility at the point of contact to drive innovation, drive insight and drive success. Enterprise portal services are useful tools for aggregating business information and providing links to relevant public websites, internal websites and enterprise data. While these capabilities have yielded considerable benefits, business portals can also serve as an effective way to integrate business applications. By providing a framework of many interdependent business applications, the specialized enterprise information portal services can play a key role in reducing complexity and increasing productivity.

A corporate portal isn't intended to eliminate applications but to offer a single focal point for company resources. Users and customers can have a truly personalized experience that allows broad access to structured and unstructured information, a centralized point for linking to a collection of applications and a method for initiating processes that span multiple systems.

Corporate portals provide many powerful and useful features to the business:

1. **Single Sign-On**

   Allowing users and customers to access all applications using a single sign-on with one username and password. The database will contain the proper authentication credentials for each component application. Users will no longer have to remember separate usernames and passwords for various applications.

2. **Personalization**

   Each portal user can have the ability to personalize the content and layout of the portal interface. Personalization also refers to personalized features and color or theme preferences. Similar to personal portals, business portals can provide users with the ability to include links to other websites as well as the inclusion of third party portals.

3. **Collaboration**

   One of the most attractive features to all portal users, collaboration, could include any or all of the following capabilities:

   - Workflow and routing of documents
   - Discussion threads
   - User-chat sessions
   - Dynamic group and team creation
   - Interactive collaboration, including video, voice, and application sharing

4. **Seamless Integration and Processing**

   Without any intervention from users, business portals are capable of performing processes that require cross-application communication and multi-database integration. This feature can eliminate a great deal of manual back office maintenance tasks and provide high value for users and customers.

5. **Document & Content Management**

   Many portal systems incorporate content and document management, providing a way to manage documents and web content. It can include versioning, security, metadata searching and a host of other features.

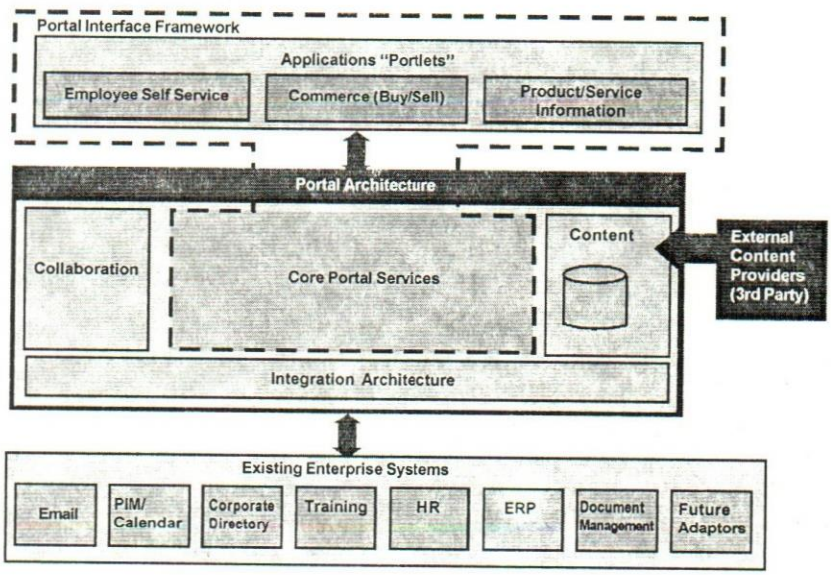
The organizations that can work together effectively will enjoy the competitive advantage in a number of areas. Those that sell information or expertise can draw a wider pool of human talent and data to generate new insights and new innovations and bring them to market more quickly. The businesses are built around the manufacturing, distribution, resources extraction—can also discover and drive the new efficiencies that bring down costs. In the age of information economy the organization has to explore new opportunities to add value and global market places in which to offer their skills and their expertise. Better collaboration of information can connect them easily to their different partners of business; minimize the time on low value administrative activities. It is observed that the world's largest organizations show their tangible business values achieved by using portals *i.e.* shorter product cycle-time, fewer meetings and lower travel expenses. The organizations believe that collaboration of information/ portals is a strategic capability that requires a strategic approach. It is about providing the infrastructure of software, hardware and services that deliver pervasive capabilities to enable people to work together more effectively.

Pic. 1 Portal Types

Portal Type	Description	Business Objective
Knowledge Management	Information gathering contexualization, organization, classification, access, presentation and distribution.	Organize and enhance the knowledge distributed throughout the enterprise so that it is accessible to all.
Electronic Commerce	On-line purchasing by consumer, partner or employee	Consolidate the e-commerce websites in the enterprise into a single portal with customizable acces to all e-comerce in the enterprise.
Collaboration	Tools to allow user communities, project teams, virtual meeting rooms, on-line chat, project management, calandar management, meeting room scheduling etc.	Improve virtual communication and reduce mis-communication and misfires often present in the enterprise.
Employee Management	Information acces standard corporate policy and procedure. Self service and intranet transactions.	Improve employee communication, streamline the HR and Benefits Management functions, provide customized employee information 24x7 from any location.
Business Process Improvement	Tools or applications to follow a specific business process (ERP, Purchasing etc.)	Model a complex process within an enterprise, and increase quality of service within an enterprise can be controlled with fewer mistakes and a more complete proces. (A typical example would be mobile phone provisioning inthe telecommunications world. This is a multi-step process where any error can result in either failure or an unsatisfied customer).

The portals embraces a complete and unified information regarding the different issues on portals which includes functionality from the desktop, mobile services, web browsers and line of business applications and also the operating systems, with integrated architecture (see pic. 2). The goal is to enable the customers to realize the benefits of collaborative environment at every level of investment. The collaboration technology is integrated by design, so that each new set of capabilities can be implemented in a modular fashion, leveraging all investments in infrastructure, application, end-user skills and technical support.

Pic. 2 The Business Portal Architecture



Pic. 3 (Portal Platform)

An enterprise portal consists of 5 elements:

Portal Core Service - Provides core portal application functions. These functions are the common services (such as user interface design and search) that are utilized by other components. These services can be supported using a 3rd party tool.

Content Services - Content components are information (knowledge) from internal sources, external feeds, databases, etc. 3rd party tools or application service providers (ASPs) can provide this component.

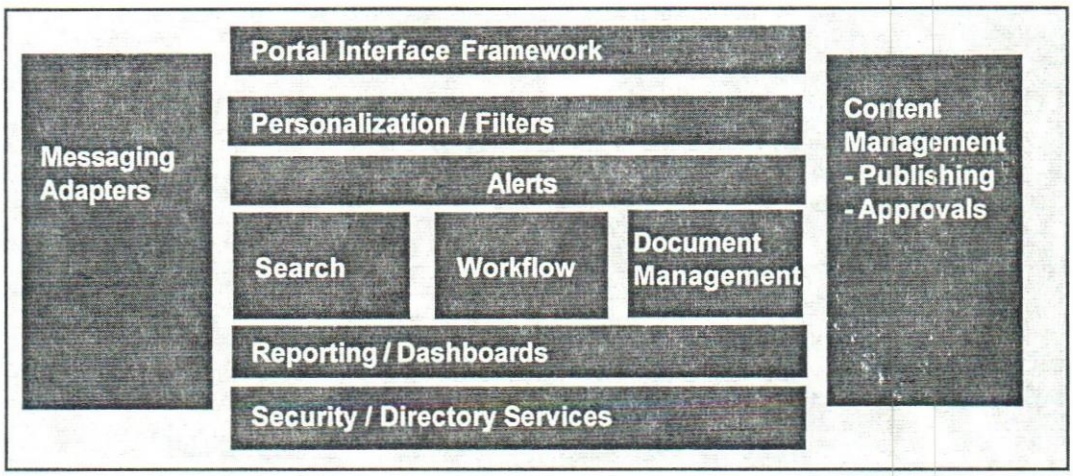
Portal Interface Framework

The interface framework provides a structure or container for other applications (or portlets). The framework allows new applications to follow a consistent visual interface standard.

Collaboration Services - Collaboration components are those that facilitate employees working together. Many components facilitate virtual meetings through application sharing, community chat rooms or videoconferencing.

Integration Services - Integration components are those that like existing services to the portal. These components provide the application and transactional linkage to enterprise systems (such as email or corporate directories). Adapters can facilitate this integration, however, integration usually is developed or customized based on requirements.

Pic. 4 (Integration Architecture)



Collaboration services allow enterprises users to communicate and solve business problems independent of location, space and time. As the organizations become more geographically diverse, alternate forms of communication are required . Since face-to-face communication is not possible, collaboration such as application sharing, video-conferencing and chat can augment the communication .The collaboration services must integrate

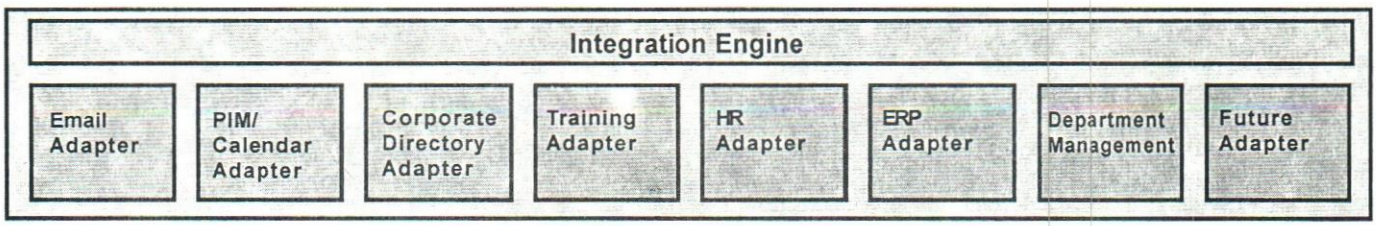
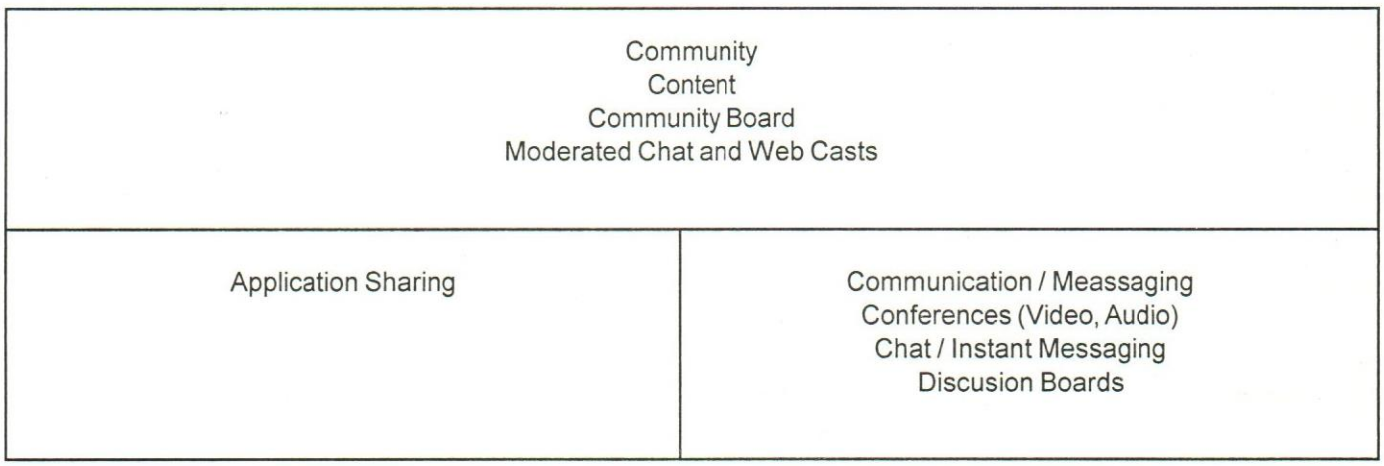


Table 1: Integration Achitecture

Component	Description	Challenges
E-mail Adapter	E-mail is the core to most enterprise communication. An efficient operating portal provides a model for supporting the existing email platform.	• Creating the right balance between e-mail and portal functionality so that one does not dominate the other (overlap between email and portal tools is significant) • Avoiding pressure for the portal to be a subset of the e-mail system
PIM/Calendar Adapter	Makes it possible for users to monitor their (and shared) calendar(s) and other performance information management information	• Providing relevant interface points Limited overlapping functionality (between portal and calendaring tools)
Corporate Directory Adapter	Integrating of corporate director (and directory services integration) for portal functions	• Important to instal responsibility for individual maintenance of personal information • Access to an enterprise directory may prove to be difficult in large, segmented companies
HR Adapter, Adapter Training, ERP Adapter, Document Management Adapter	Integrates remote learning and HR policy information into the portal	• Effective learning plans are programs require manager involvement; it's important to integrate this component or the process could create conflicts between employee and manager • Maintenance of HR policies on near real-time basis

with portal platform services and existing systems in order to realize efficiencies. The Content Services (see pic:5) is the single most database of information that is populated, integrated and/or synchronized with internal and external sources.

Pic. 5 (Collaboration of Services)



Pic. 6 Content Services

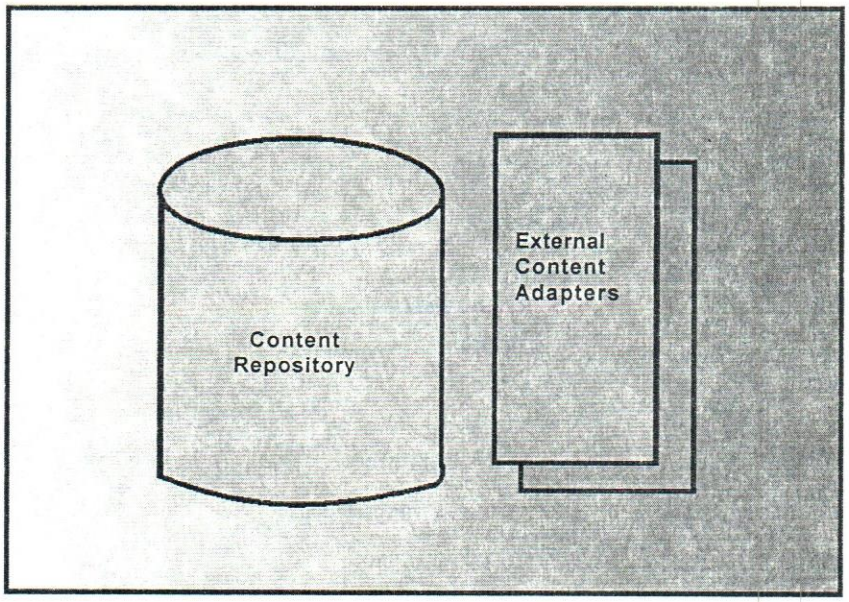


Table 2: Content Services

Component	Description	Challenges
Content Repository	A collection of data records (content) in a structured form (may be part of the portal platform tool)	• Selection of an extensible data structure and technology • Flexibility of repository to accommodate multiple sources of data
External Content Adapter	Provides integration of external news and information from outside the organization	• Integrating incoming data into existing content repository structure • Selecting an array of content that can satisfy the entire enterprise • Management of relationships with multiple services (Each news service is fee-based usually part of the portal service) • For industry specific content sources, it will be important to determine content accuracy and relevance to the business

Boosting Productivity through Business Portals

Using the business portal technology (to reduce the cost of doing business) and existing software skills, business portals capabilities lead increase the productivity and efficiency of people, and teams be more responsive to customers and stay true to their goals. Business portals provide better access to collaborative functions, documents and information to workers. Organizations with portals which can provide employees, managers, customers and partners with an effective

framework for collaboration and information sharing based on business roles and people, can work productively, no matter where they are. Employee access information, documents and business function through their browser, any time, any where. Teams can easily set up collaborations sites using business portals, web parts and pursue their goals with great efficiency. Especially valuable capabilities of a business portal are human resources self-service and the management of requisitions, time and expenses. The executives and mangers can also use portals to promote success based on smart decisions. The portals provide them with Key Performance Indicators (KPI) used in portals, so that they can review business performance by KPI and get the information about the business trends in attainment of business goals. Also add value to organizations key relationships with customers and suppliers by offering an uninterrupted online presence and make it easy for them to do business with organization. Increase in customer satisfaction and sales results by using order management for business portal. Customers can enter their orders online at their convenience, review order status and enjoy prompt, responsive services from the company.

In this highly competitive market condition businesses want to differentiate themselves from competitors through their quality of service. Customers today demand a high level of service and quick access to relevant information. They are accustomed to fast response times and instant access to relevant data over the internet and wait for order status, service request or product availability to deliver the quality service. Businesses must have instant access to a customer's complete history and the ability to update the account and anticipated customers needs.

To provide true business benefits, a portal must enable business users to define processes and information flow between applications. A portal should also give business users the capacity to report on specific events that they define. From the architectural point of view, portals need to provide an integration that performs translation, transformation, single sign on and business process management to connect systems. Process integration enables enterprises to create a single portal that can be used across the entire enterprise and support employees, customers and business partners. Process integration and portals provide a three-tier architecture that clearly separates the presentation, business process and connectivity layers. A portal with process integration enables connectivity to disparate information systems and provides users with access to relevant information in real time.

Conclusion

Effectiveness is an organizational dynamics that hunts managers. Knowledge management has recently emerged as an important area of management thought and practice. It is the process of coordinating organization wide activities of acquiring, creating, storing, diffusing, developing and deploying knowledge by the individual and the group within and outside in the pursuits of major organizational-goals. This new world of instant information and global communication technology has overturned our thinking and overthrown the old social and economic order: All around us we see enterprises and organizations transforming themselves, sometimes virtually overnight. Business Portals/Corporate Portals and a selection of business data are important aspects of any business information, which provides integral information which is necessary for any organization to compete and survive. To meet this requirement portals are developed in this direction to create content, database, building libraries for the future. "Enterprise Information Portals are applications that enable companies to unlock internally and externally stored information and provide users a single gateway to personalized information needed to make informed business decisions". The corporate portal provides a dramatic new level of sophistication in corporate intranets. Speed, efficiency, reach and an unprecedented level of collaborative interaction all flow from a well-designed portal, making possible dramatic gains in productivity.

A portal is an application of information technology that facilitates complex business interactions by presenting them in an easy to use web-based interface. The real value in a portal is its ability to create an efficient environment that allows users to collaborate, perform tasks and obtain information from a single customizable source. Remember that a portal is not the product of a single technology; it is a synthesis of many applications.

The portals embrace a complete and unified information regarding the different issues on portals which includes functionality from the desktop, mobile services, web browsers and line of business applications and also the operating systems, with integrated architecture. Enterprise portal services are useful tools for aggregating business information and providing links to relevant public websites, internal websites and enterprise data. While these capabilities have yielded considerable benefits, business portals can also serve as an effective way to integrate legacy applications. By providing a framework for gluing together many interdependent business applications, the specialized enterprise information portal services can play a key role in reducing complexity and increasing productivity.

References

Amidon, D. M., & Macnamara, D. (2003). The 7 C's of knowledge leadership: innovating our future. In C. W. Holsapple (Ed.), *Handbook on Knowledge Management* (Vol. 1, pp. 539-552). Berlin/Heidelberg: Springer-Verlag.

Bose, R. (2002). Knowledge management capabilities & infrastructure for e-commerce. *Journal of Computer Information Systems, 42*(5), 40-49.

Chou, T., Hsu, L., Yeh, Y., & Ho, C. (2005). Towards a framework of the performance evaluation of SMEs' industry portals. *Industrial Management & Data Systems, 105*(4), 527-544.

Delio, M. (1998). Keys to collaboration: 7 bottom-line strategies to promote knowledge sharing. *Knowledge Management, 1*(1).

Department.of.Navy. (2001). Knowledge centric organization (KCO) assessment. Retrieved June, 2002, from http://www.fgipc.org/02_ Federal_CIO_Council/Downloads/90_KCOSurvey.doc

Dorfman, P. (2001). The accidental knowledge manager. *Knowledge Management, 4*(2), 36-41.

Delio M. (2000). Non-formal Learning and Tacit Knowledge in Professional Work. *British Journal of Educational Psychology, 70*, 113-136.

Fernandez, M., Florescu, D., Levy, A., & Suciu, D. (2000). Declarative Specification of Web Sites with Strudel. *VLDB Journal, 9*(1), 38-55.

Gaines, B. (2003). Organizational knowledge acquisition. In C. W. Holsapple (Ed.), *Handbook on Knowledge Management* (Vol. 1, pp. 317-348). Berlin/Heidelberg: Springer-Verlag.

Garcia-Molina, H., Hammer, J., Ireland, K., Papakonstantinou, Y., Ullman, J., & Widom, J. (1995). *Integrating and Accessing Heterogeneous Information Sources in TSIMMIS.* Paper presented at the AAAI Symposium on Information Gathering, Stanford, California.

Gill, P. J. (2001). Once upon an enterprise. *Knowledge Management, 4*(5), 24.

Glavinic, V. (2002). *Introducing XML to integrate Applications within a Company.* Paper presented at the 24th International Conference on Information Technology Interfaces, Zagreb, Croatia.

Grant, R. M., & Baden-Fuller, C. (1995). *A knowledge-based theory of inter-firm collaboration.* Paper presented at the Academy of Management Best Papers.

Hanley, S., & Malafsky, G. (2003). A guide for measuring the value of KM investments. In C. W. Holsapple (Ed.), *Handbook on Knowledge Management* (Vol. 2, pp. 369-394). Berlin/Heidelberg: Springer-Verlag.

Heijden, H. V. D. (2003). Factors influencing the usage of websites: the case of a generic portal in The Netherlands. *Information & Management, 40*, 541-549.

Holsapple, C. W., & Jones, K. G. (2004). Exploring primary activities of the knowledge chain. *Knowledge and Process Management, 11*(3), 155-174.

Holsapple, C. W., & Jones, K. G. (2005). Exploring secondary activities of the knowledge chain. *Knowledge and Process Management, 12*(1), 3-31.

Jayatilaka, B., Schwarz, A., & Hirschheim, R. (2003). Determinants of ASP Choice: An Integrated Perspective. *European Journal of Information Systems, 12*(3), 210-224.

Jin, Y., Decker, S., & Wiederhold, G. (2001). *OntoWebber: Model-Driven Ontology-Based Web Site Management.* Paper presented at the The 1st International Semantic Web Working Symposium (SWWS'01), Stanford, USA.

Kim, Y. J., Chaudhury, A., & Rao, H. R. (2002). A Knowledge Management Perspective to Evaluation of Enterprise Information Portals. *Knowledge and Process Management, 9*(2), 57-71.

King, W. R. (2006). Knowledge Sharing. In D. G. Schwartz (Ed.), *Encyclopedia of Knowledge Management* (pp. 493-498). Hershey: Idea Group Reference.

Lai, H., & Chu, T.-H. (2002). Knowledge management: a review of industrial cases. *Journal of Computer Information Systems, 42*(5), 26-39.

Lapre', M. A., & Van Wassenhove, L. N. (2001). Creating and transferring knowledge for productivity improvement in factories. *Management Science, 47*(10), 1311-1325.

Liebowitz, J., & Chen, Y. (2003). Knowledge sharing proficienciès. In C. W. Holsapple (Ed.), *Handbook on Knowledge Management* (Vol. 1, pp. 409-424). Berlin/Heidelberg: Springer-Verlag.

Lin, C., Wu, S., & Tsai, R. (2005). Integrating perceived playfulness into expectation-confirmation model for web portal context. *Information & Management, 42*, 683-693.

Markus, M. L. (2001). Toward a theory of knowledge reuse: types of knowledge reuse situations and factors in reuse success. *Journal of Management Information Systems, 18*(1), 57-93.

Marwick, A. (2001). Knowledge Management Technology. *IBM Systems Journal, 40*(4), 814-830.

Massey, A. P., Montoya-Weiss, M. M., & O'Driscoll, T. M. (2002). Knowledge management in pursuit of performance: insights from Nortel Networks. *MIS Quarterly, 26*(3), 269-289.

Mullich, J. (2001). Growing a knowledge management system. *Knowledge Management, 3*(3), 54.

Nielsen, J. (1993). *Usability Engineering*: Academic Press.

Nonaka, I., & Takeuchi, H. (1995). *The Knowledge Creating Company.* Oxford: Oxford University Press.

O'Dell, C. (2000). *Stages of implementation: a guide for your journey to knowledge management best practices.* Houston: American Productivity & Quality Center.

O'Dell, C., Elliott, S., & Hubert, C. (2003). Achieving knowledge management outcomes. In C. W. Holsapple (Ed.), *Handbook on Knowledge Management* (Vol. 2, pp. 253-288). Berlin/Heidelberg: Springer-Verlag.

Shneiderman, B. (1998). *Designing the User Interface* (Third ed.): Addison Wesley Longman.

Smith, H. A., & McKeen, J. D. (2003). Knowledge management in organizations: the state of current practice. In C. W. Holsapple (Ed.), *Handbook on Knowledge Management* (Vol. 2, pp. 395-410). Berlin/Heidelberg: Springer-Verlag.

Van Alstyne, M. W. (2005). Create colleagues, not competitors. *Harvard Business Review, 83*(9), 24-28.

Woods, S., Poteet, S. R., Kao, A., & Quach, L. (2006). Dissemination in portals. In D. G. Schwartz (Ed.), *Encyclopedia of Knowledge Management* (pp. 115-121). Hershey: Idea Group Reference.

Yang, Z., Cai, S., Zhou, Z., & Zhou, N. (2005). Development and validation of an instrument to measure user perceived service quality of information presenting Web portals. *Information & Management, 42*, 575-589.

Feature

Do Learning organizations differ in their culture and reward patterns?

Bijaya Mishra, A Uday Bhaskar & Amulya Khurana

In the context of myriad environmental changes affecting organizations the capacity to learn becomes the core competency of an organization which transforms it into a learning organization. The present study aims at investigating the significance of difference in culture and reward patterns of high and low learning organizations. This paper is based on research work that studied ten IT organizations from the National Capital Region, India.

Bijaya Mishra obtained her Doctoral degree from IIT-Delhi, A Uday Bhaskar is faculty in the area of Human Resources at the International Management Institute, New Delhi; and Amulya Khurana is a Professor in the Deptt. of Humanities and Social Sciences at IIT, Delhi.

In order to cope with the uncertain and turbulent environment, organizations are recognizing the need to get hold of and utilize an increasing amount of knowledge, which is possible only through 'learning'. According to Stata (1989, p. 63), 'the rate at which individuals and organizations learn may become the only sustainable competitive advantage'. Hence learning can be thought of as the core competency of an organization.

When an organization is good at learning, gradually it becomes a learning organization (LO). Though the concept of 'organizational learning' has around for a long time, but 'learning organization' came into floor with the work of Peter Senge in 1990. He popularized the concept with the advent of his book The Fifth Discipline. He defines a learning organization as one "where people continuously expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free and where people are continually learning how to learn together". So a learning organization is one where new knowledge is generated with the collective learning of people. From its inception till date, the notion of 'learning organization' has captured the attention of both researchers and practicing managers as 'something' that can be incorporated into organizational design, to bring significant effect on organizational outcome.

Mishra et al. (2005, p. 35) suggested certain learning mechanisms through which an organization suffices the adaptability requirements and stands out as a learning organization. But what distinguishes a learning organization from other organizations? Does it have some specific characteristics? How can such learning organizations be designed? What is the current understanding of a learning organization?

The learning organization

Several authors have described LO in terms of its displaying certain unique characteristics and practices. Senge (1990) described the five disciplines that learning organizations must possess. These are personal mastery, mental models, shared vision, team learning and systems thinking. Garvin (1993, p. 78) conceptualized a learning

organization through five main activities like, systematic problem solving, experimentation, learning from the past, learning from others and transferring knowledge. Pedler et al. (1991) stated that a learning company is 'an organization that facilitates the learning of all its members and continuously transforms itself'. They developed 11 characteristics, which according to them, should be incorporated in a learning company. These characteristics are a learning approach to strategy, participative policy-making, informating, formative accounting and control, internal exchange, reward flexibility, enabling structure, boundary workers as environmental scanner, inter-company learning, learning climate and self-development opportunities for all. This learning framework provided by Pedler et al., (1991) serves both a diagnostic and development purpose.

According to McGill and Slocum (1993, p. 67), the primary responsibility of management and the focus of management practices in a learning organization are to create and foster a climate that promotes learning. Here the management encourages 'experimentation creates a climate for open communication, promote constructive dialogue and facilitate the processing of experience'. On the other hand, employees are responsible for 'gathering, examining and using the information that drives the learning processes'. The several core behaviors pertaining to such type of organizations are: learning culture, continuous experimentation, network intimacy, accurate information systems, reward system that recognizes and reinforces learning, proper selection of human resources and role of a leader in promoting learning.

Watkins and Marsick (1996 b) identified seven complementary action imperatives that lead organizations towards becoming learning organizations. These are create continuous learning opportunities, promote inquiry and dialogue, encourage collaboration and team learning, establish systems to capture and share learning, empower people towards a collective vision, connect the organization to its environment, use leaders who model and support learning at the individual, team and organizational levels. According to Ulrich et al. (1993a, p.52), in order to build and diffuse learning throughout an organization, managers should ensure that certain ideas are generated and generalized in the organization. Some of these are building a culture focused on learning capability, development of competence, ensuring a fluid organizational structure, proper reward management system. Thus, certain attributes or characteristics are unique to a learning organization.

Attributes of a Learning Organization

Review of literature indicates that there are various attributes such as organizational culture, organizational structure, reward, empowerment, strategy and so on that characterizes a learning organization. In the present study only two of these attributes, organizational culture and reward, have been investigated. Organizational culture has been defined in a number of ways by various authors.

Gephart et al. (1996, p. 34) have stressed the importance of culture in organizational learning. A learning organization culture focuses on supporting and rewarding innovation, promoting inquiry, dialogue, risk taking and experimentation. It allows mistakes to be shared and viewed as opportunities for learning and values the well being of all employees.

According to Lundberg (2002, p. 491), organizational culture is both the 'source and vehicle of organizational meanings'. It allows members to interpret particular situations, actions, objects, behavior in a meaningful way so that these can be accepted by others. Two organizations performing similar tasks do not necessarily perform then identically, because their organizational cultures may be different. As per Sorensen (2002, p. 70), organizational culture reflects not only past learning, but also the context for future learning, which, in turn, has consequences for performance reliability. McGill and Slocum, (1993, p. 67) have described a learning culture as one that promotes openness to experience, encouragement for responsible risk-taking and willingness to acknowledge failures and learn from them. In this context Ulrich et. al. (1993, p. 52) have suggested that while building a culture focused on learning capability, managers need to encourage individuals to share ideas across organizational boundaries.

Literature emphasizes the importance of organizational culture as a source and vehicle of organizational learning.

In the process of transforming an organization into a learning organization, reward and recognition assume utmost importance. Reward ignites shared minds. Reward is a form of recognition that reinforces learning. McGill & Slocum (1993, p. 67) stated that 'pay and promotion practices are tied to risk-taking, flexibility, continuous improvement and other behaviors that learning organizations require". In a study Galbraith (1996) tried to explore the reward system that is necessary for an organization to become an innovative organization. Such a reward system includes rewarding people for generating new ideas, for performing successfully and for motivating employees to do extra effort needed to innovate.

Leonard-Barton (1992, p. 23) has described incentives like employee profit sharing and shareholding as some of the factors for creating a learning laboratory. According to Ulrich et.al. (1993, p. 52), the role of managers in building learning capabilities across organizations is performed in various manners. One of these is building a proper reward system. Factors like using multiple stakeholders for

appraisal, rewarding employees when they learn from mistakes as well as from successes, encouraging and rewarding experimentation and tying bonus/incentives to learning, help increasing learning capability.

Bennett and O'Brien (1994, p. 41) regarded rewards and recognition to be essential aspects for building a learning organization. According to them, "reward-and-recognition systems must support and encourage individual and organizational learning. This can take many forms, from honouring individual employees who take risks to offering a profit-sharing plan that benefits everyone when the organization learns and grows".

Collins (1998, p.10) holds the view that leveraging the intellectual assets of knowledge workers has become the primary focus of human resource management. Thus, there is an indispensable need to put reward system and compensation policies in tune with the knowledge and skill of employees. Such learning-based reward system and compensation policies are likely to encourage the workforce to contribute significantly in enhancing organizational knowledge.

Griego, et.al. (2000, p. 5) studied predictors of learning organizations empirically. For this study, male and female professionals were asked to rate their perceptions about their organizations. They were asked to rate their organizational perceptions on rewards and recognition, training and education, information flow, vision and strategy and individual team development. They found that appropriate rewards and recognition are a guiding structure to the learning organization. In other words, those participants who answered positively that they received rewards and recognition on the job were most likely to assess their work environment as a learning organization.

Hence, a wide spectrum of reward possibilities like employee profit sharing, multiple stakeholders for appraisal, rewarding failure etc. is likely to have a positive influence on the development of a learning environment.

This review suggests that organizational culture and organizational reward system reinforce learning in organizations. But the extent of learning may vary depending on the type of organization, the sector in which the organization operates and the environmental factors that play a major role in organizational functioning. For example, "size, technology, goals and strategy are internal factors that could either facilitate or constrain the organization's ability to operate in a particular way" (Daft, 1996). Similarly, external factors such as the "legal, political and economic climate as well as powerful external stakeholders can also place constraints on an organization" (Goh, 2001, p. 329). So the constraints may be few for some and for others these may be many. As a consequence, some organizations may have more learning capability than others. What has been emphasized by DiBella (1995) is that "all organizations learn but their learning capability can vary".

Research Gaps

It is expected that there would be variations in attributes of different types of organizations, including high and low learning organizations. Previous studies have focused on the specific characteristics of organizational culture and reward patterns of learning organizations. However, there is hardly any study that compares high and low learning organizations in their culture and reward patterns. The present study is a modest attempt in this direction.

Objectives and Hypotheses

The present study aims at comparing two learning attributes (organizational culture and reward system) of high and low learning organizations. Based on the review of literature, the following hypotheses have been formulated to be tested empirically:

Hypothesis 1: High and low learning organizations differ significantly in their cultural attributes.

Hypothesis 2: High learning organizations score better in their reward patterns than that of low learning organizations.

Methodology

Sample

It has been found that there is a positive relationship between learning organization practices and financial performance (Tippins and Sohi, 2003, p. 745 and Ellinger et al, 2002a, p. 5). On the basis of their performance (financial) ranking (ET 500, APR 2003 and Data Quest Vol xxi No. 16, August 31, 2003), ten IT organizations were chosen for the study. Of these, the top five were termed as 'high' and the bottom five were termed as 'low' learning organizations. The categorization of learning organizations as 'high' and 'low' is based on their financial rankings. This aspect has been supported by Goh's study. Goh, (2001, p.329) in his paper described that learning capability and organizational performance are associated. He has described different descriptors that are frequently used to describe learning capability of any organization. Financial and market success are some of these descriptors. The organizations are located in National Capital Region (NCR) of India. Purposive sampling technique was used to select these organizations.

Sample respondents

This study was conducted on the executives working in ten learning organizations. 213 employees across all levels were selected by simple random sampling technique. The questionnaires were administered personally, by making several visits to the sample organizations. The completed questionnaires were collected personally from the respondents.

The respondents were asked not to mention their names and they were assured of confidentiality of the data. Their average age was 31.40 years (sd of 7.37 years) and average experience was 5.06 (sd of 4.05 years). Of the 213, 156 (73.23%) were male and 57 (26.76%) were female respondents.

Rationale for selecting IT industry

As evident from various reports, the IT industry has created brand equity for India in the world map. It is rightly defined as "knowledge intensive industry", as not only hands but also brains are responsible for this phenomenal rate of growth of this industry.

From previous review of literature, it can be said that India has the second largest pool of scientists and engineers in the world. Its super sharp workforce offers high quality, low-cost service products. This low cost, high quality support service has been the strength of India's IT industry. The defect density (no. of defects per 1000 lines of code) of India center was .5 as compared to .7 and 1.3 of China and US based development centers as found out by Motorola. It has 75,000 English speaking IT professionals, Low wage structure and attractive labour pools. In addition to these, IT is an emerging sector where cutting edge human resource (HR) practices are found, whose HR practices are equivalent to that of most advanced countries. Further it is run in a very professional manner where the chance of using professional knowledge is maximum.

Instruments used

For the present study, the following tools of measurement were used to collect data:

- Organizational Learning Culture Scale (Khurana and Bhaduri, 2004)
- Learning Based Reward Scale (Mishra and Khurana, 2005)

A brief description of each of these tools is given below:

Organizational Learning Culture Scales:

This instrument has 50 items with a five-point Likert type format. The scale has 8 dimensions, which are operationally defined by Khurana and Bhaduri (2004), as follows:

Core learning competency:

This factor emphasizes the importance of shared vision in the organization. The members feel a sense of ownership towards organizational goals and are willing to cooperate to achieve it. Achievements are recognized and celebrated by the organization. There is a positive motivation and competence and merit of members is valued. Some items for core learning competency are 'members feel free to voice a difference opinion in a meeting' and 'strengths are recognized and appreciated by the organization'. The scale's alpha reliability in this study is 84.

Affirmative competence:

This factor talks about the importance of values such as openness of communication. Each member feels his work is important and is valued by the organization. Example items are 'the achievements of the organization, however small, are celebrated' and 'there is a clear sense of direction in the organization and it is shared by the members'. The scale's alpha reliability in this study is .71.

Blaming and scapegoating:

This indicates that it hinders learning to happen. For example fixing 'accountability' on others at the time of crisis. This is clearly a counterproductive act. Instead, lessons from failures should be drawn for the organization without blaming and demoralizing others. Some of the items are 'whenever a problem arises the organizatin looks for a scapegoat' and 'members are aware of the negative consequences that will follow if they make a mistake'. The scale's alpha reliability in this study is .704.

Defensive routines:

This is another factor, which inhabits learning processes within organization. It emphasizes on avoiding double-bind communication in the organization and avoiding gaps in stated policy and practice. Members should feel free to communicate openly and give feedback. Therefore, there should be 'trust' between members and between members and top management. Example items are 'it is advisable in this organization to stick to the tried and tested procedures' and 'new members in this organization learn certain tactics from seniors in order to survive here'. The scale's alpha reliability in this study is .69.

Strategic planning:

This factor talks about the importance of innovation as a process in which each and every member of the organization should be involved. Enough autonomy should be given to the people at the grassroots level to plan the

details, while top management provides the broad direction. Some of the items are 'this organization is prepared for any change in the business' and 'the planning process in the organization is the domain of the top management only'. The scale's alpha reliability in this study is .58.

Customer care and feedback:

There should be forums for inviting feedback from internal and external sources, which is crucial to the learning process in an organization. Example items are 'there are forums for receiving the customer's feedback' and 'members are encouraged to critically evaluate the organization performance'. The scale's alpha reliability in this study is .56.

Peer Support:

This emphasizes the help and support members should provide each other at the individual level. The support could be in personal as well as professional crises. Some items are 'members discuss and congratulate their colleagues whenever they achieve something' and 'when a member is facing a work related crisis, other members are supportive'. The scale's alpha reliability in this study is .77.

Ethos:

Ethos is the characteristic or attitude of a community or an organization. It is intangible, but this spirit is unmistakably imbibed by members of the organization during their course of their socialization. Example items are 'members feel that their work makes a difference to the organization' and 'the organization has certain core values which influence every aspect of the organization's life'. The scale's alpha reliability in this study is .66.

Learning based Reward Scale:

This scale has 16 items with a six-point Likert type format. The scale has 3 dimensions, which are operationally defined by (Mishra and Khurana, 2005, p. 386). A brief description of these dimensions is given below:

Rewarding innovation:

This factor explains that in a knowledge intensive era, innovation in terms of risk taking, learning new skills, individual's input to organizational wisdom and so on, amounts to increase in the brand equity of an organization. So in order to encourage an employee to be innovative, an organization needs to have proper reward and recognition policy. Some items for rewarding innovation are 'environment in the organization promotes innovative and risk taking behavior' and 'learning from innovations is properly rewarded'. The scale's alpha reliability in this study is .56.

Competency based reward:

This involves alignment between one's performance and the compensation or reward one gets. If a company can accurately measure performance and align rewards accordingly, it may serve as a powerful reinforcer of desired behaviour. Keeping this in view, a successful competency reward system can incorporate policies such as proper reward and recognition of knowledge skills, pay at par with relative contribution, transparent designing of reward etc. Example items are 'acquisition of skills, knowledge is recognized and rewarded in the organization' and 'pay-for-performance policy exists in the organization'. The scale's alpha reliability in this study is .87.

Open and fair payment:

This allows employees a better understanding of reward mechanisms in their organization. This includes consistency in payment and decentralized decision-making. Some items are 'the distribution of reward system lacks parity' and 'the organization lacks incentives to promote better performers'. The scale's alpha reliability in this study is .63.

Results and Discussion

Students' 't' test has been used to find out the significance of differences in organizational culture and reward system between high and low learning organizations. The results are presented in tables I and II, respectively.

The results show that the mean scores for high learning organizations are significantly higher than those of low learning organizations in core learning, affirmative competence, peer support, ethos, customer care and feedback and strategic planning, whereas in blaming and scapegoating, low learning organizations score significantly higher than that of high learning organization. However, there is no significant difference in defensive routines between high and low learning organization. This may be due the fact that in Indian IT organizations, the nature of work is mostly maintenance type. Mainly, they concentrate on projects that are outsourced to them. Thus, they are mostly into providing services to outside companies. Probably they perceive that the work is not challenging, it is rather monotonous. Thus, the general tendency seems to be filling up of the gaps created between the stated and current policy. Perhaps, this may be the reason that there is no significant difference in defensive routines (filling the gap between actual policy and stated policy) between the high and low learning organizations.

Table 1: Comparison of organizational culture of high and low learning organizations (LO)

Dimensions of Organizational culture	High LO (N=114)		Low LO (N=99)		t-value
	Mean	S D	Mean	S D	
Core Learning	32.28	5.04	29.10	5.79	4.293***
Blaming and scapegoating	25.88	5.48	25.54	4.02	1.510***
Affirmative competence	23.22	3.99	24.67	4.40	6.175***
Defensive routines	21.54	4.34	22.07	4.33	-.884
Peer Support	14.85	2.29	13.98	3.17	2.307*
Ethos	11.28	1.97	9.77	2.25	5.188***
Customer care and feed back	11.03	1.83	9.29	2.10	6.463*
Strategic planning	24.25	3.48	23.01	3.77	2.501**

*p<.05 **p<.01 ***p<.005

Table 2: Comparison of reward system of high and low learning organizations (LO)

Dimensions of reward	High LO (N=114)		Low LO (N=99)		t-value
	Mean	S D	Mean	S D	
Rewarding Innovation	27.56	6.40	21.01	6.11	7.606***
Competency-based reward	24.52	5.47	18.50	6.44	7.373***
Open and fair payment	11.74	3.72	11.42	3.03	.683

***P<.005

The significant difference observed in other cultural attributes like core learning, affirmative competence, blaming and scapegoating, peer support, ethos, customer care and feedback and strategic planning, between high and low learning organizations. These findings are supported by some of the existing literature. In a study pertaining to how the culture impacts knowledge management, organizational learning and ultimately firm performance Lopez et al.(2004, p.93) tried to investigate the degree to which collaborative culture influences organizational learning and firm performance in 195 firms. The results showed that collaborative culture encourages the development of organizational learning and also has a significant effect on business performance. According to Senge (1990), collaborative culture is possible when people are guided by shared vision and the leader acts as a facilitator of learning by having a shared vision, surfacing and challenging mental models and engaging in systems thinking.

The first hypothesis is thus, supported by these findings, as they differ in all dimensions of organizational culture except one *i.e.* defensive routines.

Table 1 shows that high and low learning organizations differ significantly in two dimensions of reward *i.e.* rewarding innovation and competency-based reward. The sample being in the knowledge intensive sector, it is now surprising that recognition of skills, knowledge, innovation etc. are the factors which are given due importance for learning in a high learning organization. IT industry depends on people for value creation and knowledge generation. The core competency of this industry is based on employees' skills, their creativity and risk-taking ability etc. This distinguishes one company from another. This could be the reason as to why the employees have given more credit to these factors than those of 'open and fair payment'. However, investigating the way, open and fair payment policy is being practiced in these organizations, may show a clearer picture in this regard. Thus, the second hypothesis is also partially supported by the existing literature, as high and low learning organizations differ significantly in two of the three dimensions of reward patterns.

Summary and Conclusion

The objective of this study was to find out whether high learning organizations differ in their cultural and reward patterns *vis-à-vis* low learning organizations. Results of the study show that high learning organizations scored better in four cultural factors and two reward factors than those of low learning organizations. The results suggest that the presence of certain cultural factors such as core learning, affirmative competence, peer support, ethos, customer care and feedback and strategic planning as well as certain factors of reward like rewarding innovation and competency based reward, are likely to increase

organizational learning capabilities. This implies that management practices should focus on these factors for reinforcing learning in their organizations.

Implications for management practitioners:

The study revealed that there are some attributes of learning organizations which may either be called learning enablers or inhibitors. These attributes maintain the 'learning threshold' of an organization in a state of quasi equilibrium. The enablers drive learning forward and the inhibitors hold it back. When there are no enabling factors, it is possible to think of an organization being 'learning disadvantaged'. Raising of the learning threshold, therefore, is maintained by increasing the enablers and decreasing the inhibitors.

The IT sector, which is emerging as a major driver of the Indian economy, thrives on its skilled manpower. But, it seems all is not well on the skilled manpower front. In this context, the National Association of Software and Service Companies (NASSCOM, 2006) reports that although India contributes a significant 28 per cent to the total talent pool of knowledge workers globally, it will be besieged with a severe skill shortage of 5,00,000 knowledge workers by 2010.

Some other views about the IT sector are worth mentioning. Tschang (2001) said, "the Indian software industry can be considered one of the 20th century's most surprising economic developments, with India apparently coming from nowhere to become a major supplier of labor and software development services to the US and rest of the developed world". However, with this progress there arise some constraints, mainly at the "inter-firm level". The issues Tschang outlined are public infrastructure, the Human Resource (HR) base, the educational system, new financing, new ventures-based growth and an environment supportive of entrepreneurship, innovative thinking and experimenting. One of the major issues faced by these companies relates to the people issue, as this industry is run by mind rather by hand. Though there is no doubt about the individual skill, it is the "project management skill" that deserves special attention. As reported by Tschang, many firms are weak in project management skills because such professionals are hard to retain. High attrition rate is reported at the middle management level, where people leave their parent organizations to learn and accumulate knowledge from other firms.

Hence, the need of the hour is understanding and developing people to maintain an organization's HR in augmentation mode. In this regard, HR professionals have a critical role to play in identifying and developing knowledge workers. Ellingker et. al. (1999b, p.105) have stressed upon the fact that human resource developers could become a part to learning organization infrastructure. Ulrich, (1998b, p.124) has also stated that the true meaning behind information age HR management lies in ensuring that knowledge workers and their know-how are understood, developed, cultivated and retained. So in the present context when the IT industry is facing stiff competition, with high rate of turnover and a burgeoning of multinationals, there is an urgent need to develop human resources. Management can use some of the findings of this research to diagnose current strengths and weaknesses of organizations and develop strategic actions for making an organization a high learning organization.

Implications for researchers:

In addition to the above, the study has made the following significant contributions in the field of organizational learning/learning organizations.

As pointed out by Jashapara (2003, p. 31) studies relating to learning organization are mainly confined to qualitative research. He quoted that "even the related discipline of organizational learning is characterized by qualitative research with a few handful of studies involved with hypothesis development and testing" (p. 31). In this context Garvin (1993, p.78) has outlined where 'critical' issues that are worth mentioning. He called these 'three Ms' *i.e.* meaning, management and measurement. 'Meaning' denotes a definition of learning organization, which must be actionable and easy to apply. 'Management' is 'setting clearer guidelines for practice' and 'Measurement' is assessing the organization's state and level of learning. These three issues are vital for effective implementation of learning organization. This study has made an attempt to incorporate some of the above mentioned issues by collecting and analyzing quantitative data.

Limitations & Future Research

The implications of the study must be considered in light of its limitations. First, the study is based on a small sample of organizations. The sample may not fully represent the sector from which it was drawn. Second, the organizations are located in only one region *i.e.* northern region of the country. There may be cultural differences among different regions. If such studies are conducted in large samples, across the country, a clearer picture of the attributes of high learning organization may emerge. Last but not the least, the present study has taken into account only two attributes *i.e.* culture and reward of learning organizations. Future studies may consider other attributes like, organizational structure, leadership aspect, employee empowerment and so on.

Within literature on 'organizational learning' and 'learning organization', there are varied viewpoints and theoretical orientations. However, 'these theoretical discussions backed by rigorous empirical research will bring

clarity and value to this concept of 'learning organization' (Goh, 2001, p.329). The contribution of this paper is to provide some empirical evidence to support the existence of managerial implications of learning organization concept. However, this conclusion is limited to the findings of the present study only. Further research is needed before any generalizations can be made.

References

Bennett, J.K. & O' Brien, M.J., "The building blocks of the learning organization", Training, 31(6), 1994.

Collins, D., "Knowledge work or working knowledge" *Journal of Systemic Knowledge Management,* 3, 1998.

Draft, R., Organization Theory and Design, West Publishing Company, St. Paul: Minnesota, 1996.

DiBella, A.J., "Developing Learning Organizations: A Matter of Perspective", Proceedings of the 1995 Academy of Management Meeting, August.

Ellinger, A.D., Watkins, K.E. and Bostrom, R.P., "Managers as facilitators of learning in learning organizations", *HRD Quarterly,* Summer, Vol. 10 Issue 2, 1999.

Ellinger, A.D., Ellinger, A.E., Yang, B. and Howton, S.W., "The relation between the learning organization concept and firms' financial performance: an empirical assessment", *HRD Quarterly,* spring, 13, 1, 2002.

Galbraith, J.R. "Designing the innovative organization", in Starrkey, K. (Ed.), How organizations Learn, International Thomson Business Press, London, 1996.

Garvin, D.A., "Building a learning organization", *Harvard Business Review,* July-August, 1993.

Gephart, M.A., Marsick, V.J., Vanburen, M.E. and Spiro, M.S., "Learning organization come alive", *Training and Development,* Vol 50 Issue 12, 1996.

Goh, S.W., "The learning organization: an empirical test of a normative perspective", *Int'l J. of Org. theory and Behave.*, 4(3&4), 2001.

Griego, O.V., Geroy, G.D., & Wright, P.C., "Predictors of learning organizations: a human resource development practitioner's perspective", *The Learning Organization,* 7(I), 2000.

Jashapara, A., "Cognition, culture and competition: an empirical test of the learning organization", *The Learning Organization,* 10(1), 2003.

Khurana, A. and Bhaduri, S., "Organizational learning culture scale", Available http://www.iitd.ernet.in/tech/,2004.

Leonard-Barton, D., "The factory as a learning laboratory", *Sloan Management Review,* fall, pp. 23-38, 1992.

Lopex, S.P., Peon, J.M.M., & Ordas, C.J.V., "Managing knowledge: the link between culture and organizational learning", *Journal of Knowledge Management,* 8(6), 2004.

Lundberg, C.C., "Managing in a culture that valuyes learning", in Cavelari, S. and Fearon, D. (Ed.), Developing and Managing a Learning Organization, Infinity Books, pp.491-508, 2002.

McGill, M.E. and Slocum, J.W., "Unlearning the Organization", *Organizational Dynamics,* Vol. 22 No. 2, 1993.

Mishra, B. and Khurana, A., "Development of learning based reward scale", *Indian Journal of Industrial Relations,* January, Vol. 40 No. 3, 2005.

Mishra, B., Gupta, R. and Khurana, A., "Organizational learning: a review", *Productivity,* Vol. 46 No. 1, 2005.

NASSCOM report, *www.nasscom.in*, 2006.

Pedler, M., Burgoyne, J. and Boydell, T., The Learning Company, McGraw-Hill, London, 1991.

Senge, P., The Fifth Discipline, Currency Doubleday, New York, 1990.

Sorensen, J.B., "The strength of corporate culture and firm performance", *Administrative Science Quarterly,* Vol. 47, 2002.

Stata, R., "Organizational learning-the key to management innovation", *Sloan Management Review,* 30(3), 1989.

Tippins, M.J. and Sohi, R.P., "IT competency and firm performance: is organizational learning a missing link?", *Strategic Management Journal,* 24, 2003.

Tschang, T., "The basic characteristics of skills and organizational capabilities in the Indian software industry", ADB working paper 13, Manila: Asian Development Bank, 2001.

Ulrich, D., Jick, T. and Glinow, M.A.V., "High impact learning: Building and diffusing learning capability", *Organizational Dynamics, autumn,* 1993.

Ulrich, D., A new mandate for human resources. *Harvard Business* Review, Jan-Feb, 1998.

Watkins, K.E. and Marsick, V.J. (Ed.), In Action: creating the learning organization. Alexandria, VA: American society for training and development, 1996 b.

Feature

Impact of Automated Guided Vehicles on the Productivity of a Manufacturing System: A Simulation study

Ravinder Kumar, Suresh K Garg & Rajesh K Singh

Improving flexibility and productivity of manufacturing systems is an important requirement in a competitive environment. Automated Guided Vehicles (AGVs) keep enhancing flexibility. The effects of the number of AGVs and the speed of the AGVs on the performance of the manufacturing system are studied through simulation on WITNESS software Machine utilization and the number of parts processed by the machines are taken as the performance measures.

Ravinder Kumar is lecturer in Mechnical Engineering Department at the HRM Institute of Technology, Delhi; Suresh K Garg is a Professor and Rajesh K Singh is a Senior Lecturer in Mechanical Engineering Department at Delhi College of Engineering, Delhi.

Intense competition in the global market for mechanical parts manufactured on machine tools and other metal working equipment has compelled manufacturers to reduce delivery times and quote a competitive price even for relatively small orders. The batch size is ever decreasing and the need to meet specific customer requirement warrants considerable flexibility in the working of the manufacturing system. The manufacturing industries deal with continually changing and increasingly complex product requirements as well as mounting pressure to decrease costs. Flexible manufacturing system (FMS) have been evolved to meet these requirements.

When a FMS is being planned, the objective is to design a system which will be most efficient in production of an entire range of parts (Mohamed, 1998). FMSs are designed to combine the objective of high productivity of mass production system and the flexibility of job shop production. FMS is an integrated production system consisting of multifunctional numerically controlled machines connected with an automated material handling system (Kumar and Sridharan, 2006). A FMS can be defined as the collection of production equipment, logically organized under a host computer and physically connected by a material handling system. The term flexible manufacturing system is generally use to indicate a wide variety of automated manufacturing systems. Different classification systems have been used to classify FMS based on size, level of complexity, type of material handling system, process characteristics and scheduling environments (McCarthy and Lius, 1993; Rachmadugu and Steck , 1994: Stecke and Browne, 1985). FMS can be of two categories; Dedicated FMS and Random order FMS. A dedicated FMS is designed to produce a limited variety of parts styles and complete universe of parts to be made on the system is known in advance. A random order FMS is the system in which new part designs are introduced and the production schedule is subject to change from day to day. The random order FMS must be more flexible than the dedicated FMS.

The difference between implementing a manually operated machine cell and installing a FMS are (Grover, 2001):—

- The FMS requires a significantly greater capital investment because new equipment is being installed, rather than existing equipment being rearranged.
- The FMS is technologically more sophisticated for the human resources who must make it work.

The potential benefits are substantial. The benefits that can be expected from an FMS are as follows:

- Increased machine utilization
- Fewer machines required
- Reduction in factory floor space required
- Greater responsiveness to change
- Reduced inventory requirements
- Lower manufacuring lead times
- Reduced inventory requirements and higher labor productivity
- Opportunity for unattended production.

FMS are often characterized by a large part mix, alternate part rutings, negligible tool changeover times, limited buffer storage between machines and faster processing times (Sarin and Dar, 1986). These features make FMS capable of rapidly adjusting to product mix and product design changes. To meet these challenges, Flexible Manufacturing systems must be more robust, reconfigurable, adaptable and more flexible.

Classification of Flexibility in FMS

Flexibility in FMS can be defined as the capacity to operate effectively and efficiently under changing market and technological production conditions. Flexibilities in FMS can be of the following types (Browne et al. 1984; Falkner, 1986, Luggen; 1991; Mohamed, 1994 and Gupta, 2003).

(a) *Routing flexibility*: Capacity to produce part through alternate workstation sequences in response to equipment breakdowns, tool failures and other interruptions at individual stations.

(b) V*olume flexibility*: Ability to economically produce parts in high and low total quantities of production, given the fixed investment in the system.

(c) *Product flexibility*: Ease with which design changes can be accommodted or ease with which new products can be introduced.

(d) *Product mix flexibility*: Ability to change the product mix while maintaining the same total production quantity; *i.e.*, producing the same parts only in different proportions.

(e) *Labor flexibility*: Labor flexibility is achieved by having people with multiple skills and good education level.

(f) *Machine flexibility*: Capability to adapt a given machine in the system to a wide range of operations and part styles.

(g) *Planning flexibility*: The ease with which the production planning can be changed based on the urgency of the customers.

(h) *Production flexibility*: The range or universe of parts styles that can be produced on the system.

(i) *Expansion flexibility*: Ease with which the system can be expanded to increase total production quantities.

(j) *Communication flexibility*: The ability to communicate with many persons from different functional areas.

Literature Review

Prakash & Chen (1995) presented the results of simulation study of a flexible manufacturing system. This presents the results of a simulation on FMS consisting of six machining centers capable of performing a variety of tasks, an automated guided vehicle-based material handling system and a single input, single output storage retrieval system connected to the manufacturing system by conveyors. They analyzed FMS by simulation on SIMAN IV simulation software and studied the effects of various parameters (number of AGVs, speed of AGVs, scheduling rules) on the performance of the FMS. The study was towards the performance evaluation of the system under different scheduling rules, various conditions of AGV availability different processing times and different layout of the manufacturing system. Mohamed (1998) studied operations planning a scheduling problem in FMS under different loading strategies, due date assignment and part type arrivals and analyzed the effect on mean flow time, mean tardiness, mean earliness and system utilization. The results presented that the overall system utilization was higher for a certain type of loading strategies and the balancing of the system was better achieved by some other loading strategies. Kumar and Sridharan (2006) analyzed the performance of the Part Launching Rule (PLR) and Tool Request Selection Rule (TRSR) in FMS when the system shares the tools between the machines. The performance measures evaluated are mean tardiness, conditional mean tardiness and mean flow time. Based on the anlysis of the simulation results, the best possible

scheduling rule combinations for part launching and tool request selection have been identified for the three scenarios considered.

Das and Canel (2006) proposed an algorithm for scheduling batches of parts in the FMS. The setup time depend on the particular batch just processed by the system as well as on the next batch to be processed in the system. The objective measures that is used in this research is the minimization of the total production time *i.e.* makespan. This is achieved by minimizing the inter-batch setup times The method used is the Branch and Bound method, which solves large size problems in a reasonable time. This paper presents an algorithm to solve the FMS planning problem of scheduling batches of parts having sequence dependent setup time (SDST) in a multi-cell FMS exhibiting flowshop characteristics.

It has been shown that the time to solve a problem of large size (having more number of machines and batches) can be reduced by the Branch and Bound method. This was used to minimize the makespan by changing the number of machine cells and number of batches. Gertosio *et al.* (2000) proposed to integrate in a single simulation model a physical model which corresponds to the hardware elements of the FMS with their physical characteristic and interactions, and a logic model which corresponds to the modeling of the computer control system and its interaction with the material part. The logical and physical entities are synchronized using a "wait/signal" process which enables to block an entity (physical or logical) in a transaction waiting for its corresponding entity to send a signal. This study involves control strategies, which allow managing in a flexible way, the resources as well as the production parts. In this paper only pre-release decisions and strategies which deal with the allocation of parts to the resources, have been considered.

Yildirim et al., (2006) used the artificial neural network to achieve the goals management in a production system. Sometimes management's goal is not to minimize the total manufacturing cost and a more expensive option may be chosen in order to bring more flexibility to accommodate possible demand spikes. The Back Propagation Artificial Neural Network (BPANN) is used to achieve the targeted performance measures of the production system when the system is not used to its full capacity. Artificial neutral networks have been utilized to model a highly nonlinear system, a multi-objective nonlinear optimization problem in a manufacturing system having identical parallel machines in each work center, in which the goal is to obtain a solution that is a close as possible to management goal. The framework presented here reduces the number of alternatives to be simulated significantly. The result presents the utilization of the production system under different scheduling rules while achieving the targeted performance measures (mean flow time, mean tardiness, maximum completion time and machine utilization rate etc.) for the various configuration of the production system.

Kosturiak and Gregor (1998) studied the simulation in FMS and proposed some experience and recommendations for effective simulation application. This paper presents how the improvement measures can be evaluated using simulation and a Taguchi plan of experiments. The influence of various control strategies on the manufacturing system parameters is demonstrated. The simulation in the manufacturing system analysis has been proved to be an indispensable tool. It also has been shown that how the manufacturing cost can be reduced through the use of simulation. Angelo et al (1990) presented a study to select the statistically significant variable and to determine the relative impact on system performance. The paper presented methods for monitoring three types of plants performance: Daily Output, Lead Time and Work in Process. In this paper, by utilizing a appropriate computer simulation model and by adopting convenient statistical tools, such as design of experiments, the relationship between the system's technological performance and the significant factors governing the process dynamics has been investigated. Tunali (1996) presents a simulation model of a job-shop type FMS developed to investigate how the performance of scheduling decision (*i.e.* mean job flow time) is affected by the use of flexible or prefixed part process plans in case of a machine breakdown situation. It has been shown that allowing the parts affected by a machine failure to be scheduled on to alternate mahines helps to reduce the possible negative effects on mean job flow time. Yan et al. (1997) presented the New Extended Stochastic High-Level Evaluation Petri Nets (ESHLEP-N), which show that these are more suitable for modeling and simulation of flexible manufacturing systems. The results presented that the throughputs of the rescheduling can increase on an average by 6.48% as compared with those of non-rescheduling. It also has been shown by comparison between simulation results and the experiment ones under the identical experiments conditions and processes, that the relative effort between both are less than 3%.

Brown et al., (1984); Falker (1986), Luggen (1991); Mohamed (1994); performed the studies on the various types of flexibilities in FMS and classified the flexibilities in FMS. Gupta (2001) performed a study on the flexibility and showed that a particular type of flexibility can be measured taking into account the weight of various parameters contributing to it and the response of an enterprise to these parameters. Gupta (2003) has shown how to manage flexibility as well as relationship of different types of flexibilities with various types of productivity.

Simulation

Simulation is the laboratory experimentation of reality for determining the effect of a number of alternative policies without disturbing the real system. Simulation is the use of the quantitative system model that has the designed characteristics of reality in order to produce the essence of actual operation by developing a series of organized experiments to predict the behaviors of the process over a period of time (Shankar, 2003). Simulation can lead to decisions that save money and time, but it can also lead to costly mistakes if this technique is applied improperly. The main problems of the effective use of simulation are above all insufficient knowledge and experience, wrongly defined project objectives, insufficient co-operation, inappropriate detail level of the model and insufficient input data (Kosturiak and Gregor, 1998).

Simulation by WITNESS

Projects which involve simulation have several unique aspects, which must be managed particularly carefully to ensure their success. The typical sequence of events in a project, using a practical methodology:

- Establishing objectives
- Deciding the scope and level of detail in the model
- Collecting data
- Structuring the model
- Building the model
- Running the model
- Generating reports
- Testing the model
- Experimenting with the model
- Documenting the model
- Presenting the results and implementing them

WITNESS is one of the simulation software for simulating the automated manufacturing systems. The above objectives can be successfully achieved with the help of this software. The model of the manufacturing system can be designed in this software using various design elements provided in the software. Once the model has been designed the next step is to detail the various elements of the system. Detailing can be explained as the logical relationship between various elements of the manufacturing system. Once all the elements of the system have been detailed the model can be run and the various activities can be viewed on screen in the form of graphics. Thereafter the statistics report can be viewed in the form of tables and charts. The performance parameters of the system can be studied by changing the design variables in the manufacturing system. The system with the best performance is chosen. The results can be presented in the form of tables and charts.

Case study

A hypothetical FMS consisting of the following equipment and accessories has been considered for the study:—

- Two part types (engine and transmission system) are to be assembled. For both the parts inter arrival time is 30 min. in a lot size of one.
- Two identical washing machines (cycle time 45 min)
- Two identical painting machines (cycle time 35 min)
- One assembly machine (cycle time 25 min)
- One testing machine (cycle time 30 min)
- An AGV based material handling system (capacity two parts at a time or one assembled part, speed in m/min.)
- Tracks for the AGVs having the following lengths in meters

T1	T2	T3	T4	T5	T6
300	100	60	75	150	450

- Buffers for storing the parts temporarily as shown in the fig. 1.

The following assumptions are made for this study of the simulation:

The layout of the manufacturing system for this study has been shown in Fig. 1. The model developed here for the study consists of two identical washing machines, two identical painting machines, one assembly machine and one testing machine having cycle times of 45.0 min, 35.0 min, 25.0 min and 30 min respectively.

The parts enter in the system at the front end of the track T6 and are loaded on to the AGV. The parts are then transported to the front end of the track T1 and when the machines are free the parts are unloaded and washing operation is carried out simultaneously on both the parts on separate machines. After washing, the parts are loaded on to the painting machines where parts are unloaded and printing operation carried out on separate machines. The parts are then transported to the assembly machine where both the parts are assembled and only one part comes out from the assembly machine. The assembled part is then loaded onto the AGV and transported to testing machine for testing. After the testing of the part has been completed the part is loaded onto the AGV and transported to the front end of the track T5 and unloaded in the buffer. The

unloaded AGV moves along the track T6 to load the next parts. Thus the cycle of the manufacturing system is completed.

The following assumptions are made for this study of the simulation:

- The parts arrive in the system at a fixed interval of time.
- The part arriving first enters first in the system.
- The AGVs based material handling system considered operates like serial access material handling systems; the flow pattern of parts from machine cell to machine cell is similar to that of a flow shop.
- The loading and unloading time of the parts at AGV is neglected.
- The acceleration and deacceleration of the AGVs is neglected.
- Kanban (pull) rule is used for the flow of the parts in the system.
- The parameters other than the number of AGVs and speed of AGVs are assumed to be constant.

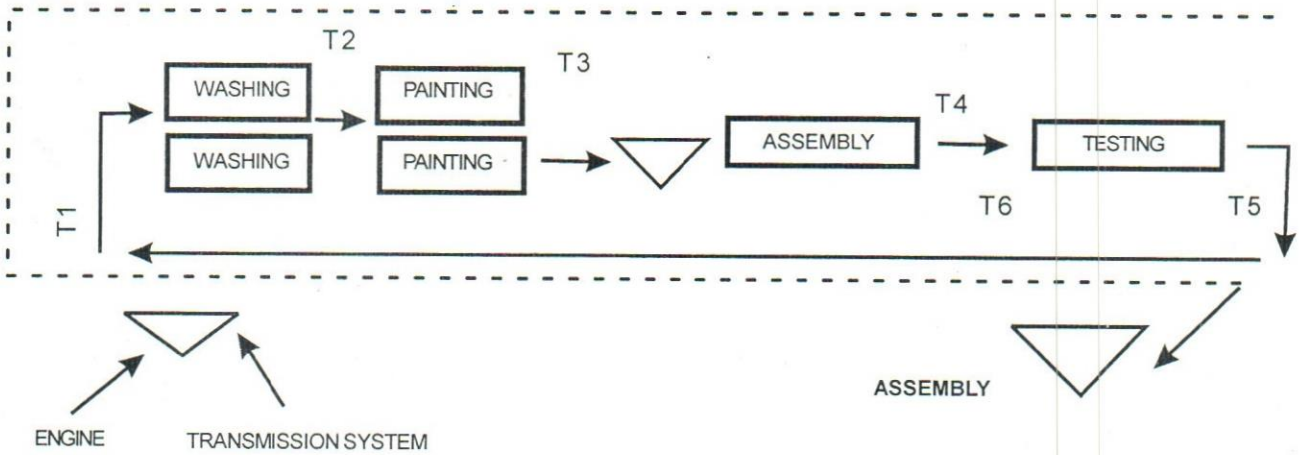


Fig. 1 Lay out of the manufacturing system (T-tracks, ▽ - buffers)

Result and discussion

The study is performed to analyze the effect of change of the number of AGVs and the speed of the AGVs on the performance of the system. The other variables are kept constant. The assembly system modeled for the study is simulated on the WITNESS simulation software and run for a period of 19980 minutes *i.e.* one week (7 day × hr. × min.). First the number of AGV in the system is taken as one. The speed of the AGV is increased keeping all other parameters constant. The result is obtained for the performance parameters *i.e.* machine utilization and output.

After changing the speed of the AGV in steps, the numbers of AGVs in the system are increased and the speed of the AGVs is also increased for each number of AGVs. The machine utilization and the number of operations carried out by each machine for the different cases are shown in table 1. Figure in bracket shows the output i.e. number of operations performed. Different cases are discussed as below.

Case I

The effect of the number of AGVs on the performance parameters:

From table 1 it is observed that when the numbers of AGVs are increased at low speed the machine utilization increases significantly up to four AGVs but thereafter the machine utilization increased with the increase of the number of AGVs. Four numbers of AGVs give the optimum performance of the system and increasing the AGVs further lead to the increased cost of the material handling system with no gain.

Case II

The *effect of the change in the speed of the AGVs.*

From the results given in table 1 it is also observed that for the given manufacturing system the change in the speed of the AGVs also has some impact on the performance of the manufacturing system. When the speed of the AGVs is increased the performance is not improved at the low number of AGVs, but when the number of AGVs are three the percentage utilization of all the machines increases significantly. There is an optimum speed for the AGVs to give the best performance of the manufacturing system.

Table 1 Effect of the number of AGVs and their speed on machine utilization (%)

1a. Washing Machines					
No. of AGVs	Speed of AGVs				
	20	40	60	80	100
01	24.55(55)	28.57(64)	29.91(67)	30.80(69)	31.25(70)
02	49.11(110)	57.68(127)	59.82(134)	61.50(137)	62.50(140)
03	73.66(165)	84.90(190)	89.46(200)	91.86(205)	93.39(209)
04	98.19(219)	99.90(223)	99.33(223)	99.95(223)	99.96(223)
05	99.80(223)	99.90(223)	99.93223)	99.95(223)	99.96(223)
1b. Painting Machines					
No. of AGVs	Speed of AGVs				
	20	40	60	80	100
01	19.10(55)	21.94(63)	46.34(133)	23.94(68)	24.31(70)
02	38.19(110)	43.82(126)	46.34(133)	47.55(136)	48.34(139)
03	57.29(165)	65.69(189)	69.26(199)	71.16(204)	72.30(208)
04	76.04(219)	77.42(222)	77.43(223)	77.43(223)	77.43(223)
05	77.31(222)	77.42(222)	77.43(223)	77.43(223)	77.43(223)
1c. Assembly Machines					
No. of AGVs	Speed of AGVs				
	20	40	60	80	100
01	13.64(55)	15.63(63)	16.62(67)	16.87(68)	17.29(69)
02	27.28(110)	31.25(126)	32.99(133)	33.73(136)	34.40(138)
03	40.72(164)	46.88(189)	49.36(199)	50.60(222)	51.52(207)
04	54.12(218)	55.06(222)	55.08(222)	55.10(222)	55.11(222)
05	55.06(222)	55.06(222)	55.08(222	55.10(222)	55.11(222)
1d. Testing Machines					
No. of AGVs	Speed of AGVs				
	20	40	60	80	100
01	16.37(55)	18.75(63)	19.65(66)	20.24(68)	20.54(69)
02	32.66(109)	37.50(126)	39.29(132)	40.48(136)	41.07(138)
03	48.74(163)	56.09(188)	58.93(198)	60.71(203)	61.61(207)
04	64.81(217)	65.99(221)	65.94((221)	66.01(221)	66.02(221)
05	65.82(221)	65.99(221)	65.94(221)	66.01(221)	66.02(221)

Note: *Figure in bracket shows the output *i.e.* number of operations performed.

The above results show that for the given manufacturing system using either four AGVs with speed of 20 m/min can optimize the performance of the system or a speed in the range of 60 to 80 m/min with three AGVs is the best. The decision can be taken based on the cost of the AGVs or the increase in cost with the increase of the speed of the AGVs.

From the results it is concluded that the machine utilization and the number of operations carried out by each machine increases with the increase in the number of AGVs. But when the number of AGVs are increased further, the machine utilization becomes optimum and further increases in the number of AGVs will only make these AGVs unutilized in the system and the cost of the material handling system will also increase accordingly.

It also observed that when the speed of the AGVs is increased, the impact of the speed is more in case of the certain number of the AGVs. From table 1 it can be seen that the machine utilization is increased with the increase of speed of AGVs when the number of AGVs are two. But when the number of AGVs is increased beyond a limit, the speed of the AGVs is not having much effect. So in this configuration of FMS we find a material handling system with three AGVs with a speed of 60 to 80 m/min or four AGVs with a speed of 20 m/min as the most efficient material handling system.

Conclusion

This paper presents the results of a simulation study of flexible manufacturing system for assembling two parts after carrying out the washing and painting operations and then testing the assembled part. The simulation is performed on the simulation software WITNESS. The result indicates that the number and speed of the AGVs can be increased to a certain level beyond which the efficiency of the system does not improve. This is as per the law of diminishing returns.

Further we can extend our study by taking a more complex manufacturing system capable of performing more number of operations and selecting some rule for the parts to be processed. The AGVs configuration can be set for the different types of FMS and some algorithm can be formed to find the optimum solution to the problem. The study can also include the analysis of the cost of the AGVs when its number increases.

References

Angelo, A.D., Gastaldi, M. and Levialdi, N., (1996). "Dynamic analysis of the performance of a flexible manufacturing system: A real case application". Computer Integrated Manufacturing systems, Vol. 9, No. 2. pp. 101-110

Browne, J., Dubois, D. Rathmil, K., Sethi, S.P. and Stecke, K.E., (1984). "Classification of Flexible Manufacturing systems", FMS Magazine, Vol.2, April 1984, pp. 114-117.

Das, S.R. and Canel, C., (2006). "An algorithm for scheduling batches of parts in a multi-cell flexible manufacturing system" *International Journal of Production Economics*, Volume 97, No. 3, pp. 247-262.

Falkner, C.H., (1986). 'Flexibility in Manufacturing system'' Proceedings, Second ORSA/TIMS Conference on Flexible Manufacturing Systems: Operstions Research Models and applications Edited by K E Stecke and r Sui, Elsevier Science Publishers, New York, pp. 95-106.

Gupta A.B. (2001). "Flexibility in an automobile manufacturing enterprise" *Global journal of flexible systems management*, Vol. 2, No.1, pp. 43-50.

Gupta A.P. (2003)."Managing the manufacturing flexibility in a piston ring manufacturing plant – a case study". *Global journal of flexible systems management*, Vol. 4, Nos. 1&2, pp. 49-56.

Kosturiak, J. and Gregor, M., (1998) "FMS simulation: Some experience and recommendations'. Simulation Practice and Theory, Vol. 6, pp. 423-442.

Kumar, N.S. and Sridharan, R., (2006)."Simulation modeling and analysis of tool sharing and part scheduling decisions in single stage multi-machine flexible manufacturing systems.

Luggen, W.W., (1991). "Flexible Manufacturing Cells and systems". Prentice Hall, Inc., Englewood Cliffs, New Jersey.

Mohamed, Z.M., (1994) "Flexible Manufacturing Systems – Planning Issues and Solution", *Garland Publishing*, Inc., New York.

Mohamed N.S. (1998). Operations planning and scheduling problems in an FMS. An integrated approach. Computers Ind. Engg. Vol.35, Nos. 3-4, 443-446.

Prakash, A., Chen, M., (1995). A simulation study of flexible manufacturing systems. Computers. Ind. Engg. Vol.28, No.1, pp. 191-199

Sarin, S. and Qr, (1986). Scheduling parts in an FMS. Large Scale Syst. 11,83-94.

Tunali, S., (1996). "Evaluation of alternate routing policies in scheduling a job-shop type FMS", Computer Ind. Engg. Vol.32, No.2, pp. 243-240.

Yan, H.S. Wang, N.S.Zhang, J.G. and Cui, X.Y., (1997). "Modeling, scheduling and simulation of flexible manufacturing system using extended stochastic high level evaluation Petrri nets". Robotics and Computer-Integrated Manufacturing, Vol. 14, pp.121-140.

Yildirim, M.B. Cakar, T., Dogue, U. and Meza, J.C. (2006) "Machine number, priority rule and due date determination in flexible manufacturing systems using artificial neural networks". Computers & Industrial Engineering, Vol. 50, No. 1-2, pp. 185-194

Feature

Sociotechnical System and Employee Retention: A Comparative Organizational Study

Koustab Ghosh & Sangeeta Sahney

The present study aims at understanding the impact of social and technical work systems of industrial organizations through threefold research issues: Assessing the social system of the organizations with the help of the identified constructs; assessing the technical system of the organizations with the help of the identified constructs; and their relationship with employee retention. The overall analysis of the study suggests that employees believe that to retain people in the organization, both the social and technical factors have to be taken care of.

Koustab Ghosh is a Doctoral Scholar and Sangeeta Sahney is an Assistant Professor at the Vinod Gupta School of Management, Indian Institute of Technology, Kharagpur.

The term 'sociotechnical system' was coined by Eric Trist (Trist & Bamforth, 1951) to describe a method of viewing jobs, which emphasizes the interrelatedness of the functioning of the social and technical subsystems of the organization. The sociotechnical model was formulated and later comprehensively developed by Eric Trist, Fred Emery and a group of researchers at the Tavistock Institute of Human Relations, as a result of extensive fieldwork in a number of British coal fields.

The social system of an organization is comprised of the people who work in the organization and the relationships among them (Trist & Bamforth, 1951; Emery, 1959, 1962; Trist et al., 1963; Pasmore, 1978). The technical system of an organization consists of the tools, techniques, procedures, skills, knowledge and devices used by members of the social system to accomplish the tasks of the organization (Trist & Bamforth, 1951; Trist et al., 1963; Emery, 1959; Woodward, 1958; Thompson & Bates, 1957). The impact of sociotechnical demand on work and organizational outcomes has been the subject of extensive research at the macro level (Eason, 1988; Gillespie & Mileti, 1979; Woodward, 1965). Recent research into sociotechnical systems have shown significant potential for understanding the dynamics in industrial organizations and for providing management some guidelines for effective organizational job design (Pasmore & Sherwood, 1988; Shani et. al. 1992; Medsker & Campion, 1997; Older et al., 1999; Jacobs et. al., 2001; Appelbaum, 1997; Torraco, 2005).

Broadly, the social system includes the profile and expectations of organizational members, patterns of supervisory-subordinate relationships, interpersonal relationship of employees and the nature and interaction of subgroups within the population through organizational values, norms and practices. Based on the extensive review of literature in the analysis of organizational sociotechnical system, a total of six sociotechnical constructs were identified for the purpose of this study:

Supervisory Relationship, Peer Group Interaction, Person-Organization Fit belong to social system variables and Nature of Job, Nature of Technology, Received Organizational Support pertain to technical system variables. All these six constructs were examined along with the seventh construct namely Employee Retention to find out the correlations among them. Nature of Job covered the aspects like task complexity, planning, coordination, group work, required skill sets, control and autonomy (Ryan and Smith, 2000).

The definition of technology was quite comprehensive and well-documented in the literature of technology and organization by scholars like Charles Perrow, Joan Woodward and James Thompson. For this study technology included dimensions of user acceptability and satisfaction, operational complexity, effectiveness and flexibility and required technological skill (Shani, 1992). Received Organizational Support related to operational support facilities in terms of infrastructure, resource availability, employment policies, work and family balance; compensation, assistance from other units; support of senior personnel (Eisenberger and Rhodes, 2002). Supervisory Relationship was based on the framework of Leader-Member Exchange (LMX) Theory by Dienesch and Liden (1986) and in particular covered the aspects like reliability and trustworthiness, consultation and openness on sharing information, feedback, coaching and guidance for improving performance, fair evaluation of performance (Dierendonck *et.al.*, 2002).

Peer Group Interaction included informal interaction among people both inside and outside the job, group problem solving, collective influence on departmental decision making, cooperation in the course of performing the task (Van der Vanquet *et.al.*, 1998). The Person-Organization Fit aspect of organizational culture was studied through dimensions like respect for diversity, sharing of organizational information at all levels, importance of competency over seniority, interdepartmental cooperation, support for experimentation and out-of-box thinking (O'Reilly *et.al.*, 1991).

Data and Sample

The questionnaires were distributed to 85 junior and middle level executives (technical and non-technical) of a large electrical equipment manufacturing organization and to 42 junior and middle level executives (technical and non-technical) of an integrated steel manufacturing organization. Of these 127 questionnaires, we received back 93 duly completed questionnaires. The average age of respondents was 40 years (Mean = 39.82, SD = 9.99). Their average work experience was 10 years. The information regarding the educational background of the respondents suggested that 62% of them were qualified graduates in Engineering and Technology, 31% were qualified graduates and post-graduates in the areas of Science, Business and Commerce and Social sciences. 7% reported to have professionally qualified Degrees like Business Management, Chartered Accountant, Cost and Management Accountant. 70% of the respondents belonged to public sector organization and 30% from private sector organization.

Measures

The questionnaire developed by the authors (Ghosh & Sahney, 2006) was used in the present study. The questionnaire comprised 53 items related to social and technical aspects of work dimensions and their influence on employee retention. The first 46 items in the questionnaire measured the social and technical systems of the organization on a 1-5 (not at all to a very large extent) verbal frequency scale and the remaining 7 items measured their influence on employee retention with the help of 1-5 (strongly disagree to strongly agree) Likert scale. Some background information of the respondents was collected with respect to their age, education, position in the organizational hierarchy, gender and work experience.

The Variables Defined

The study was an effort to understand how employees perceive the different dimensions of social and technical work system in their own organization and to see what impact they create in the employee's mind to stay back with the organization. This study aims to address how the sociotechnical system variables influence the retention of employees in an organization.

There were two sets of sociotechnical variables: (1) Items related to Social System and (2) Items related to Technical System.

1. Items related to Social System were classified as:
   (a) *Supervisory Relationship (SR):* The nature of the exchange process between supervisor and subordinate.
   (b) *Peer Group Interaction (PGI):* The social interdependence among people working in a department or group to generate positive work outcomes.
   (c) *Person – Organization Fit (POF):* A pattern of value systems, behavioral norms and ways of doing business that aim at making person-organization fit.
2. Items pertaining to Technical System were classified as:

(a) *Nature of Job (NJ):* The extent to which work pressure, challenge, repetitiveness, control are present into the task element.

(b) *Nature of Technology (NT):* The combination of individual expertise, techniques, machines and computers required for converting inputs into outputs in the form of products or services.

(c) *Received Organizational Support (ROS):* The extent to which the organization facilitates the employees' performance by providing support and caring for their wellbeing.

Employee Retention(ER): The ability of the employer to create a favorable work situation through which the employee feels that his/her needs can be met by the organization and hence develops an intention to continue with the work. The outcome variable had a total of seven items related to it, out of which six items measured the direct effects of social and technical variables on employee retention and the seventh item was related to the employee's view of the firm's success of retaining people at different levels.

Data Analysis

This section represents the results of the statistical analysis of the data collected. In order to provide an assessment of the reliability and convergent validity, three separate exploratory factor analysis were conducted – one on social system constructs (supervisory relationship, peer group interaction, person – organization fit), another on technical system constructs (nature of job, nature of technology, received organizational support) and the third one on employee retention construct. For both the organizations, the correlation coefficient between any two constructs was significantly below unity, which supports the discriminant validity of the two factors.

Table 1: Correlation, Mean and Standard Deviations of all constructs used in the study.

Constructs	NJ	NT	ROS	SR	PGI	POF	ER
NJ	1.00						
NT	.45**	1.00					
ROS	.45**	.26*	1.00				
SR	.39**	.14	.69**	1.00			
PGI	.47**	.32**	.48**	.60**	1.00		
POF	.47**	.41**	.66**	.70**	.66**	1.00	
ER	.33**	.17	.42**	.36*	.43**	.47**	1.00
Mean	3.64	3.34	3.43	3.47	3.47	3.36	4.00
Standard Deviations	.62	.71	.63	.87	.59	.63	.60

** Correlation significant at .01 level (2 tailed)
* Correlation significant at .05 level (2 tailed)

It is seen from table 1 that there are significant correlations between NJ and NT, NJ and ROS and NT and ROS at .01 level of significance. So far as the technical system is concerned, there is significant association between the individual task characteristics and the kind of technological and organizational support facilities required for performing the task. Similarly, there are significant observed correlations between POF and SR, POF and PGI and SR and PGI. It implies that in so far as the social system of the organization is concerned, the organizational values, norms and behaviours, relationships with hierarchical supervisors and interpersonal relationships at peer levels share a strong association among them. In the case of employee retention (ER), it has significant correlations with NJ, ROS, SR, PGI and POF respectively. The implication is that task characteristics, organizational support facilities, interpersonal relationship with superiors and peers, organizational values, norms and practices are significantly associated with the level of employee retention in the organization.

Table 2: Exploratory Factor Analysis results of indicator variables of the technical system construct of multigroup sample.

Measurement Item	Factor Loading (λ)	Reliability (Cronbach's Alpha)	Composite Reliability (α)
NJ1	.74	.64	
NJ2	.69	.63	
NJ3	.64	.61	
NJ4	.72	.63	
NJ5	.74	.66	
NJ6	.71	.62	
NJ7	.68	.62	
NJ8	.79	.65	.68
NT1	.83	.72	
NT2	.84	.72	
NT3	.81	.71	
NT4	.81	.67	
NT5	.83	.77	
NT6	.82	.73	
NT7	.82	.74	.78
ROS1	.79	.68	
ROS2	.80	.67	
ROS3	.80	.71	
ROS4	.77	.61	
ROS5	.77	.64	
ROS6	.66	.58	
ROS7	.83	.71	
ROS8	.66	.59	
ROS9	.77	.61	.75

Acceptable factor loadings and reliabilities (guidelines used $\lambda > .5$ and reliability > .5 respectively).

For the technical system constructs (NJ, NT, ROS) the above table was calculated displaying the factor loading, item reliability and composite reliability. Factor loadings ranged from .64 to .84 fell in an acceptable range and were statistically significant ($p<.01$). Therefore, the measure displayed adequate convergent validity. Reliability measurements also reached the recommended cut–off .50.

Table 3: Exploratory Factor Analysis results of indicator variables of the social system construct of multigroup sample.

Measurement Item	Factor Loading (λ)	Reliability (Cronbach's Alpha)	Composite Reliability (α)
SR1	.89	.81	
SR2	.88	.83	
SR3	.92	.81	
SR4	.92	.84	
SR5	.89	.82	
SR6	.93	.83	
SR7	.94	.83	.88
PGI1	.78	.66	
PGI2	.75	.68	
PGI3	.75	.61	
PGI4	.68	.65	
PGI5	.78	.67	
PGI6	.79	.70	
PGI7	.77	.69	
PGI8	.71	.67	.72
POF1	.71	.66	
POF2	.76	.68	
POF3	.78	.65	
POF4	.81	.72	
POF5	.78	.71	
POF6	.74	.68	
POF7	.74	.69	.76

Acceptable factor loadings and reliabilities (guidelines used $\lambda > .5$ and reliability > .5 respectively).

Table 3 was separately created to measure the social system constructs namely SR, PGI and POF. Factor loadings ranged from .71 to .94 fell in an acceptable range, and were statistically significant ($p<.01$). Therefore, the measure displayed adequate convergent validity. Reliability measurements also reached the recommended cut–off .50.

Table 4: Exploratory Factor Analysis results of indicator variables of the employee retention construct of multigroup sample.

Measurement Item	Factor Loading (λ)	Reliability (Cronbach's Alpha)	Composite Reliability (α)
ER1	.82	.73	
ER2	.78	.67	
ER3	.78	.74	
ER4	.77	.68	
ER5	.76	.65	
ER6	.68	.62	
ER7	.66	.61	.77

Acceptable factor loadings and reliabilities (guidelines used $\lambda > .5$ and reliability > .5 respectively).

Table 4 displays the factor loadings and reliability measures of the employee retention (ER) construct. Factor loadings ranged from .66 to .82 fell in an acceptable range and were statistically significant (p<.01). Therefore, the measure displayed adequate convergent validity. Reliability measurements also reached the recommended cut–off .50.

Table 5: Results of Independent – Samples T Test for comparison of mean difference of social system, technical system, and employee retention.

Dimensions	Organization 1	Organization 2	t – value
Social system	3.41	3.47	.42**
Technical system	3.37	3.68	2.95*
Employee retention	3.91	4.21	2.51*

** p < .01
* p < .05

Multiple items indicating the social system, technical system and employee retention constructs were summed and averaged into scales. Independent sample T – test revealed statistically significant differences in the construct values across the two organizations. A review of the results in Table 5 indicated that the resulting t – statistic was .42 (p<.01) for social system, 2.95 (p<.05) for technical system and 2.51 (p<.05) for employee retention. Both social system and technical system mean values were higher for organization 2 than organization 1. It implies that the social and technical system parameters of the organization 2 have been more positively recognized and responded by the employees than that of the organization 1. Hence the systems are present and operate in a better manner in organization 2 than that in the organization 1. The higher employee retention mean value also substantiates the same point.

Discussion and Conclusion

The overall findings of the study show that the values of alpha reliability coefficients for all constructs ranged from 0.75 to 0.94, and hence are significantly higher. It reinforces the scale reliability effectiveness for this study. The convergent validity ranged from the lowest of 0.51 to the highest of 0.89. The correlation analysis of the study suggests that to retain people in the organization, both the social and technical factors have to be taken care of simultaneously. More importantly, during personal interaction with selective employees out of the total sample it was found out that on factors of social dimension employees perceive their impact together as a whole rather than consciously isolating them from each other for each factor *per se*. As a result, the relative higher satisfaction on one or two factors at the cost of others can not fully compensate for the entire set. For example, if an employee does not have a healthy relationship with his immediate supervisor, he believes that the organization does not have values of mutual respect at hierarchical levels. So the matter of interpersonal relationship blocks the organization view of the employee, which in due course generates the intention to leave. The comparative sociotechnical assessment of two organizations reveals that the organization 2 has a more favourable outcome, and that in turn, leads to higher employee satisfaction, hence higher retention. Therefore it becomes imperative to carefully design the jobs, processes and structure of the organizations on the basis of an integrative perspective of social and technical factors. Employees perceive their daily incidents related to the tasks, support facilities, interpersonal and role relationships, organizational policies and practices as small pieces of information, and by putting all these pieces together they try to make a view of the entire organization and accordingly form opinions. If these opinions are favourable, they continue with the organization or else decide to leave when an opportunity is available outside. Hence it is important for top management and senior managerial personnel to design the jobs and organizations on a balanced sociotechnical measures to generate positive mental outcome of employees. The job itself can be very interesting, but if he does not get the needed support from his peers, supervisor and organization or if the organizational policies and practices do not motivate him to perform better, the satisfaction level will come down. The strategies and measures for retention should be adopted by considering the possible impact of all these factors. In reality, it is often found that retention policies are made not in tune with this principle, and that these fail to solve the problem of high attrition especially in junior level technical and managerial personnel.

References

Appelbaum, Steven, H., (1997), Management Decision, Vol. 35, No.6, p. 452-463.

Dienesch, R.M.; Liden, R.C., (1986), Leader-member exchange model of leadership: A critique and further development, The *Academy of Management Review*, Vol.11, Iss. 3.

Dierendonck *et.al.* (2002), Supervisory behavior, reciprocity and subordinate absenteeism, *Leadership and Organization Development*, Vol.23, Iss. 2.

Eason, K., (1988), *Information technology and organizational change*, London: Taylor & Francis.

Eisenberger & Rhodes, (2002), Received organizational support: A review of the literature, *Journal of Applied Psychology*, Vol.87, Iss. 4.

Emery, F., (1959), *Characteristics of sociotechnical systems*, Tavistock Institute of Human Relations, Doc.527.

Emery, F., (1962), *Technology and social organization*, Tavistock Institute of Human Relations, Doc. T-42.

Gillespie, D.F., & Mileti, D.S., (1979), *Technostructures and inter organizational relations*, Lexington, MS: Lexington Books.

Jacobs, D.A., Keating, C.B., Fernandez, D.A., Kauffmann, P., (2001), Business Process Management Journal, Vol.7, No.1.

Mak & Sockel, (2001), A confirmatory factor analysis of information-system employee motivation & retention, *Information and Management*, Vol.38, Iss. 3.

Medsker, G.J., Campion, (1997), Handbook of Human Factors and Ergonomics, 2nd edition, Wiley, New York.

Older, M.T., Waterson, P.E., Clegg, C.W., (1999), A new method for allocating tasks amongst humans and machines, Institute of Work Psychology, University of Sheffield.

O'Reilly *et.al.* (1991), People & organization culture: A profile comparison approach, *Academy of Management Journal*, Vol.34, Iss. 3.

Pasmore, W., & Sherwood, J., (1978), (Eds.) *Sociotechnical Systems: A Sourcebook*, San Diego: University Associates.

Ryan & Smith, (2000), The relation between job level & job satisfaction, *Group and Organization Management*, Vol.23, Iss. 4.

Shani *et.al.* (1992), Advanced manufacturing systems & organizational choice: Sociotechnical system approach, *California Management Review*, Vol.34, Iss. 4.

Thompson, J., & Bates, F., (1957), Technology, organization and administration, *Administrative Science Quarterly*, Vol.2, Iss. 3.

Torraco, Richard, J., (2005), Human Resource Development Quarterly, Vol.16, no.1, Spring 2005.

Trist, E., & Bamforth, K., (1951), Some social and psychological consequences of the long wall method of coal-getting, *Human Relations*, Vol. 4, Iss 1.

Trist, E.; Higgin, C.; Murray, H.; & Pollock, A., (1963), *Organizational choice*, London: Tavistock Publications.

Van der Vanquet *et.al.* (1998), Motivating effects of task and outcome interdependence in work teams, *Group and Organization Management*, Vol. 23, Iss. 2.

Woodward, J., (1958), *Management and technology*, London: Her Majesty's stationery Office.

Woodward, J., (1965), *Industrial organization: Theory and practice*, London: Oxford University Press.

In order that people may be happy in their work, these things are needed : They must not do too much of it ; and they must have a sense of success in it — not a doubtful sense, such as needs some testimony of others for its confirmation, but a sure sense, or rather knowledge, that so much work has been done well, and frontfully done, whatever the world may say or think about it.

— W . H . Auden

Feature

Emerging Issues in Supply Chain Collaboration

Ashwani Kumar & S K Bansal

Collaboration with customers, suppliers and even competitors has been considered a key to success or survival in the intensively competitive global environment. Sharing accurate demand information on a timely basis, at both tactical and strategic levels, is important to supply chain performance. Various firms have been using different methods for supply chain collaboration ranging from Vendor Managed Inventory (VMI), to Collaborative Planning, Forecasting and Replenishment (CPFR) techniques. This trend is just a starting point of the next generation supply chain and it may develop into a set of methods by which supply chain partners would have joint sales forecasts and production plan. The present paper highlights some of the emerging issues in supply chain collaboration.

Ashwani Kumar is senior lecturer at the Govt. Bikram (PG) College of Commerce, Patiala, Punjab; and S K Bansal is the Dean of Punjab School of Management Studies, Punjabi University, Patiala.

The past decade has witnessed a significant increase in globalization and the rapid adoption of outsourcing across all industry segments. As a result, supply chains are operating in a highly complex "networked" business environment. In this new environment, supply chains must exhibit a high degree of adaptability, responsiveness and collaboration (Lim, 2007).

Organizations are now finding it essential to transform traditional supply chains from linear, sequential processes into adaptive supply chain networks in which communities of customer-centric, demand driven companies share knowledge, intelligently adapt to changing market conditions and proactively respond to shorter, less-predictable life cycles (www.sap.com). Adaptive supply chain networks are the key to supply chain collaboration. Collaborative practices have been upheld as the key to supply chain collaboration. Collaborative practices have been upheld as the key to delivering superior supply chain performance. Collaboration is often represented as unidimensional, with particular focus on inter-firm relationships with the emphasis on mutuality and trust (Barratt, 2004).

The Next Generation SCM

The new version of SCM has improved the way business works by focusing on driving operational efficiencies and improving collaboration and communication across and beyond functional silos. *SCM has been defined as an integrated and collaborative network of suppliers through which the whole supply chain of logistics processes is managed for a fast and flexible coordination between a company, its customers and suppliers within the chain. Sharing-based collaboration such as information sharing, research sharing, risk sharing and activity sharing plays a critical role to create an efficient SCM* (Simatupang and Sridharan, 2005). The evolution of SCM can be categorized into four major generations (www.sap.cpm). Each generation provided increased productivity and value, building upon past advances and lessons learned.

The MRP/MRPII (material requirement planning/

material resource planning) generation in the 1970s and 1980s enabled companies for the first time to compute material requirements based on sales forecasts. The *ERP* (*enterprise resource planning*) generation integrated supply chain transactions across the enterprise. The *APS* (*advanced planning and scheduling*) generation addressed the shortcomings of MRP and ERP through functional optimization, resulting in improved supply chain efficiency and productivity. The modern supply chains are no longer linear-they are complex networks of relations that require synchronization defines the next generation of supply chain management. Today, supply chain management technology is focused on addressing evolving business needs. A new generation of solutions is necessary to accelerate time to value and increase competitive advantage.

Collaboration—A Competitive Weapon

Basmaci (2003) defined collaboration as "managing interdependencies to *maximize shared goals and enhance individual goals*", with a focus on complex problem-solving or joint innovation. Collaborating companies work closely together to "make the pie bigger" for everyone involved, rather than simply to increase the size of their own "piece of the pie". Collaboration, which is most appropriate when issues or opportunities faced by supply chain partners are too difficult or complex to be resolved individually, requires joint planning and decision-making; open sharing of information; a free flow of creative ideas; and rich communication through face-to-face meetings (Anderson and Lee, 2001). A definition of organizational collaboration is "a process in which organizations exchange information, alter activities, share resources and enhance each other's capacity for mutual benefits and a common purpose by sharing risks, responsibilities and rewards". Collaboration is a competitive weapon that can be used to improve business performance (Cox, 2004). It allows establishing strategic partnerships with the suppliers and trading partners in order to set mutually beneficial goals and share business processes and information. Collaboration helps drive market share, sales and product adoption while maximizing the return on assets (ROA) and return on investment (ROI). Successful collaboration relies on the development of mutual trust between the firm and its partners to share information (McKaige, 2001). The goal is to treat all suppliers, outsourcing partners, customers and service providers as an extended supply chain. This mutual level of trust is enhanced by defining a set of service-level agreements and associated performance measurement metrics that provide rapid and accurate feedback on how well the collaborative efforts are being executed.

Companies in the high-tech space are looking to get actual production visibility beyond traditional purchase-level response, to better control quality, cost and availability and to improve key customer service metrics such as customer request date. Capital equipment and manufacturing companies are looking to leverage collaboration technologies to extend lean supply chain principles across the enterprise (Cachon and Fisher, 2000). Regardless of the industry, we find common techniques and approaches appearing. Table 1 shows supply chain collaboration operating at different levels across all industries.

Table 1: Supply Chain Issues at Different Levels

Level	Issues
Strategic	➢ Portfolio joint marketing ➢ Pricing plans ➢ Product design ➢ Production capacities ➢ Production facility and fulfillment network expansion
Tactical	➢ Allocations ➢ Contract terms, *i.e.* supply capacity, inventory and services ➢ Forecasts ➢ Inventory ➢ Orders ➢ Prices and promotions ➢ Product and material availability ➢ Product descriptions ➢ Production & transportation plans and capacities Bills of material (BOMs) ➢ Service levels
Execution	➢ Credit notes ➢ Debit notes ➢ Invoices ➢ Payments ➢ POS information ➢ Production/work orders ➢ Purchase orders ➢ Sales orders

Source : www.sap.com

Brief Literature Review

Collaborative literature, which in recent times has been extensive, has never the less been cited as presenting a confused mess message (Barratt, 2004), as to its definition, how it should be applied and whether it alone delivers excellent supply chain performance. The term collaboration has been used (See Table 2) to define a spectrum ranging from different dimensions:

A research study by Ferreria, et al. (2001), shows that "the group of companies that leads in coupling business processes and information exchange across their trade partners deliver as much as 70 percent higher profitability that those organizations that do not integrate with trading partners". McKaige (2001) refers to supply chain collaboration as "a win/win arrangement that is likely to provide improved business success for both parties". It may

Table 2: Collaboration Dimensions

Collaboration Dimensions	Authors
The culture of trust and mutuality	Barratt, (2004), Basu and Seims (2004)
Degree of process integration	Holweg et al., (2005)
CPFR, VMI,	Lim (2007), Bukovic (2005)
Inter-firm relational requirements, the need for decision synchronization and incentive sharing	Simatupang and Sridharan, (2005), Barratt, (2004)
Shared vision and objectives along with cross-organizational behavior	Lee and Whang (2001), Kilbane (2001)
Coordination of logistics, information incentives	Peterson (2001), Lee and Amarel (2001)
Integration of strategy, structure and processes	Raghunathan (1991), Gattorna (1991)
As alignment to end-consumer needs	Simatupang et al., (2005), Peters (2001)
Strategic partnerships between suppliers and manufacturers	Liker and Choi (2004), Rodriguez et al. (2004)
Demand chain management	Zrimsek (2001), McGarr (2001)
Behavioral requirements that allow collaborative practices to work	Hingley, (2005); Cox, (2004); Rodriguez et al., 2004

even be considered a prerequisite for future competitive performance. Indeed, Edward et al. (2001) maintain that "future success no longer belongs to a single firm, no matter on what scale it functions. The future belongs to networks of supply". Lee et al. (2001) recognize a "trend toward greater use of the collaborative approach". Also, supply chain collaboration is considered an essential part of demand chain management, which advocates "extending the view of operations from a single business unit or a company to the whole chain". By meeting the needs and wants of specific customer segments and working backward to raw material suppliers, demand chain management is claimed to deliver significant performance improvements to companies successfully adopting this approach. McGarr (2001) distinguishes two kinds of collaboration:

1) *Structured collaboration*: It is a rigid transaction focused cooperation that allows supply chain partners to share inventory forecasts and pricing information. It may be clear that CPFR is mostly about structured collaboration.

2) *Unstructured collaboration*: It involves streamlining supply chain communications and processes through next-generation workflow tools.

Collaborative planning is a part of the collaborative commerce concept as introduced by the analysts of Gartner Group. Companies work together with their suppliers and customers to improve the competitive position of the total supply chain, instead of improving the position of only one company within this chain (Pollard, 2001). Anderson and Lee (2001) say more or less the same. "At the heart of the matters are customers' ever increasing demands. Customers—whether they are business customers or individuals—are looking beyond cost as the sole arbiter of value". The supply chain activities of the different partners must be tightly synchronized with the demands of the market place. Not only the ability to communicate is required, but also the capability to manage the complexity and immediacy of this synchronization.

Information Sharing through Collaboration

Strategic actions to address global supply chain visibility in 2008 center on enhancing supplier and customer collaboration, streamlining supply chain processes for easier monitoring and implementing new information technology. In a major study by Aberdeen Group in 2008 (www.aberdeen.com) it was reported that companies are planning to take the following five actions to improve global visibility technology capabilities in 2008:

- Improve data quality and timeliness of status messages—73%
- Incorporate additional status events—63%
- Add warning alerts if actual events deviate from plans—61%
- Enhance analytics capabilities—61%
- Increase the number of trading partners providing status information—49%

The next-gen state-of-the-art SCM involves a great deal of information sharing based on collaborative framework. The role of the "information system" is to provide past, present and future-oriented information for decision making (Cachon and Fisher, 2000). This information is related with demand, costs, materials, capacities etc. Information sharing provides complete visibility among the supply chain components. When different stages of the supply chain plan locally without sharing information, the result is the "bullwhip effect", whereby the small fluctuations in customer demand lead to large fluctuations at the manufacturer and supplier (Cachon and Lariviere, 2001). The increased variability leads to long supply lead times, excess capacity, high transportation and warehousing costs, large inventories and dissatisfied customers (Lee

et al. 2001). The information sharing through the use of B2B e-commerce can create value in a supply chain in two ways. One, by increasing visibility across the supply chain, the internet can dampen the "bullwhip effect". Two, the internet can provide value from increased collaboration. The Stanford Global Supply Chain Management Forum lists four dimensions of supply chain integration (Lee, 2001). These four key dimensions are:—

1. Information integration
2. Synchronized planning—identifies 'what' is to be done with the information that is shared
3. Workflow coordination—one step further by not only identifying 'what', but also 'how' to handle the shared information
4. New business models—use supply chain integration for whole new ways of doing business

Lee et al. (2001) point out that information sharing alone could provide significant inventory reduction and cost savings to the manufacturer. The benefit of information sharing lies in the manufacturer's capability to react to the retailer's needs via the knowledge of the retailer's inventory level to help reduce uncertainties in the demand process faced by the manufacturer. They provide mathematically that information sharing provides dual benefits to the manufacturer in the form of Inventory reduction and expected cost reduction. They conclude that the manufacturer would experience great savings when: (a) the demand correlation (r) over time is high: (b) the demand variance (s) within each time period is high; or (c) the lead times are long. These conditions seem to fit the profile of most high-tech products. Therefore, their results suggest that information sharing would be especially useful for improving the efficiency of the supply chain in the high-tech industry.

Raghunathan (2001) describes that the model as used by Lee et al. (2001) is not the right one to use. Their results depend on the critical assumption that the manufacturer uses only the most recent order from the retailer to forecast the future orders. They overestimate the benefits of demand information sharing, compared with the case of no information sharing. The assumption is that the manufacturer only uses the current period's retailer order quantity to forecast the next period's retailer order quantity. He concluded that when manufacturers can reduce the variance of its forecast by making use of already available internal information (*i.e.* order history) there is no need to invest in inter-organizational systems for information sharing purposes. Cachon and Fisher (2000) show that there is an upper bound on the value of information sharing within the context of a stationary demand supply chain and that accelerating the physical flow of goods through a supply chain is significantly more valuable than expanding the flow of information. On the contrary, Gunasekaran and Ngai (2004) explain that demand sharing can indeed be very useful in case that (1) the demand process changes over time; and when (2) disturbances in the demand process influences the demand in other time periods.

Models for Enterprise Collaboration

Edwards et al. (2001), stress that in order to gain supply chain advantage, companies need to exchange larger amounts of planning and operational data. The emergence of the Internet and new software applications has provided opportunities for companies to move towards an extended enterprise business model—one that enhances value across traditional corporate boundaries.

The most important model given by Jagdev and Thoben (2001) introduces a 'collaborative relationship continuum' model that shows the scope of enterprise network (Figure 1). Within enterprise networks they identify

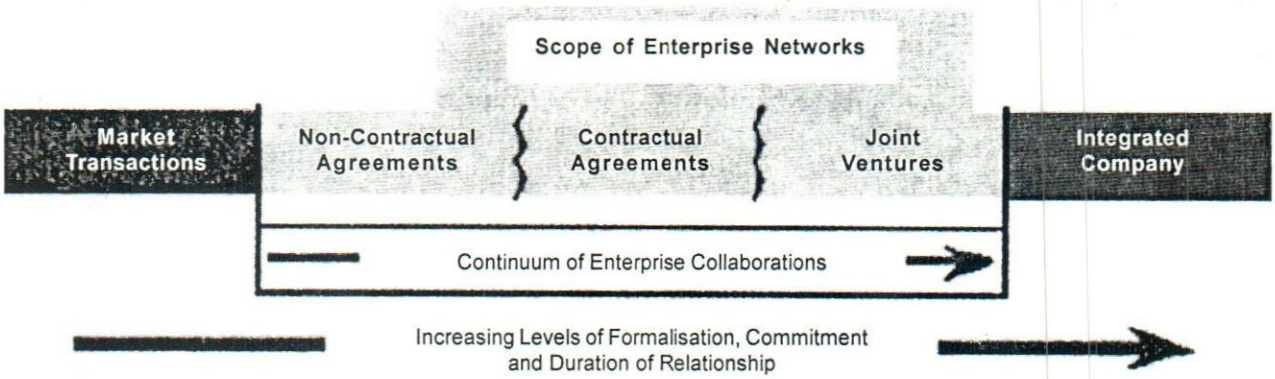


Fig. 1. Continuum of Enterprise Collaborations
(Source: Jagdev and Thoben, 2001)

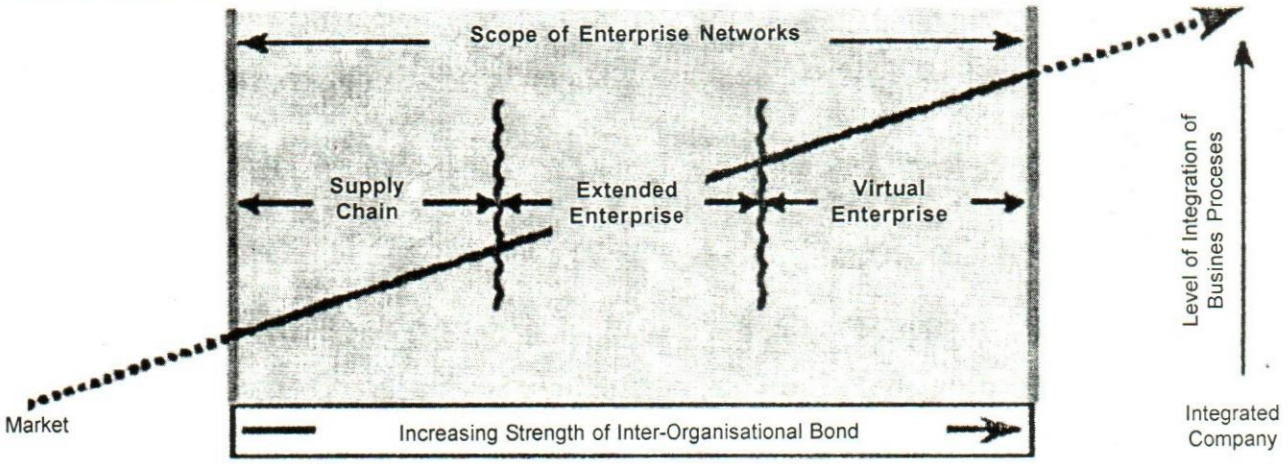


Fig. 2. Types of Collaborations within Enterprise Networks
(Source: Jagdev and Thoben, 2001)

three types of collaboration architectures, *i.e.* isolated supply chain, extended enterprise and virtual enterprise. Figure 2 shows that the level of integration of business processes goes on expanding as we move to the right of the continuum. According to them the virtual enterprise differs from the other types of collaboration. Some authors define virtual enterprises as a temporary network of independent companies engaged in providing a product or service or even appearing as a supplier of goods and services to its customers, but with no internal production activities (Childe, 2001). It is better to define a virtual enterprise as a network of independent organizations that jointly form an entity committed to provide a product or service. If a virtual enterprise is based on short term interactions only, the emphasis will be on the need to allocate the resources, monitor the execution of the order and take necessary steps if deviations occur and not on regulating stock policies and overall logistic management (Wortmann and Szibik, 2001).

Lee and Whang (2000), define three different models of information sharing in more traditional supply chains: (1) the transfer model, (2) the third party model and (3) the information hub model. They identified following sources of information that may be beneficial to share in a supply chain context:

1. Inventory level
2. Sales data
3. Order status for tracking/tracing
4. Sales forecast
5. Production/delivery schedule
6. Performance metrics
7. Capacity information

Wortmann and Szirbik (2001) introduced a similar model to show the different levels of interaction complexity. Anderson and Lee (2001) distinguish four key areas in their model where the new Internet—enabled supply chain differs from the traditional supply chain. The first three areas are related to major management processes leveraging the Internet. The last area is concerned with upgrading the performance of physical processes to match the speed and virtual capabilities of the new supply chain. The four areas are:

1. eDesign—Product innovation on the web
2. eMediaries and Exchanges—Using online markets to revolutionze buying and selling
3. Web-based Collaborative Planning—The virtualization of the supply chain
4. eFulfillment

It shows that collaborative planning is not the only aspect that brings a company—or supply chain—up to Internet speed, but it is definitely important. The analysts feel that supply chain collaboration will soon become a standard SCM business practice which will play a key role in B2B technologies (Peterson, 2001). The majority of SCM collaboration will occur through private e-marketplaces and B2B c-commerce solution providers. During this period, collaborative technologies will evolve from a transaction focus to incorporation content, time-phased data standards, analytics (*i.e.*, measurement) and workflow technologies. Gartner Group expects this transition to be a progressive one, with three distinct phases (Figure 3), as follows:

1. Pilot Phase: Pilots are formed to synchronize data for singular processes using batch integration. The focus is mainly on sales forecast and component supplier requirements in response to user-defined exceptions.

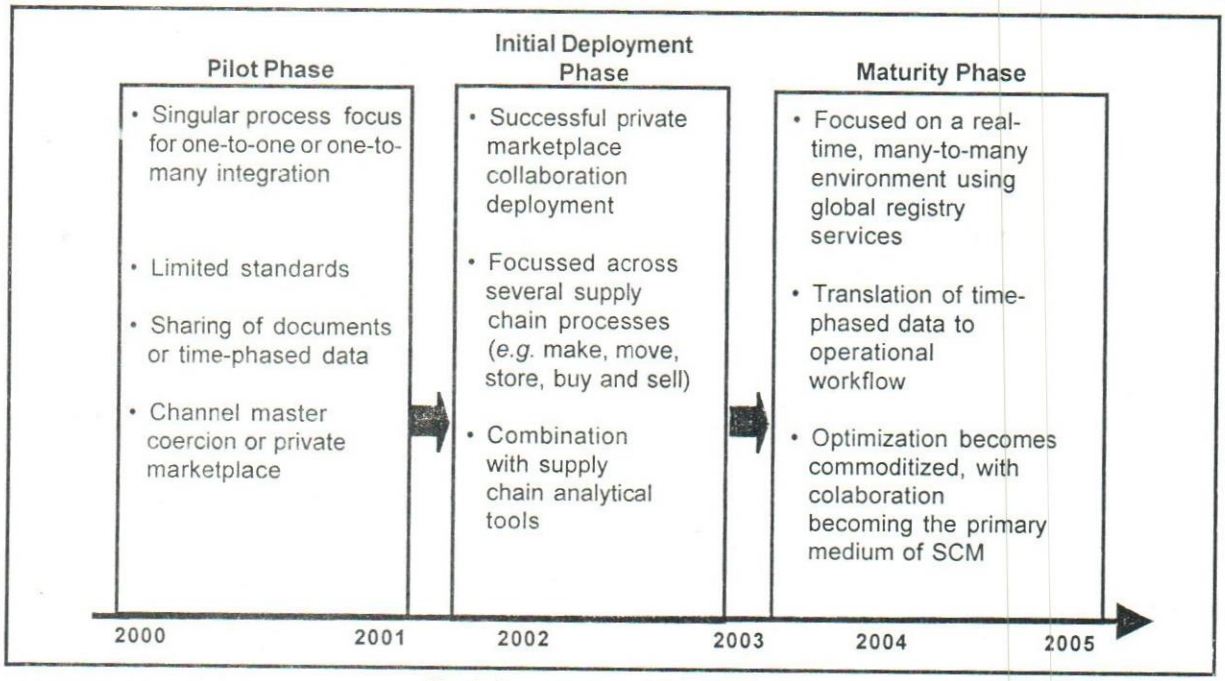


Fig. 3. Supply chain collaboration timeline

2. Initial Deployment Phase: Collaboration technologies are adopted for a process focus across a trading community. The CPFR is fast becoming a standard for larger B2B solutions for forecasting. Time-phased collaboration technologies such as ANX (automated network exchange), Covisint and RossettaNet begin to be merged with workflow technologies in the new environment. Collaboration technologies still depend on batch processes and hosted B2B c-commerce solutions proliferate.

3. Maturity Phase: Collaboration processes mature and real-time SCM software supports collaborative marketplaces. Such software covers all the strategic, tactical, operational and executional time horizons. Solutions for industry-specific communities also develop, with the ability to plan and execute data, documents, exceptions and transactions.

Jeffery and Thomas Model of Supplier Collaboration

Jeffrey and Thomas's (2004) six-step model is better known as the Japanese Partnering Mode/'Supplier-Partnering Hierarchy'. This model (Table 3) is based on the research of how two Japanese automakers (Toyota and Honda) have had stunning success building relationships with North American suppliers with whom they had contentious dealings. On the basis of this model, Japanese automakers first slashed the number of suppliers they did business with , awarded the survivors long-term contracts and encouraged top-tier vendors to manage the lower tiers. They also got top-tier suppliers to produce sub-systems instead of components, to take responsibility for quality and costs and to deliver just in time.

Table 3: The Supplier-Partnering Hierarchy

Conduct joint improvement activities
• Exchange best practices with suppliers
• Initiate kaizen projects at suppliers' facilities
• Set up supplier study groups
Share information intensively but selectively
• Set specific times, places and agendas for meetings
• Use rigid formals for sharing information
• Insist on accurate data collection
• Share information in a structured fashion
Develop suppliers' technical capabilities
• Build suppliers' problem solving skills
• Develop a common lexicon
• Hone core suppliers' innovation capabilities
Supervise your suppliers
• Send monthly report cards to core suppliers
• Provide immediate and constant feed backs
• Get senior managers involved in solving problems
Turn supplier rivalry into opportunity
• Source each component from two or three vendors
• Create compatible production philosophies and systems
• Set up joint ventures with existing suppliers to transfer knowledge and maintain control
Understand how your suppliers work
• Learn about suppliers' businesses
• Go see how suppliers work
• Respect suppliers' capabilities
• Commit to co-prosperity

Forms of Collaboration

Supply network collaboration can take place upstream, downstream and within the four walls of an organization, as follows:

Internal and External Collaboration

Literature suggests that firms must achieve a relatively high degree of collaboration among internal processes before initiating supply chain arrangements (Stank et al., 2001). Ericson (2001) noticed that companies that have torn down walls of inefficiencies within their own organizations are now exploring better ways to streamline processes between trading partners. A research study focusing on internal and external collaboration done by researchers from Michigan State University and The University of Oklahoma (Stank et al., 2001) reveal that internal collaboration significantly influences logistical service performance, which implies that firms should promote cooperation and collaboration across internal processes to achieve logistical effectiveness. The lack of support for a direct link between collaboration and service performance is interesting and, on the surface, suggests that collaboration with customers and suppliers will not improve performance. Further the study revealed, however, that collaboration with external supply chain entities influences increased internal collaboration, which in turn improves logistical service. Therefore, best practice firms focus on both.

Another research conducted by a team from the University of Toledo, concludes that firms should focus first on integration and innovation across the (internal and external) value chain, then they should automate the activities which add value to the customers (Vonderemse, 1997).

Supplier collaboration

It refers to a collaborative business process between the manufacturer and its suppliers in a typical buy-sell relationship. With the increase in globalization and outsourcing, supplier collaboration has become even more complex (Stank et al, 2001). For example, a manufacturer working with several contract manufacturing suppliers may also be collaborating with a number of OEM suppliers. In turn, some of these suppliers may be providing component not only directly to the manufacturer, but also to some of its contract manufacturing suppliers. This creates a complex web of connections that makes it difficult for all parties involved to share essential data regarding shipments, inventory on hand, quality, manufacturing capacity and other factors that impact productivity (Wortmann and Szirbik, 2001).

Contract Manufacturer Collaboration (CMC)

CMC is of increasing importance for many companies because of its ability to reduce operating costs, improve new product time to market and increase return on capital investment. However, to successfully implement an outsourcing strategy, company must shift its focus from owning and organizing assets to working collaboratively with partners (Raghunathan, 2001). This collaboration must extend beyond simply exchanging information regarding order fulfillment. Collaborative efforts must reach across the entire supply chain to help streamline essential processes such as product development and pricing and product manufacturability, as well as reduce manufacturing costs and improve responsiveness to customer demand (Zrimsek, 2001).

A new level of visibility into the work order status is also essential to ensure seamless visibility across all manufacturing processes, both internal and outsourced. When automating these processes, you must support the information-sharing, collaboration and monitoring activities that are needed to effectively manage the relationship with a contract manufacturer.

Customer Collaboration

It includes the business processes that result when the manufacturer is the seller and distributors, wholesalers or retailers are the customers (Raghunathan, 2001). Customer collaboration is gaining traction in many industries that are pushing to become more demand driven. Customer collaboration is focused on efficient demand planning and inventory replenishment. This is most commonly seen in consumer products and other industries that operate downstream distribution structures that extend to retailers (Pollard, 2001).

This approach supports the following benefits:

- Enables the shift from a manufacturer "push" to a balanced, demand-driven "push-pull" supply chain
- Combines forecast and demand—driven supply chain strategies
- Ensures intelligent short-term demand management for baseline and promotion processes and automates the response to changing demand
- Helps manufacturing companies fulfill store-level-based replenishment requirements such as cross-docking

Unlike traditional forecast-driven replenishment, with a customer collaboration strategy, replenishment processes become more responsive and are triggered primarily by actual customer demand information. According to Peck and Jotter, 2000). Point of sales (POS) and electronic product code (EPC) data also adds to visibility across the entire supply chain and enhances the process. It allows

manufacturers and retailers to manage and execute joint promotions that can take into account last-minute changes.

Collaboration with 3PL and 4PL

3PL collaboration focuses on jointly planning logistics activities and added advantage of better packaging. The 4PI logistics organization is one of the intermediate stages along the logistics spectrum that combines the benefits of outsourcing and in-sourcing (Altekar, 2005). The following table exhibits some of the benefits to manufacturers and suppliers from collaboration:

Collaboration Constraints

The enterprise has to be fully supportive before trying to go beyond the four walls. Undoubtedly, all three levels of collaborative interaction bring various benefits to the company and its partners. McGarr (2001) adds: "Ultimately e-business and collaboration are not about information or technology, but about changing how people work". Internal collaboration is another important conclusion drawn by practitioners. Pollard, 2001 identified the following key collaboration constraints:—

1. Management buy-in
2. Clearly understood ROI
3. Conflicting and competing priorities

However, establishing a sound collaboration framework is difficult and there are numerous other barriers to effective collaboration to overcome. Such as:

- Heterogeneous Infrastructures of trading partners
- Supplier and Customer Challenges
- Lack of Effective performance Metrics
- Security and Safety across the entire supply chain

Collaboration Functionalities

Deloitte Research points out that the expectations of the most companies that start collaborative commerce initiatives are that they will deliver strategic benefits such as greater speed, higher revenues and enhanced competitive advantage (Ferreria, 2001). According to them, collaboration with the use of Internet technologies is the basis for the supply chain of the future. Though companies have been successful in creating infrastructure for tracking and monitoring supply chain events they are still looking beyond just monitoring and are actively leveraging the visibility data and tools to conduct in-depth analysis to support both day-to-day activities and long-term strategic planning. Fig. 4. exhibits some of the innovations in SCM collaboration functionalities to transform a traditional supply chain into a 'new-gen supply chain'.

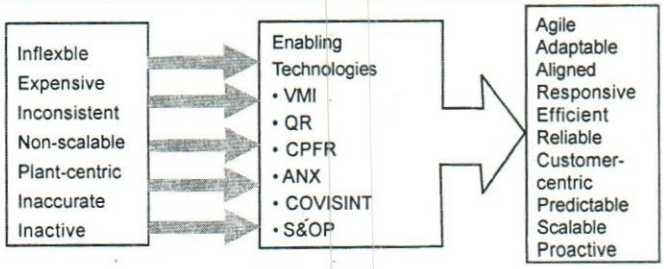


Fig. 4. Effect of Enabling Technologies as on scan

1. Vendor-Managed Inventory (VMI)
2. Quick response (QR)
3. Collaborative Planning, Forecasting and Replenishment (CPFR)
4. Automated Network Exchange (ANX)
5. CONVISINT
6. Sales and Operations Planning (S&OP)

Vendor-Managed Inventory (VMI)

VMI introduced by Kurt Solomon Associates in 1992 (http://www.kurtsalmon.com) has emerged as the most widely known system for managing supply chains. Under VMI, the buyer authorizes the vendor to manage the inventory of a set of stock-keeping-units (SKU) at the buyer's site under agreed upon parameters (*e.g.* minimum and maximum inventory target). The buyer provides the supplier with sales and/or inventory status information; and the supplier makes and implements decisions about replenishment quantity and timings. VMI reduces information distortion, which is one of the causes of the Bullwhip effect (Lee et al., 1997). The VMI concept provides improved visibility across the supply chain that helps manufacturers, suppliers and retailers reduce inventory and improve production planning, inventory turnover and stock availability. In exchange, the buyer typically receives price discounts or improved terms of payment from the supplier. EDI is an integral part of VMI process and plays a vital role in the data communication. With advancements in technology, VMI has become fully automated today. VMI implementation has become more robust and effective.

VMI is not a new concept and has its roots in the early 1980s. It became prominent in the Efficient Consumer Response (ECR) era as one of the methods that achieved desired results, although it had earlier been used in general merchandise and other sectors. Initial applications of VMI resulted in dramatic inventory reductions across the supply chain as one inventory control point and complete supply chain inventory visibility allowed for the reduction of redundant safety stocks at different supply chain points. Retail giants like Wal-Mart switched to 'automated VMI' in

the late 1980s. One of the driving factors was the difficult task of predicting how much seasonal apparel was needed. Since then, the apparel industry has continued to be a pioneer in VMI. For example, Greensboro, maker of brands like Lee, has been implementing a sophisticated system that integrates retail inventory data from VMI into floor-space management at the store level. In a beta test, ShopKo Stores Inc. in Wisconsin reportedly experienced a gain of more than 20% in sales of men's jeans. Ironically though, industries facing complex situations have been among the last to adopt automated VMI. Supermarkets have typically taken longer than department stores. For example, the sheer number of items in consumer grocery store carts has meant greater complexity in tracking and using sales data. However, spurred by the benefits of a VMI model, it is being adopted gradually by companies in the computers, electronics and automotive sectors. Going forward, VMI will rapidly evolve into more of a coordinated or collaborative approach with the expansion of Collaborative Planning Forecasting and Replenishment (CPFR)

Quick Response (QR)

QR was innovated in the early 1990's by Milliken & Company (http://www.millken.com) and subsequently codified by Voluntary Inter-Industry Commerce standards (VICS) Association. QR embraces four levels of application and technology. Level 1 and 2 involve retailer inventory-status information-sharing and automatic order-processing between retailers and suppliers. Levels 3 and 4 include VMI and cross-docking warehouses. Although VMI and QR are known as best known management systems among the practitioners, but large retailers have also developed their own proprietary systems, such as Wal-mart's Retail Link, K-Mart's Workbench and Target's Partner Online. These systems share two common characteristics:

(1) The sharing of transactions-level data between among partners; and

(2) The use of agreed-upon metrics (e.g. in-stock, inventory-turnover and on-time delivery measures and targets to assess partner performance.

RetailLink captures sales, inventory and delivery-related data for every SKU at every Wal-Mart facility and uploads it to a central database at least every 24 hours (Lee and Whang, 2001). These metrics based data are made available to every manager and every company up or down the supply chain whose performance is related to this SKU. The decisions based on shared information and their implementation depends on the specific partnership agreement and the type of SKUs being managed.

Collaborative Planning, Forecasting and Replenishment (CPFR)

CPFR is a standard developed to help retailers and their suppliers communicate more effectively throughout the demand planning and replenishment process in SCM terminology, CPFR is a process model, shared by a buyer and supplier, through which inventory-status, forecast and promotion-oriented information is shared and replenishment decisions are made. CPFR began as CFAR (Collaborative Forecasting and Replenishment) with a pilot program between Wal-Mart and Warner-Lambert, to work together to improve the replenishment processes by using Electronic Data Interchange (EDI) and spreadsheets. The new forecast turned out to be much more accurate which meant that the companies could work with lower inventory levels in the supply chain and a higher service-rate in the Wal-Mart stores. Wal-Mart and Warner Lambert wanted to make it an open public initiative and so they took it to the Uniform Code Council (UCC). In January 1997, a CPFR committee was formed under the auspices of the Voluntary Inter-Industry Commerce Standards (VICS) association. Members of that committee included Wal-Mart, Kmart, Procter & Gamble, Nabisco and Hewlett Packard. VICS association (http://www.cpfr.org) developed "CPFR initiative" (http://www.cpfr.org) in 1997 and published the first "CPFR Guidelines" (http://www.cpfr.org./Guidelines. Html) in 1998.

The CPFR Process

CPFR helps trading partners generate the most accurate forecast possible and set highly effective replenishment plans (CPFR Survey, 2000). Collaboration is more than messaging. The process begins with an agreement between trading partners to share information with each other and to collaborate on planning, with the ultimate goal of delivering products based on true market demand (Ensley, 1999: and Reda, 2000). The VICS defined nine steps in the CPFR process (Figure 5) as follow:

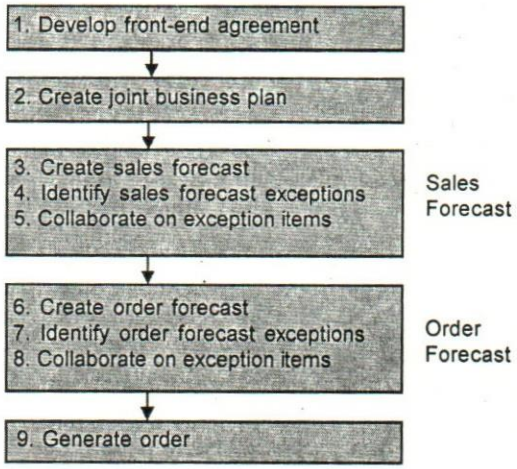


Fig. 5. Steps in CPFR Process

CPFR Technology

Today with the VICS guidelines as the fundation, several companies have developed CPFR—enabling software applications, including Syncra Systems, Logility, Manugistics, 12 Technologies, Entomo, SAP, Oracle, J.D. Edwards, SCT and Invensys. The benefits reported by CPFR partners are increased inventory turns (*i.e.* lower buffer inventory) and increased fill-rates for the SKUs involved: that is, higher levels of customer service. CPFR is also being implemented on B2B exchanges such as Worldwide Retail Net, Transora and NetXchange. Since then a large number of partners have developed CPFR pilots.

Based on the success of CPFR between single buyer-suppler pairs, practitioners have suggested its extension to include collaboration with the logistics providers. This is known as "CTM". Collaborative transportation management. (http://www.cpfr.org/whitepaper/CTM whitepaper. Pdf). It has also been suggested that for a successful supply chain, collaboration should involve all of the links of a supply chain. It is known as "n-Tier collaboration" (http://www.org/whitepap/n TierProposal.doc). For example, Kimberly-Clark collaborated with Wal-Mart to plan Wal-mart's orders of Kimberly-Clark collaborated with Wal-Mart to plan Wal-mart's orders of Kimberly-Clark products, but Kimberly-Clark would, in turn, collaborate with the suppliers to determine Kimberly Clark's orders for materials for its paper products.

The challenges of CPFR

Although CPFR has tremendous potential for reducing the total cost of a supply chain, there are also various challenges such as:—

(1) Buyers and suppliers must develop mutual trust between them.

(2) Technically, buyers and suppliers must develop a common language for identifying products and decision making.

Systems must be developed for linking the buyer's and supplier's business processes.

Automated Network Exchange (ANX)

In 1994, The Automotive Industry Action Group (AIAG) recommended the auto industry to develop a business oriented network service based on internet protocols. In this way, ANX, a leading edge extranet service emerged. ANX is an information super highway infrastructure company, funded and endorsed by major original equipment manufacturers (OEM): GM, Daimler-Chrysler, Ford Toyota, Caterpillar, Navistar and Paccar (Hajibashi and Brooks, 2001).

ANX is a sole global high security IP based Virtual Private Network (VPN) designed and operated to meet the needs of TPs/auto-manufacturers. It provides key benefits in terms of encouraging price competition, while ensuring Quality of Service (QOS) certification requirements. The Certified Service Providers (CSP) and security gateway vendors are certified. ANX requires each CSP to adhere to a demanding Service Level Agreement (SLA). The CSP has to comply with a total of 130 technical and business metrics across eight areas of service quality such as Network service features, interoperability, performance, reliability, business continuity and disaster recovery, security, customer care and trouble handling. In 2001, there were seven CSPs: Ameritech, AT&T, Bell Nexxia, Equant, Ideal Technology Solutions, Ipulsys and MCI. Eight IPSec gateway vendors had been approved: Alcatel, checkpoint, Cisco, Network Associates, Nortel, Radguard and VPNet.

The Rationale of ANX

The rationale behind the ANX service was to replace costly and redundant proprietary networks between automakers and suppliers with a single information network to seek performance, centralized administration, standards based network level security and the reliability of a VPN. It also supported industry specific ERP applications. Potential direct savings from ANX Service include (Altekar, 2005):

- Consolidation of multiple communications to individual trading partners
- Elimination of contract, billing, network management, equipment maintenance and floor space overhead associated with multiple connections
- Potential opportunities to reduce the cost of cross-border traffic
- Partial replacement or implementation of a corporate network using ANX service rather than private lines
- Reduced need for multiple providers to reach geographically dispersed trading partners

COVISINT

Launched in November of 2000, Covisint is an online marketplace for the worldwide automotive industry. It was originally conceived in 1999 by Ford Motor Co., General Motors and Daimler Chrysler to streamline the purchasing and production processes of automobile making. Later, France's Renault S.A. and Japan's Nissan also agreed to join the partnership. The idea for Covisint emerged from the rivalry between Ford's Auto-Xchange and GM's Trade X-change, both launched in November of 1999. It was realized that a combined B2B exchange would be much more lucrative and a universal online automotive marketplace could improve the process of new parts

development by facilitating better communication between automakers and suppliers. It also had the potential to speed vehicle development times and give dealers better control over inventory by customization. Convisint has attained its goal of becoming the world's largest B2B exchange and help to save hundreds of dollars off the production costs of each automobile. Automotive OEMs faced the following challenges before implementation of Covisint:

- After already realizing the benefits of a portal to communicate and collaborate with suppliers, automotive manufacturers needed a reliable out –sourced solution that would free them to focus on continually improving business processes with suppliers.
- Managing a supplier portal internally was expensive and time-consuming. They were responsible for all aspects of development, maintenance and administration of the portal, including the challenges of security, content management, supplier registration, identity management and help desk support and all in multiple languages.
- The investment in technology required continual upkeep and maintenance fees: changing security threats and regulatory requirements demanded full-time attention; and help desk support for the supplier web environment was growing out of control.
- They realized that their employees could be better utilized by improving core business processes with suppliers could be better utilized by improving core business processes with suppliers as opposed to maintaining the supplier portal infrastructure.
- Even within a single company, there were regional supplier websites that were completely independent and had the same inefficiencies as those websites from multiple companies.

Table 4 shows some of the benefits achieved in the automotive sector through Covisint:

Table 4: Benefits of COVISINT to Automotive Firms

Automotive	
Automotive OEMs	By discontinuing internally developed systems and selecting Covisint, Automotive OEMs achieved a lower-cost and highly comprehensive portal solution to securely share information with suppliers.
DaimlerChrysler	More than 8,000 DaimlerChrysler suppliers worldwide conduct day-to-day business functions via Covisint's secure, single point of entry.
Delphi	Delphi deployed Covisint's solution, which provided supplier users with a simple, central user interface to access all Delphi applications.
Ford Motor Company	Covisint is used by Ford to securely share a large number of Ford-Specific applications with global supplier companies.
GM	GM selected Covisint to provide a single, highly redundant connection for GM to exchange EDI information with its suppliers.
Visteon	Visteon selected Covisint's ready-built portal solution that met and exceeded all requirements and launched within 90 days.

Sales and Operations Planning (S&OP)

S&OP is a widely used collaborative process that allows the organization to introduce critical supply chain information into the decision-making process. With globalization and outsourcing, much of the information impacting an organizations's decision-making process is generated externally to the enterprise. Given these trends, organizations are finding that a comprehensive S&OP process is even more important. The S&OP decision-making process ensures that a business is continually managed to meet agreed-upon strategies, goals and commitments, despite constant changes in your environment.

The S&OP process comprises a series of integrated and interdependent business reviews, structured and focused to ensure that the tactical plans in all of the business functions and geographies are aligned with company's strategy/ S&OP allows introducing collaborative information into the decision-making process. When used as part of collaborative efforts, it enables better communications between cross-functional groups and the trading partners.

A good S&OP process helps a company:—

- To achieve an optimal balance between demand and supply, reduce shortages and improve cash flow
- Reduce lead times as well as finished-goods inventory and transportation costs
- Better ability to collaborate with all members of the extended supply chain and to serve customers.

Performance Measurement in a Collaborative Environment

A collaborative supply chain consisting of all members of the value chain-from the organization to its most distant trading partners and suppliers-requires continuous and careful monitoring and evaluation (Rodrigues et al., 2004). Effective supply chain metrics and collaboration go hand in hand (Mishra and Sreekumar, 2007). Capturing and evaluating meaningful per formic measures can help you align activities across your entire supply chain, target profitable market segments and obtain a competitive advantage. However, an organization may have a limited set of metrics in place that do not extend beyond its own operations to include other members of the collaborative supply chain. This lack of visibility makes it difficult to integrate, synchronize and optimize inter-enterprise processes (Vereecke and Muylle, 2005). A collaborated supply chain demands a fully coordinated, closed-loop SCM solution that monitors events, sends alerts and evaluates performance across the entire network (Ahuja and Rao, 2002). In such environment, partners can synchronize, manage and evaluate activities across the supply chain network through the functionalities provided by Supply chain event management, supply chain performance management and S&OP.

Performance management functionalities allow the company and its supply chain partners to define, measure, analyze, share and improve KPIs (key performance indicators) such as costs, efficiency and asset usage. It also allows all the partners to quickly identify and react to delays, as well as identify and investigate areas of potential waste. Supply chain performance management constantly tracks key performance measurements and automatically generates an alert when performance deviates from standards (Lee and Hang, 2000). The technologies that support the performance management functionality include operational and analytic software. Operational software generates the data, production plans, stock and delivery dates that are used to calculate KPIs. Extractors transfer data from from this operational software to analytic software at predetermined intervals. On a strategic level, this type of advanced supply chain performance management creates a window into the performance of your entire supply chain. In a collaborative environment, it provides the visibility needed into performance (Lim, 2007). Performance management gives you the necessary feedback to create true, closed loop supply chain management, which is a key to driving continuous improvement, delivering superior performance and ensuring that the supply chain continues to be efficient and competitive.

Conclusion

The perception of suppliers is changing from a link in the 'chain' to a vital 'relationship'. This will forge a new way of doing business in the modern global world to sustain competition. Each approach has its own features and limitations. Though collaborative relationships are costly and resource intensive, but arms-length agreements potentially expose buyers to dominant suppliers. The ultimate strength of a supply chain lies in the ability of supply managers to align and connect each link appropriately.

References

Roadmap to CPFR: The case studies : *VICS CPFR committee*; 1999

The next wave of Supply Chain Advantage: Collaborative Planning, Forecasting and Replenishment-CPFR Survey Findings & Analysis; *Industry Directions Inc.* and Syncra Systems, April 2000

Ahuja, Amit and Rao, U.S. (2002), "Impact of IT and Information Sharing on Supply Chain Performance-A Simulation Study", Vision: *The Journal of Business Perspective,* pp.109-116.

Altekar, Rahul V. (2005), Supply Chain Management: *Concepts and cases,* New Delhi: Prentice Hall of India .

Anderson, David L: Lee, Hau L. (2001), "The Internet-enabled supply chain: From the "first click" to the "last mile", 2001. whitepaper from the *Supply Chain Management Review* (www.scmr.com) AND Stanford University.

Bardaki, Cleopatra: Pramatari, Katerinaand and Doukidis, Georgios I. (2007), RFID-Enabled Supply Chain Collaboration Services in a Networked Retail Business Environment, 20th Bled eConference, eMergence: Merging and Emerging technologies, Processes and Institutions, June 4-6, 2007: Bled, Solvenia.

Barratt, M (2004 (2004). "Understanding the meaning of collaboration in the supply chain", *Supply Chain Management: An International Journal,* Vol.9,p.3042,

Basmaci, Osman Serdar (2003), "SCM Collaboration in Textile Industry", Thesis submitted for the Degree of MS to the Sarbanci University.

Basu, Amit and Siems, Thomas F. (2004). "The Impact of E-Business technologies on Supply Chain Operations: A macroeconomic perspective", Research Department, Working paper 0404, Federal Reserve Bank of Dallas.

Bukovic, Lynne (2005), "CPFR: Reaping the benefits through Transora"; Whitepaper from *Syncra Systems and Transora: January,* (www.syncra.com)

Cachon, G. and Fisher, M (2000), "Supply chain inventory management and the value of shared information", *Management Science*, Vol. 46(8), p.127

Cachon, Gerard P. and Lariviere, Martin A. (2001), "Contracting to assure supply: How to share demand forecasts in a supply Chain", *Management Science*: Volume 47(5), pp. 234-256.

Childe, S.J.(2001), "The extended enterprise—a concept of co-operation", *Production Planning & Control,* Vol. 9(4), pp. 320-327.

Cox, A. (2004) "Business relationship alignment: on the commensurability of value capture and mutuality in buyer and supplier exchange", *Supply Chain Management,* Vol. 9, p. 4 104.

Edwards, Peter, Peters, Melvyn and Sharma, Graham (2001), "The effectiveness of information systems in supporting the extended supply chain", *Journal of Business Logistics;* Volume 22(1), p. 201.

Enslow, B.(1999), "When does supply chain collaboration work?", *Gartner Group,* Research Note, DF-08-3301, June 7, 1999.

Ericson, Jim (2001), "From platform to process", *Line 56.com,* November 1, 2001.

Ferreria, John; Schlump, Eric and Prokopets, Len (2001), "Collaborative commerce: going private to get results', *Deloitte Research,* 2001.

Gattorna, J.L., Chom, N.H. & Day, A. (1191), "Pathways to Customers: Reducing Complexity in the Logistics Pipeline", *International Journal of Physical Distribution & Logistics Management,* Vol. 21(5), p.213.

Gunasekaran, A. and Nagai, E.W.T. (2004), Information systems in supply chain integration, *European Journal of Operational Research,* Vol. 159, pp. 269-295.

Hajibashi, Mohammed; Brookes, Jeffrey D. (2001), "eCommerce standards: From A2A to B2B", Accenture Research Note in *Supply Chain Excellence:* issues Five: May, 2001

Holweg, M.; Disney, S,: Holmstrom, J. and Smaros, J. (2005), "Supply Chain Collaboration: Making Sense of the Strategy Continuum", *European Management Journal,* Vol. 23,pp. 170-181.

Jadgde, H.S.: Thoben, K.D. (2001), "Anatomy of enterprise collaborations", *Production Planning & Control:* Vol. 12(5), pp.437-4510.

Kilbane, Doris (2001), "Nuts and bolts: CPFR", *Supply Chain Technology News*: October 1, 2001.

Lee, Hau L. and Amaral, Jason (2002), Continuous and Sustainable Improvement through Supply Chain Performance Management, Stanford Global Supply Chain Management Forum (SGSCMF-W1-2002), pp.1-14.

Lee, Hau L. (2001), "Ultimate Enterprise Value Creation", Whitepaper from the *Stanford Global Supply Chain Forum*; September, 2001.

Lee, Hau L.; So, Kut C. and Tang, Christopher S. (2001), "The value of information sharing in a two-level supply chain", *Management Science;* Vol. 46(5), May 2001.

Lee, Hau L.; Whang, Seungjin (2001), "E-business and supply chain integration", whitepaper from the *Stanford Global Supply Chain Management Forum*, SGSCMF-W2-2001; November 2001.

Lee, Hau L.; Whang, Seungjin (2000), "Information sharing in a supply chain", *International Journal of Technbology Management;* Vol. 20 (3/4).

Liker, Jeffrey K. and Choi, Thomas Y. (2004) "Building Deep Supplier Relationships", *Harvard Business Review,* pp. 104-113.

Lim, Se Hun (2007), "Rations of Supply Chain Management Performance and Sustainable Collaboration using Balanced Scorecard under the e-Business Context", *International Journal of Computer Science and Network Security,* Vol. 7(2), p. 43.

McGarr, Michael S. (2001), "Collaborating to drive commerce", *Electronic Commerce World,* July 2001.

McKaige, Walter (2001), "Collaborating on the supply chain", *IIE Solutions;* March 2001.

Mishra, Kravi and Sreekumar (2007), "Benchmarking for supply chain Collaboration", *The Icfai Journal of Supply Chain Management,* Vol. IV (2), pp. 14-25.

Peck, Helen; Juttner, Uta (2000), "Strategy and relationships: defining the interface in supply chain contexts", *The International Journal of Logistic Management;* Vol. 11 (2), 2000.

Peters, Chris (2001), "You ain't seen nothing yet", *Line 56.com;* November 2001.

Petersen, K. (2001), "Determining your role in c-commerce relationships *Gartner Group; Research* Note, DF-14-1853; October 12, 2001.

Petersen, K.; Eschinger, C. and Frey, N. (2001), "Supply chain collaboration lessons from the leading edge", *Gartner Group; Setrategic Analysis Report*, 13-9859; August 8, 2001.

Pollard, Simon (2001), 'Supply chain council finds collaboration a confusing concept'; *AMR Research Alert*; October 5, 2001.

Raghunathan, Srinivasan (1991), "Inter-organizational collaborative forecasting and replenishment systems and supply chain implications", *Decision Sciences;* Vol. 30(4), Fall 1999.

Raghunathan, Srinivasan (2001), 'Information sharing in a supply chain: A note on its value when demand is nonstationary'; *Management Science;* Vol. 47(4), Fall 2001.

Reda, Susan (2000), "CPFR Takes Off", *Stores*; February 2000.

Rodrigues, A., M.; stank, T., P. and Lynch, D., F. (2004), "Linking strategy, structure, process and performance in integrated logistics", *Journal of Business Logistics,* Vol. 25, p. 65.

Simatupang, T.M. & Sridharan, R. (2005), "The collaboration index: a measure for supply chain collaboration", *International Journal of Physical Distribution and Logistics Management,* Vol. 35, p. 4462.

Stank, Theodore P.; Keller, Scott B. and Daugherty, Paetricia J. (2001), "Supply chain collaboration and logistical service performance", *Journal of Business Logistics,* Vol. 22(1).

Supplier Relationship Management: Moving from "Counterparties" to Collaboration, An IDC Executive Brief, January 2003, www.idc.com

Vereecke, Ann and Muylle, Steve (2005), "Performance Improvement Through Supply Chain Collaboration: Conventional Wisdom Versus Empirical Findings", Working Paper in Ghent University, January, 2005.

Vonderemse, M.A.; Raghunathan, T.S.; Suibba Rao, S.(1997), "A post-industrial paradigm: to integrate and automate manufacturing", *International Journal of Production Research;* Vol. 3599), pp. 2579-2599.

Wortmann, Hans; Szirbik, Nick (2001), "ICT issues among collaborative enterprises; from rigid to adaptive agent-based technologies", *Production Planning & Control;* Vol. 12(5), pp. 452-265.

Zrimsek, B.(2001), "Manufacturing planning: fundamentals and indicators of collaboration", *Gartner Group; Research* Note, COM-13-3853; May 29, 2001.

Book Review

Indian Manufacturing Sector in Liberalised Era by Dr.A.Vijayakumar, MD Publications Pvt Ltd,, New Delhi, First Edition 2008, pages 284, Price. Rs.795.

During the liberalization era India has emerged as a global manufacturing hub next only to China. Taking advantage of vast domestic market and availability of low cost workers with advanced technical skills, several multinational companies have set up their shop in India requiring advanced technical expertise.

The book under review presents 25 published research papers by the author in various journals on the broad theme 'Indian manufacturing during the liberalized era.' These papers have been grouped into seven broad parts such as Profitability analysis, Working capital management, Liquidity analysis, Productivity analysis, Performance appraisal, Social performance and Impact of Liberalisation, Privatisation and Globalisation.

The first part of the book contains six papers under the broad heading Profitability Analysis. These articles analyse firm size and profitability across a number of manufacturing sectors in India with special emphasis on automobile industries and Public sector manufacturing units. The paper on automobile industry analyses profitability of 18 leading automobile manufacturers ranging from commercial vehicle, passenger cars, two and three wheelers categories during 1991-92 to 2003-04 through a regression analysis. The paper on firm size and profitability tests Indian public sector manufacturing industries during 1981 to 2001 period. The paper on determinants of corporate dividend in Public Sector Undertakings analyses the trends in PSU dividends through a regression analysis.

Part two of the book includes five articles in the area of working capital management. Two articles in this section discuss working capital management in sugar mills of Tamil Nadu. The other three papers included in this section discuss theoretical and empirical issues related to the estimation of demand functions of working capital – partial adjustment model and bivariate discriminant analysis approach. The last paper included in this section discusses transactions demand for working capital in Indian public sector enterprises including some theoretical and practical results.

Part three of the book includes only one paper on assessment of corporate liquidity based on a discriminant analysis approach. This paper attempts to determine the short term liquidity position in the context of selected sugar factories of Tamil Nadu during the period 1984-85 to 1993-94.

Part four of the book discusses productivity analysis. There are four papers that discuss total factor productivity in the paint industry, drug industry, paper industry and chemical industry. The papers on paint industry and drug industry estimate total factor productivity during 1991-92 to 2001-02 based on Kendrick, Solow, Divisia methods. This paper also estimates production function based on Cobb Douglas and Constant Elasticity of Substitution methods. Paper on productivity and profitability of the Paper industry provides a case study of Seshasayee Paper and Boards Limited, Tamil Nadu. Productivity has been estimated using Cobb-Douglas production function whereas profitability is estimated using multiple regression analysis during the period 1981-82 to 1993-94. The last paper in this section estimates total factor productivity and production function analysis for both organic and inorganic chemical industry in India during 1991-92 t 2001-02.

Part five of this volume includes six articles and discusses performance appraisal across sectors such as sugar industry, automobile industry etc. One important article of this section estimates financial health of Indian Public Sector Manufacturing Enterprises before and after liberalization. Statistical technique such as Multiple Discriminant Analysis (MDA) have been used to weight the different financial ratio types into a multiple regression model that produces an index or credit score (Z), a technique developed by Altman in 1968. The required accounting information about Indian public sector manufacturing enterprises for the Z scores analysis was obtained from the PROWESS data base of CMIE. The study reveals that the operational efficiency using Altman's "Z" score that the financial health of selected public sector manufacturing enterprises was never in the healthy zone in pre-liberalisation period (1981-91 period) whereas the post-liberalisation (1991-2001 period) exhibited a healthy zone result. Papers on automobile industry analyses economic value added (EVA) and market value added

(MVA) approaches. EVA is a residual income concept on cost of capital whereas MVA is a measure on shareholders wealth.

Part six of the volume presents only one article on appraisal of social performance of Tamil Nadu Sugar Corporation based on a value added approach during the period 1985-86 to 1990-91. Part seven of the volume discusses two papers on the impact of liberalization, privatization and globalization on public sector enterprises. Though these papers are quite sketchy in detail and discuss only initial stages of globalization in India till 1995, no doubt they throw some light on the early stages of liberalization in India.

As a whole the book under review provides an interesting reading on a wide range of issues on Indian manufacturing studied on the basis of different methodologies and econometric estimations. The author deserves appreciation for bringing together as many as 25 empirical research articles on Indian manufacturing during the liberalization era published in various journals. Given the depth of analysis and spread of topics, I have no doubt that this volume would be of immense utility to practicing managers, financial executives, Ph.D and M.Phil scholars, students of M.A, M.Com, MBA, MFC etc.

Reviewer: Dr.K.P.Sunny
Dy.Director (ES)
National Productivity Council
New Delhi

Productivity and the growth of produtivity must be the first economic consideration at all times, not the last. That is the source of technological innovation, jobs and wealth.

—William E. Simon

Annual Index of Productivity Vol. 48 (April 2007 – March 2008)

Vol. 48 April-June., 2007 No.1

Vol. 48 July-Sept., 2007 No. 2.

Vol. 48 Oct.-Dec., 2007 No.3.

Vol. 48 Jan.-March., 2008 No.4.

Registered with Registrar of Newspapers REGD. NO. 4757/59

Productivity

Announce

a

Special Issue (Combined)

July-September, 2008

&

October - December, 2008

on

Agriculture

Place your orders with :

MD Publications Pvt Ltd
"MD House", 11, Darya Ganj,
New Delhi - 110 002
Telephone : 91-11-41563325, 41562846
E-mail : order@mdppl.com, sales@mdppl.com
website : www.mdppl.com