Knowledge management practices in Indian industries – a comparative study

Deepak Chawla and Himanshu Joshi


Deepak Chawla is Professor and Himanshu Joshi is Senior Lecturer, both based at the International Management Institute, New Delhi, India.

The paper is part of the outcome of a research initiative sanctioned by the Department of Information Technology, Ministry of Communications and Information Technology; Government of India entitled ''National Competitiveness in the Knowledge Economy'' to four institutions, namely IIT-M, IIT-R, IMI and NPC.

Abstract

Purpose – *The purpose of this paper is to study Knowledge Management (KM) implementation in Indian manufacturing, IT and IT Enabled Services (ITES) and power generation and distribution companies. Various dimensions of KM, namely: process, leadership, culture, technology, and measurement are compared across the three industries to understand the differences in KM practices.*

Design/methodology/approach – *Samples comprised 17 responses from ITES, 32 from manufacturing and eight from power generation and distribution organizations. Convenient sampling scheme was used. The paper reports the findings of the difference in KM practices with respect to the organizations' use of the above mentioned dimensions across the three industries.*

Findings – *The raw mean score of various dimensions for ITES is the highest followed by manufacturing, and power generation and distribution on all except the leadership dimension. However, one way ANOVA results indicate that no significant difference is found for KM process, culture and technology. Statistical difference is found on the remaining two dimensions, namely, leadership and measurement, which are further analysed.*

Research limitations/implications – *The study includes 17 responses from ITES and eight from power generation and distribution. A larger sample from these two industries may enhance generalizability of results.*

Practical implications – *Findings of the study can serve as input to companies from the three industries in developing best practices across KM dimensions for improving performance.*

Originality/value – *While KM has been studied in Indian manufacturing, pharmaceutical and IT industries, its comparison across industries has not been carried out.*

Keywords *Knowledge management, Manufacturing systems, Communication technologies, Electric power generation, India*

Paper type *Research paper*

Introduction

The concept of knowledge has been there for ages as generations have used it for achieving prosperity. But as a discipline and a field of research, it is very recently that it is gaining wider acceptability. A number of projects on Knowledge Management have been initiated by organizations worldwide keeping in view the kind of benefits that can be derived. According to Davenport *et al.* (1998), such Knowledge Management projects are attempts to do something useful with knowledge to accomplish organizational objectives through the structuring of people, technology and knowledge content. Indian organizations too have not been far behind with some using it as an integrated approach towards developing competencies for sustainable competitive advantage. Infosys Technologies Limited, Wipro Limited, Tata Steel Limited, Bharti Limited etc. to name a few have been quiet successful in using it as part of their overall strategy to achieve excellence. But why is knowledge and management of knowledge gaining popularity?

With globalization and proliferation of Information and Communications Technology (ICT), the business environment is characterized by heightened level of competition. This new

world of business is characterized by high level of uncertainty and an inability to predict the future; what worked yesterday may or may not work tomorrow (Singh and Soltani, 2010). The traditional factors of production land, labour and capital can no longer guarantee sustainable competitive advantage. Organizations have realized that the only source of sustainable competitive advantage is knowledge and intellectual capital. Drucker (1995) believes that knowledge has become the key economic resource and the dominant – and perhaps the only source of competitive advantage. Industries like manufacturing, financial services, software development, outsourcing etc. are becoming information-intensive and therefore organizations are looking at ways to improve capabilities to store, process, disseminate and apply knowledge relevant across many functions of the organization. According to Bukowitz and Williams (1999) the other set of forces that has pushed knowledge management to the fore is the legacy of reengineering and downsizing which has resulted in a serious brain for many organizations.

The last two decades have seen transformation of local economies into global economies. In India, this wake of globalization started in 1990s with India emerging as an important player globally owing to its ability to offer quality labor and infrastructure at low cost. Post liberalization, the Indian economy has seen considerable growth and expansion in various industry sectors. This accelerated economic growth in India, since the early 1990s, can be largely attributed to the manufacturing and service sector. Manufacturing sector has been the backbone of Indian economy providing growth, productivity, employment, and strengthening agriculture and service sector. Information Technology (IT) and Information Technology Enabled Services (ITES) have played a major role in the growth of the service sector. The increasing demand for power, structural and regulatory reforms, participation of private sector has resulted in sustained growth of Indian power sector. Post liberalization, Indian manufacturing, IT/ITES and power sector have undergone reforms leading to higher investment, better management practices and improved efficiency which is discussed next.

Manufacturing sector in India

Indian manufacturing sector has contributed immensely to Indian economy. After opening up of economy, it has undergone a considerable growth trajectory providing employment and strengthening the agriculture and services sector. Indian manufacturing sector is classified into automotive components/engineering, chemicals, petroleum, fertilizers, packaging, electrical, electronics, IT hardware and peripherals, basic metals, textiles and other products.

The manufacturing industry contributes about 29 per cent of GDP to Indian economy. Among emerging economies of the world, India's manufacturing base is the fourth-largest and one of the fastest growing. The sector has been averaging 9 per cent in the last few years (2004-2008), with an impressive 12.5 per cent in 2006-2007. Manufacturing companies from across the world see India as a great potential having required skill set in people, process, engineering and technology. This has resulted in India being developed as a hub for worldwide operations.

India has a wide domestic market and availability of low cost skilled workforce has been instrumental in attracting all the major multinational companies for setting their manufacturing base in India. General Motors, ABB, Honeywell, Siemens, Sony Ericsson, Toyota Motor, Hyundai, Samsung Electronics, Nokia etc. have all set up their manufacturing base in the country. Large numbers of manufacturing assembly jobs that require low skills have moved from the USA and Western Europe to developing countries like India.

"The last two decades have seen transformation of local economies into global economies."

But there are many factors which plague this industry and limit its potential. Use of primitive technology, under utilization of existing resources, poor infrastructure, over staffed operations and expensive financing and bureaucratic decision making are some of the factors.

Information Technology (IT) and Information Technology Enabled Services (ITES) sector in India

Service Sector in India today accounts for more than half, i.e. about 54 per cent of India's GDP. IT in India is spread across four key sectors, namely: IT services; IT enabled services (ITES); software; and e-business. According to NASSCOM (2006), the most visible growth has been in information technology (IT) and business process outsourcing (BPO) services. The Indian information technology industry has played an important role in the growth of the knowledge industry in India. Countries, bureaucrats, business leaders and academicians from all over the world cite the success story of the growth of this sector. Indian private sector has contributed significantly to the hyper growth of this sector.

Opening up of economy, changing role of the government, availability of educated and English speaking workforce, entrepreneurial spirit of Indians are some of the factors that has contributed to the growth of the industry. The Indian government has shown transformational shift in style of operation and has exhibited participation and encouragement for starting and existing companies in the IT sector. This resulted in creating new opportunities for foreign direct investment in India. The increasing number of graduates and engineers that pass out of college every year particularly has helped the growth of this sector. Post liberalization numerous startup companies began to grow in various geographic area of the country with high number of technical graduates and engineers. As a result, various clusters of information technology related activities formed in cities like Bangalore, Hyderabad, Pune, Gurgaon and others bringing in new investments. Indian IT industry is mostly export oriented with majority of its revenue coming from selling product/service to other countries. Indian business houses like the Tata Group and firms like Ranbaxy Laboratories Limited, Wipro Limited, Sun pharmaceutical Industries Limited, Asian Paints etc. have acquired foreign companies to take leadership positions in India.

Power sector in India

Power sector has mainly been the state subject in India and is dominated by government-owned companies at both the national and state levels; 88 percent of utility-based power is produced by government generators (state government generating plants account for close to 60 percent of total installed utility capacity in the country), and transmission is almost entirely within the public sector.

The process of planned development of the Indian economy began in 1950 post independence. The power sector has registered significant progress since then. Hydropower and thermal power have been the main sources of generating electricity. Nuclear power is also gaining momentum to minimize dependency. There is a big gap between demand and supply and the power industry has been under constant pressure to bridge the same.

Power sector reforms like industry restructuring, setting up independent regulator, privatization and market liberalization have been undertaken in power generation, transmission and distribution to enhance efficiency and reduce costs. The road to competitive power markets in India will depend on how the restructuring process deals with three key issues namely payment risk from sale of electricity and tariff rationalization. Payment risk means the companies may not get paid for the electricity they produce as most distribution companies are still under state control. The State Electricity Boards (SEB) has incurred commercial losses resulting from underlying tariff structure and low revenue collection rates. Rationalization of tariffs through subsidies to agriculture and household consumers has resulted in losses as tariffs are not in sync with costs involved. Other emerging challenges to growth of this sector include limited fuel options and high transmission and distribution losses.

> **"In the present era, the competitive advantage of organizations is linked to its knowledge base and intellectual capital."**

In the present era, the competitive advantage of organizations is linked to its knowledge base and intellectual capital. There is a lot of emphasis placed upon dissemination of knowledge, and knowledge workers within organizations. This increased focus on management of the knowledge resource in organization is discussed next.

Literature survey

The concept of knowledge is not new and has been there since ages. There are various definitions of knowledge that exist. According to *Oxford English Dictionary* (1989), knowledge is:

- expertise, and skills acquired by a person through experience or education; the theoretical or practical understanding of a subject;
- what is known in a particular field or in total; facts and information; or
- awareness or familiarity gained by experience of a fact or situation.

McDermott (1999) defines knowledge as a human act, a residue of thinking which comes from experience and which belongs to and circulates through communities. Bollinger and Smith (2001) define knowledge as the understanding, awareness, or familiarity acquired through study, investigation, observation, or experience over the course of time. The term knowledge is also used to mean the confident understanding of a subject with the ability to use it for a specific purpose if appropriate. According to Davenport *et al.* (1998) knowledge is information combined with experience, context, interpretation and reflection. According to Nonaka (2007) organizations which consistently demonstrate continuous innovation by creating new knowledge, disseminating and embodying it in new products are ''knowledge-creating'' companies. The secret of their success is their approach to manage the creation of new knowledge.

The creation and transfer of knowledge has become a critical factor in an organization's success and competitiveness. From this concept, emerged the idea of knowledge management which ensures that the right information is delivered to the right person just in time, in order to take the most appropriate decision. The areas of applications and scope of knowledge management have increased but the underlying principles governing it remain the same. How we manage knowledge, determines the decisions we make and actions we take. Hence it makes sense to recognize and understand the processes that affect our decision making and actions so that necessary steps may be taken to improve the quality of these processes and in turn improve the quality of the decisions and actions taken. Therefore, organizations are concentrating their efforts towards improving knowledge transfer. According to Drucker (1995) knowledge has become the key economic resource and the dominant, perhaps even the only, source of competitive advantage. It has been observed that at the heart of an organization's strategy process is a force, which has been termed as the ''knowledge force'', which is powered by the knowledge workers. It is this knowledge force that determines the growth strategy of the firm and is reflected in terms of customers retained or gained, or new products/services launched from time to time. (Natarajan and Ganesh, 2008). As companies become more geographically dispersed and engage with a growing number of suppliers, partners and customers, vital information of processes or potential new products is likely to lie outside the organization in the broader

supply chain which makes it made it more important than ever to establish effective mechanisms to share knowledge (Economist Intelligence Unit Report, 2007).

Knowledge management is a broad, multi-disciplinary concept with no unanimous definition. The discipline has evolved since its introduction and since then various new dimensions of management have been incorporated. Although the study of knowledge has its root in antiquity, the field of ''Knowledge Management'' as a self conscious discipline is a recent phenomenon. According to Drucker (1995) the collective knowledge residing in the minds of its employees, customers, suppliers etc., is the most vital resource of an organizations growth, even more than the traditional factors of production i.e. land, labour and capital (Grossman, 2006). Knowledge management involves the identification and analysis of available and required knowledge, and the subsequent planning and control of actions to develop knowledge assets so as to fulfill organizational objectives. According to Wiig (1999) Knowledge Management is broad, multi-dimensional and covers most aspects of the enterprise activities. Simply stated, the objectives of Knowledge Management are: to make the enterprise act as intelligently as possible to secure its viability and overall success and realize the best value of its knowledge assets. Knowledge management is the deliberate and systematic coordination of an organization's people, processes, technology, and organizational structure in order to add value through reuse and innovation (Dalkir, 2007)

The concept of knowledge transfer derives from the field of innovation (Major and Cordey-Hayes, 2000). Knowledge transfer is the conveyance of knowledge from one place, person, ownership, etc. to another. Any transfer must involve more than one party. There has to be a source (the original holder of the knowledge) and a destination (where the knowledge is transferred to). Generally when some is transferred one party loses and other gains. But, knowledge being an intangible asset, it does not necessarily have to be given up by one party to be gained by the other. Enterprises are realizing how important it is to ''know what they know'' and be able to make maximum use of the knowledge. According to Natarajan and Ganesh (2008) not only firms engaged in IT business, which are naturally best suited to embrace Knowledge Management, but also firms engaged in manufacturing, retail, banking and, lately, outsourcing, of business processes are actively promoting the practice of Knowledge Management in their respective organizations. Hansen *et al.* (1999) found that consulting firms employ two different strategies (codification and personalization) for managing knowledge. Codification strategy centers on IT where knowledge is codified and stored in databases for easy accessibility. In personalization strategy, knowledge is shared mainly through direct person-to-person contact and IT is used to help people communicate knowledge and not store it. British Petroleum learnt a key technology for deep-sea oil exploration from its partnership with Shell Oil Company not by building a large electronic library of best practices but by connecting people (McDermott, 1999). Singh *et al.* (2006) identified the types of knowledge that are critical for the success of manufacturing firms, namely: customer feedback; core competencies; product/services; emerging trends; best practices; and competitive knowledge. These are required to manage competitive priorities like improving quality, cost reduction, efficiency improvements, improved delivery, flexibility in problem solving, and innovation.

Since 1990s various research studies have been carried out to identify the dimensions of Knowledge Management. Various frameworks and models have also been proposed by KM experts based on these dimensions. Literature shows that the KM dimensions are evolving with new management views being incorporated resulting in a more comprehensive and complete KM discipline. A study by Chong and Choi (2005) identified 11 key KM components for successful KM implementation. These are training, involvement, teamwork, empowerment, top management leadership and commitment, information systems infrastructure, performance measurement, culture, benchmarking, knowledge structure and elimination of organizational constraints.

Managing knowledge in organizations requires managing several processes of knowledge such as creation, storage, sharing and evaluation; generation, codification, transfer and application (Singh and Soltani, 2010); socialization (tacit-to-tacit), externalization

(tacit-to-explicit), combination (explicit-to-explicit), and internalization (explicit-to-tacit) (Nonaka and Takeuchi, 1995); generation (acquisition; dedicating resources; fusion; adaptation; and building knowledge networks), codification and transfer (Davenport and Prusak, 1998). According to Soo *et al.* (2002) the knowledge-creation process can be defined in three ways, i.e. sourcing of information and know-how from internal and external network opportunities, internalizing and integrating the information and applying it. It is also important to investigate how the acquired information influences the quality of decision making. The knowledge based outcomes of this process is innovation and creativity often reflected in form of better product and services.

To effectively manage competitive priorities, the top management plays a crucial role. Leadership influences the organizational ability and approach to deal with knowledge related issues. According to Singh (2008) consulting and delegating styles of leadership are positively related with knowledge management whereas directive and supportive styles of leadership are negatively associated with knowledge management practices in Indian software firms. This does not mean that middle and frontline workers have no role to play. No one department or group of experts has the exclusive responsibility for creating new knowledge and senior management, middle managers and frontline employees play a part; infact creating new knowledge is the product of dynamic interaction among three roles (Nonaka, 2007).

Information technology is another dimension which helps organization in leveraging knowledge. It is a means to the end and not a means in itself; managers often get trapped in the affinity of using IT for managing knowledge. There is no doubt that information systems are needed but creating one without understanding what users need often results in a knowledge junkyard. One such application of information systems is communities of practices which are an efficient way to share ideas. According to McDermott and Archibald (2010) earlier these networks of experts were independent and unofficial; today they are integrated into company formal management structures with specific goals, explicit accountability and clear executive oversight.

While IT plays an important role in realizing the benefits of Knowledge Management, it itself cannot make KM a reality. The difficulty in most KM efforts lies in changing organizational culture and people work habits; however, most KM efforts treat these cultural issues as secondary implementation issues (McDermott, 1999). According to Bollinger and Smith (2001) at the individual level, people are often reluctant to share knowledge as it is a source of power and status and therefore culture plays a primary role in the likelihood that employees will be willing to work together and share their knowledge. A study by Ensign and Hebert (2010) on knowledge sharing within research and development industries found reputation as an important factor in knowledge sharing within social networks. They found that reputation plays a role in interpersonal sharing of individually controlled knowledge – the sharing of personal, non-codified technical knowledge.

To remain competitive, it is important for organizations to benchmark its internal knowledge management processes to estimate the knowledge gaps pertaining to customers, suppliers, investors etc. While knowledge itself is difficult to measure, it does have a clear impact on business outcomes; there are good proxies in terms of innovative outputs that can be used to measure whether management is doing a good or poor job of managing their firm's knowledge base (Soo *et al.*, 2002). Rao (2005) considers five types of KM metrics necessary to estimate the state of KM, namely: technology; process; knowledge; employee; and

"The creation and transfer of knowledge has become a critical factor in an organization's success and competitiveness."

business. A number of tools and metrics have been developed by researcher's world wide to estimate the state of KM in organizations. These include KMAT tool developed by American Productivity and Quality Center (APQC) and Arthur Anderson, KMAT by Maier and Moseley (2003), Knowledge Management Diagnostic (KMD by Bukowitz and Williams (1999), Knowledge Audit (K-Audit) etc.

A number of organizations in India like Tata Steel Ltd, Wipro Technologies Ltd, Infosys Technologies Ltd, Bharti Cellular Ltd etc. have demonstrated how effective utilization of knowledge resources can contribute towards improving profitability.

Tata Steel Ltd

Tata Steel started its KM initiative with 1999 realizing that knowledge provides cutting edge through enabling knowledge sharing across all levels of employees be it executive, managers, engineers or shop floor. In manufacturing industries like the steel business, the knowledge requirements of a top executive is quite different from a line manager, which, in turn, is different from a shop floor employee. Being manpower intensive industry involving complex processes employees working at the shop floor encountered variety of problems. It was felt that although there was no dearth of knowledge sharing at the top level, the small innovations at the shop floor level remained unnoticed in the absence of a structured knowledge sharing platform. To tap this huge repository of tacit knowledge, Tata Steel embarked upon the idea of Aspire Knowledge Manthan, which was a structured method of capturing and sharing tacit knowledge at the shop floor level. The process involves selection of topic and selection of nominees. For each topic there are about 50-60 participants from various departments other than a champion or subject expert and a technical expert to steer the discussion. Storytelling, brainstorming, problem solving etc. techniques are used to generate ideas and knowledge which is captured and recorded. The project has encouraged cross-fertilization of ideas giving confidence to employees to adopt best practices. (Khanna *et al*., 2005)

Wipro Technologies Ltd

Wipro Technologies have demonstrated that a sound, knowledge management effort is no longer merely an option but rather a core necessity. The KM initiative established by Wipro has helped it to build up greater competitive advantage in its global market (Chatzkel, 2004). Its KM initiative at Wipro has its roots in continuous quality improvement program that it started to benchmark itself against top international standards. According to Rajakannu (2008), a core team of employees was identified and given the task of focusing organizational efforts on four business drivers: competitive responsiveness; collaborative work culture; shorter time to market; and capturing tacit knowledge. The KM framework identifies the current gap analysis, use of technology to provide information as when required and employing the knowledge base to ensure error-free and speedy deployment of products, services and solution. Some of the key success factors in Wipro's journey of KM has been the commitment from top management recognition of employees who contribute maximum to the knowledge base. (Kamalavijayan, 2005).

Infosys Technologies Ltd

KM initiative at Infosys began in the year 1999 under the inspiration of the CEO at that time, Mr. Narayanan Murthy. Against the backdrop of explosive customer demand and increasing network, the challenge was to develop practices to manage the knowledge supply chain to stay ahead of competition. A five-stage knowledge maturity model (KMM) was conceptualized to aid KM implementation. This knowledge management framework encompasses business strategy, people, processes and technology. The rollout was done incrementally followed by an important principle of not forcing employees to use the system. KM is a slow and incremental change process. (Suresh and Mahesh, 2008). Co-mentorship at Infosys was employed to gear the organization towards developing mutually beneficial relationship between the mentor and learner. Infosys KM group instituted various rewards, recognition and incentive programs to encourage all contributors (Info scions) to play an active role in the Knowledge Management initiative. Infoscions can earn Knowledge

currency units (KCU) for contributing, reviewing and using the Body of Knowledge (BoK) or other knowledge assets. Infosys KM leverages technology to provide an ''Integrated Access'' to organization-wide knowledge.

Bharti Ltd

At Bharti KM is used to create an organizational culture of uninhibited sharing to promote smooth flow and sharing of knowledge relevant to business and to eliminate reinventions. The focus and seriousness of its top management towards KM is shown from the fact that KM and its results are part of monthly business reviews and communications. KM initiatives are structured and focused around critical business processes within each business unit. The role of employees as change agents is seen as important to create knowledge sharing culture by bringing employees together in communities of exchange. Rewards and recognitions are part of the process as employees can earn Knowledge-dollar (K$) every time they contribute to organizations knowledge repository. Contributions are scanned and evaluated by knowledge-champions to maintain quality of content. Corporate intranet, KM portal is used as technology enablers to facilitate collaboration among communities. Bharti has also developed measures to identify the impact of KM on business processes (Hariharan, 2005).

From the above examples it is obvious that there are some common attributes which make a knowledge management initiative a success or a failure. Irrespective of whether the organization from manufacturing industry or services, the underlying foundation concepts of KM and its implementation is quiet similar. Therefore, it is important to analyze and compare these attributes and how effective management of the same can help in developing best practices for knowledge creation and dissemination in organizations.

Objectives

The objective of the study is to study Knowledge Management implementation in Indian manufacturing, IT Enabled Services, and power generation and distribution companies. The study also attempts to compare dimensions of Knowledge Management across three industries and bring out the differences. Since IT enabled service industry is knowledge intensive and knowledge driven, it is obvious to believe that it is more adaptive to Knowledge Management practices as compared to its other two counterparts, i.e. manufacturing and power generation and distribution. Therefore, it is expected that IT enabled service organizations would score higher than the other two on each of the dimensions of Knowledge Management.

Methodology

In this study, a structured questionnaire, Knowledge Management Assessment Tool (KMAT, 1995) developed by the American Productivity and Quality Center and Arthur Anderson, is used. The KMAT tool consists of 24 questions, divided into five sections namely Knowledge Management Process, Leadership in Knowledge Management, Culture, Knowledge Management Technology and Knowledge Management Measurement.

Each of the above mentioned five dimensions have various items in it. For example, the Knowledge Management Process is divided into five items labeled P1 to P5, Leadership in Knowledge Management is divided into four items labeled L1 to L4, Knowledge Management Culture is divided in five items labeled C1 to C5, Knowledge Management Techniques is divided into six items labeled as T1 to T6 and Knowledge Management Measurement is divided into four items labeled M1 to M4. Each of the items under the five dimension is measured on a five point interval scale defined as 1 = no, 2 = poor, 3 = fair, 4 = good and 5 = excellent. The scores of each of the items of various dimension is added to give a total score for each dimension. For example, the total score for Knowledge Management Process is obtained by adding the score of the item P1 to P5 and is represented by the variable KMP. Similarly, the total score for the Leadership in Knowledge Management (LKM), Knowledge Management Culture (KMC),

Knowledge Management Technology (KMT) and Knowledge Management Measurement (KMM) is computed. However, for purpose of comparison, the mean score is considered.

A number of Indian companies across three industries were contacted for collecting data. The basis for selecting these industries is their contribution to Indian economy. The classification depends on the operational orientation of the value chain. In manufacturing organizations, the value chain includes, inbound logistics, production, delivery and after sales service to customer. Although the value chain includes the services component but primarily the focus is on integrating the manufacturing processes from product design to manufacturing and delivery. Similarly for service oriented organizations the focus is structured around the customer immediate and emerging needs. For example, in an automobile manufacturing organization like Tata Motors Limited, the systems and processes are rigid in terms of product design, manufacturing and control, i.e. the information flow is process oriented. On the other hand, a service organization such as Tata Consultancy Services (TCS) Limited, the systems and processes are flexible and the information flow is customer oriented. The reason for selecting Power as a separate industry is to identify the differences with core manufacturing and IT driven services industry since all the three sectors have experienced different growth rates.

Regular mail, e-mail, personal visits and, telephonic conversations were used to make the respondents aware of the objectives of the study and to seek their cooperation and participation in providing the information. A convenient sampling scheme was used to select the respondents. A number of companies, in spite of our best efforts, and their promise to mail back the questionnaires did not participate in the study. About 100 organizations operating in India were contacted. A follow-up with these organizations resulted in 16 companies finally participating in the research study giving the primary data on the KMAT instrument. Many companies also shared their literature on the issues of Knowledge Management.

A sample of 57 top and middle level executives of 16 private and public sector companies from India participated in the study. A total of 32 responses were received from manufacturing sector companies, 17 from IT Enabled Services and remaining eight from power generation and distribution. The manufacturing sector companies are Mahindra & Mahindra Limited, Tinplate Company of India Limited, Tata Motors Limited, Samtel Color Limited and Tata Steel Limited. IT enabled service companies included Infosys Technologies Limited, Satyam Computer Services Limited, International Business Machines (IBM) Corporation Limited, Patni Computer Systems Limited and Aricent Inc. Powerlink Corporation Limited and North Delhi Private Limited are power generation and transmission companies.

Before conducting the analysis a reliability test was conducted on the KMAT instrument used in the study. This is done by using α coefficient (cronbach alpha) as given below:

$$\alpha = \left(\frac{K}{K-1}\right)\left(1 - \frac{\sum_{i=1}^{K} \sigma_i^2}{\sigma_i^2}\right)$$

K = No. of items in the scale.

σ_i^2 = Variance of scores on items i across subjects.

σ_t^2 = Variance of total scores across subjects where the total score for each respondent represents the sum of the individual item scores.

A reliability test was conducted on each of the five dimensions and the entire twenty four items included in the KMAT instrument. The value of Cronbach alpha varied from 0.755 to 0.940 indicating a high degree of reliability. A confirmatory factor analysis was conducted for each of the dimensions of KMAT instrument separately. The results indicated that each of the dimension resulted in only one factors with variation being explained ranging from 51.95

percent to 70.99 percent. This shows that the variables chosen in any dimension belong to that particular factor only.

In this study, we want to compare the Knowledge Management process (KMP), Leadership in Knowledge Management (LKM), Knowledge Management Culture (KMC), Knowledge Management Technology (KMT) and Knowledge Management Measurement (KMM) across three industry sectors. To compare, for example, the KMP score for IT Enabled Service, Manufacturing, and power generation and distribution industry, an analysis of variance is conducted as shown below:

H0. $\mu_{KMP,IT} = \mu_{KMP,M} = \mu_{KMP,\ PG}$.

H1. All μ's are not equal.

Where:

$\mu_{\ KMP,IT}$ = Population mean of KMP for IT Enabled Services.

$\mu_{KMP,M}$ = Population mean of KMP for manufacturing.

$\mu_{KMP,PG}$ = Population mean of KMP for power generation and distribution.

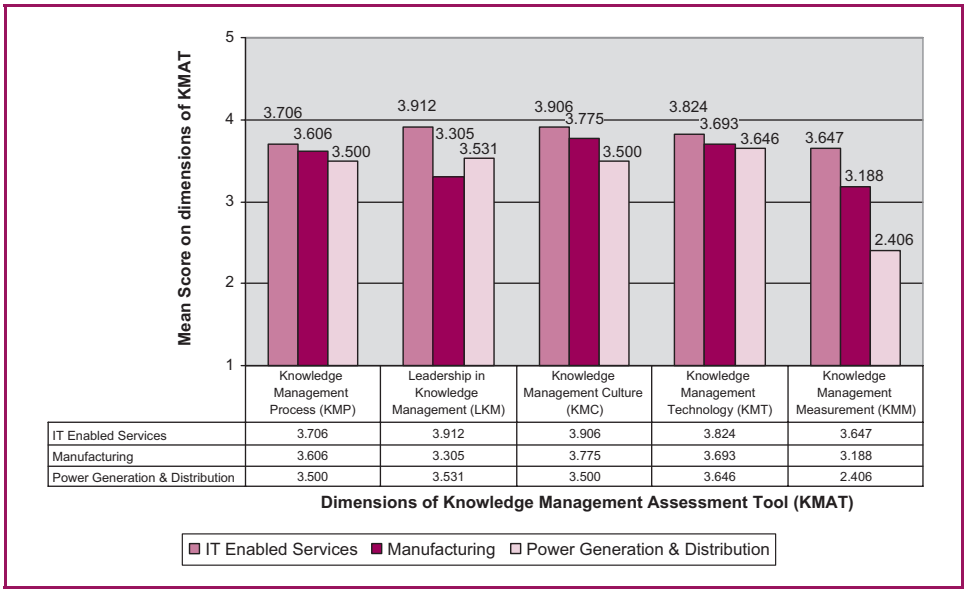
Similarly, the hypothesis could be written for the remaining dimensions of KMAT.

Next, we examine whether there are differences in the knowledge management processes among the three industry groups namely IT Enabled Services, manufacturing and power generation and distribution. We aim to bring out the difference, if any, among the three types of industries in their initiative for Knowledge Management Practice. The findings of the study are discussed in the following part of the paper.

Results and analysis

The mean score for each of the five dimensions of Knowledge Management Assessment Tool (KMAT) is compared for the three industries based on the responses obtained from their executives. A comparative picture of the mean scores of the five dimensions is calculated for the sample respondents and is shown in Figure 1.

Figure 1 Comparison of mean score for three industry groups on various dimensions of KMAT



An analysis of variance was carried out to test whether the mean score for each of the five dimensions of KMAT is same across all the three industries. In case of Knowledge Management Process (KMP), for, e.g. the null hypothesis may be written as below:

H0. $\mu_{KMP,IT} = \mu_{KMP,M} = \mu_{KMP,PG}$

H1. All μ's are not equal.

Similarly, the hypothesis could be written for the remaining dimensions of KMAT. The result of the analysis of variance is summarized in Table I.

An examination of the results of Table I indicates that there is no significant difference in the mean scores of the three industries with respect to the dimensions Knowledge Management Process (KMP), Knowledge Management Culture (KMC) and Knowledge Management Technology (KMT). A significant difference is found only in case of the dimensions Leadership in Knowledge Management (LKM) and Knowledge Management Measurement (KMM). Therefore, for further analysis only the two dimensions are considered across the three industry groups.

Considering the dimension LKM, the mean score for the dimension was compared across the three industry groups namely IT Enabled Services and manufacturing, IT Enabled Services and power generation and distribution, and manufacturing and power generation and distribution. The results of the independent sample *t*-test for the above mentioned grouping with respect to the dimension LKM is summarized in Table II.

The results of Table II indicate that there is a significant difference in the dimension LKM for the industry pair IT Enabled Services and manufacturing. Further, it is higher in case of IT Enabled Services than manufacturing. The simple mean score indicates that IT Enabled Services is on the top, followed by power generation and distribution, and manufacturing. However, there is no statistical difference between the industry pair IT Enabled Services, and power generation and distribution, and the other industry pair, namely manufacturing and power generation, and distribution. To know the reasons for this significant difference between the IT Enabled Services and manufacturing industry pair, the difference between

Table I Results of one-way ANOVA for various dimensions

S no.	*Dimension*	$^{2}F_{54}$ *statistic*	*Conclusion*
1.	Knowledge Management Process (KMP)	0.299	Accept null hypothesis of no difference between means
2.	Leadership in Knowledge Management (LKM)	3.963	Reject null hypothesis of no difference between means
3.	Knowledge Management Culture (KMC)	1.568	Accept null hypothesis of no difference between means
4.	Knowledge Management Technology (KMT)	0.259	Accept null hypothesis of no difference between means
5.	Knowledge Management Measurement (KMM)	6.527	Reject null hypothesis of no difference between means

Table II Independent sample *t*-test for the dimension LKM for industry groups

S no.	*Industry pair*	t	*Significance at 5 per cent*	*Degrees of freedom*
1.	IT enabled services v. Manufacturing	2.878	*	47
2.	IT enabled services v. Power generation and distribution	1.226	Not significant	23
3.	Manufacturing v. Power generation and distribution	−0.780	Not significant	38

Note: *Indicates significance as indicated by one tailed *t* statistic at 5% level

the mean score for the various items that constitute the dimension LKM was undertaken using an independent sample *t*-test. Table III summarizes the results.

Table III indicates that the two items, namely: L1; and L4, are not significantly different between IT Enabled Services and Manufacturing. However, for L2 and L3 there is statistical difference between the industry pair. The results indicate that the organizations in the IT enabled services understand the revenue generating potential of its knowledge assets and develop strategies for marketing and selling them better than manufacturing organizations. Further, the IT enabled service uses learning to support existing core competencies and create new ones better than that of manufacturing.

Next we analyzed the dimension KMM to examine whether there is any significant difference in the mean score of this dimension across the industry pair IT Enabled Service and manufacturing, IT Enabled Service and power generation and distribution, and manufacturing and power generation and distribution. The results of the *t*-test are summarized in Table IV.

An examination of the result in Table IV indicates that there is a difference in the mean scores with respect to the dimension KMM in all the three industry pairs. Further, it is interesting to know that the mean score of IT Enabled Services is significantly higher than for both manufacturing, and power generation and distribution. In fact IT Enabled Services scores highest in KMM followed by Manufacturing, and power generation and distribution.

In order to analyze the cause of difference in the mean score among the three industry pair, a comparison of the mean scores of each of the four items that constitute the dimension Knowledge Management Measurement (KMM) across the three industries was carried out and the results are summarized in Table V.

Table III Results of independent sample *t*-test for comparing the means of various items of Leadership in Knowledge Management (LKM) for IT Enabled Services and manufacturing

S no.	*Items*	t *statistics for comparing mean difference between the industry pair*	*Significance at 5 per cent*	*Degrees of freedom*
1.	Managing organizational knowledge is central to the organization's strategy (L1)	0.926	Not significant	47
2.	The organization understands the revenue-generating potential of its knowledge assets and develops strategies for marketing and selling them (L2)	3.353	*	47
3.	The organization uses learning to support existing core competencies and create new ones (L3)	3.823	*	47
4.	Individuals are hired, evaluated and compensated for their contributions to the development of organizational knowledge (L4)	0.963	Not significant	47

Note: *Indicates significance as indicated by one tailed *t* statistic at 5 per cent level

Table IV Independent sample *t*-test for the dimension KMM for industry groups

S no.	*Industry pair*	t	*Significance at 5 per cent*	*Degrees of freedom*
1.	IT enabled services v. Manufacturing	1.845	*	47
2.	IT enabled services v. Power generation and distribution	3.417	*	23
3.	Manufacturing v. Power generation and distribution	2.667	*	38

Note: *Indicates significance as indicated by one tailed *t* statistic at 5 per cent level

Table V Results of one-way ANOVA to compare the average score of each item of dimension Knowledge Management Measurement (KMM) across these industries

S no.	*Item*	*$^{2}F_{54}$ statistic*	*Conclusion*
1.	The organization has invented ways to link knowledge to financial results (M1)	5.933	Reject null hypothesis of no difference between average scores of item
2.	The organization has developed a specific set of indicators to manage knowledge (M2)	5.823	Reject null hypothesis of no difference between average scores of item
3.	The organization's set of measures balances hard and soft as well as financial and non-financial indicators (M3)	8.836	Reject null hypothesis of no difference between average scores of item
4.	The organization allocates resources toward efforts that measurably increase its knowledge base (M4)	0.466	Accept null hypothesis of no difference between average scores of item

Note: *Indicates significance as indicated by one tailed *t* statistic at 5 per cent level

The result of Table V reveal that the mean scores of all the items except M4, which is the organization allocates resources towards efforts that measurably increase its knowledge base is significantly different. Further, in order to analyze the differences between the industry pair for each of the item for which the mean score turned out to be significantly, a *t*-test to compare the mean score of each item among the industry pair was conducted.

The result for the item M1, which is the organization, has invented ways to link knowledge to financial results is in Table VI.

Table VI indicates that the mean score for item M1 is statistically significant in all the three industry pair. However, it is interesting to know that the average score for IT Enabled Services is at the top followed by manufacturing, and power generation and distribution. In fact the mean score is 3.28, 2.59 and 1.63 for IT Enabled Services, manufacturing, and power generation and distribution respectively. The score is far below satisfactory for manufacturing, and power generation and distribution. Although the score of IT Enabled Service is highest, it can just be equated to ''fair'' and is far away from ''excellent''.

The results for item M2, which is organization has developed a specific set of indicators to manage knowledge is summarized in Table VII.

Table VI Results of *t*-test to compare the average score of M1 across the three industry pair

S no.	*Industry pair*	t	*Significance at 5 per cent*	*Degrees of freedom*
1.	IT enabled services v. Manufacturing	1.843	*	47
2.	IT enabled services v. Power generation and distribution	3.051	*	23
3.	Manufacturing v. Power generation and distribution	2.532	*	38

Note: *Indicates significance as indicated by one tailed *t* statistic at 5 per cent level

Table VII Results of *t*-test to compare the average score of item M2 across the three industry pair

S no.	*Industry pair*	t	*Significance at 5 per cent*	*Degrees of freedom*
1.	IT enabled services v. Manufacturing	1.916	*	47
2.	IT enabled services v. Power generation and distribution	3.394	*	23
3.	Manufacturing v. Power generation and distribution	2.24	*	38

Note: *Indicates significance as indicated by one tailed *t* statistic at 5 per cent level

It is clear from Table VII that the difference among all the industry pair is significant with respect to the mean score of item M2. In fact the mean score for this item is 3.9412, 3.4063 and 2.625 for IT Enabled Services, manufacturing, and power generation and distribution. This shows score of both IT Enabled Services and manufacturing is above the ''fair'' score whereas for power generation and distribution it is a cause of concern and requires action.

The result for the item M3, which is organizations set of measures balances hard and soft as well as financial and non-financial indicators is summarized in Table VIII.

The results of Table VIII further indicate there is a significant difference across the industry pair with respect to the mean score for item M3. It is again observed that the IT Enabled Services is ahead of manufacturing, and power generation and distribution. The score for power generation and distribution is ''poor'' whereas for manufacturing is ''just fair'' and for IT Enabled Services is just ''below good''.

Conclusion

In this paper, an attempt is made to determine the extent of Knowledge Management implementation across three industries in India. An analysis of the dimensions of Knowledge Management based on the mean raw scores shows that IT Enabled service organizations are ahead of both manufacturing, and power generation and distribution companies. However, statistical tests of difference have shown that it is so in two dimension namely Leadership in Knowledge Management (LKM) and Knowledge Management Measurement (KMM). Singh *et al.* (2006) have found that in Indian manufacturing industry people do not share knowledge because they perceive that it may have an adverse impact on their job security. They found that employees lack adequate understanding of the importance of human and cultural aspects in the success of KM initiatives. Similar results were found in a study by Economist Intelligence Unit Report (2007) involving European manufacturing firms where lack of communication between functions in the company, tendency of some individuals to hoard important knowledge and knowledge residing in unstructured sources were found as internal barriers to flow of knowledge. These finding supports our finding as the mean scores of KMC show that although IT enabled service scores are better than manufacturing and power generation and distribution companies, the scores are below four and far from satisfactory.

With respect to KMP, the findings clearly indicate the need for improvement in developing supportive processes in all industries. The effectiveness of KM processes is determined by the active and willing participation of employees. Empirical evidence on knowledge workers show them to be commonly willing to work extremely hard for their employers. The structure of employment relationship between the two is often fuzzy in knowledge intensive organizations which cause conflict. Therefore, it is important to develop processes and structure where the interests of relationships between employer and employee, supervisor and subordinate are equally given importance. Also the processes involved should maintain a delicate balance between control and autonomy as knowledge workers demand and expect high degrees of autonomy in working conditions and patterns (Hislop, 2007).

With regard to LKM, it is seen that IT enabled services is ahead of the Manufacturing companies. However, there is no statistical difference between the industry pair of IT

Table VIII Results of *t*-test to compare the average score of item M3 across the three industry pair

S no.	*Industry pair*	t	*Significance at 5 per cent*	*Degrees of freedom*
1.	IT enabled services v. Manufacturing	1.863	*	47
2.	IT enabled services v. Power generation and distribution	3.934	*	23
3.	Manufacturing v. Power generation and distribution	3.23	*	38

Note: *Indicates significance as indicated by one tailed *t* statistic at 5 per cent level

Enabled Services and power generation, and distribution and manufacturing, and power generation and distribution. IT organizations understand the importance of the linkage between knowledge assets and improved business performance which could be in terms of increased revenues, profits, new product development, lower costs etc. This shows that manufacturing industries need to look into the leadership aspect in a more holistic manner so as to become competitive in both domestic and international markets. Top management plays a very crucial role in bringing cultural transformation and determines the long term sustainability of organizations. Similar findings were obtained in a study by Chong (2006) involving Malaysian ICT companies. It was found that since ICT companies are service-based; their nature of the business is knowledge-intensive which involves employees working in teams; and therefore leadership plays an important role in empowering employees to take decisions. According to Singh and Soltani (2010) awareness level and commitment was found to be high in Indian IT companies, but the involvement of top management in allocating the necessary resource towards sustaining KM initiatives require attention. They also found that individuals were not visibly rewarded for knowledge sharing and knowledge management was not given due importance in the performance appraisal system. Another study by Pillania (2005) in Indian context reveals that the attitude of employees in software industry towards creating new knowledge is worrying. Majority of them perceive it is the job of R&D department only. Hence, leadership plays an important role in defining the importance of KM in such organizations. Our finding also reinforces the importance of top management in making KM is an integral part of organization philosophy and culture. The raw score of IT enabled services which are on the top of the three industry groups is not very encouraging and also need improvement. It is therefore suggested that manufacturing industry should use Knowledge Management to develop strategies for marketing and selling their products. It should also use it to enhance its existing core competencies and create new ones to attain better competitive advantage.

In terms of the dimensions KMC and KMT, IT enabled services fare better than the other two industry groups. According to Davenport *et al.* (1998), if the cultural soil is not fertile for a knowledge project, no amount of technology, knowledge content, or good project management practices will make the effort successful. There is a perception that culture is not facilitating sharing and learning in the organizations. A study by Chadha and Kapoor (2010) in Indian auto-component manufacturing firms found that the culture in organizations did not encourage participation of employees in knowledge transfer and the respondents felt that in order to facilitate knowledge sharing, employees should be trained and evaluated on the value and use of knowledge. There is no doubt that IT is an important enabler of all processes in KM. But one must keep in mind that technology is just a facilitator for Knowledge Management. It is a means to the end and not an end in itself. Technology is not a panacea but storing knowledge in electronic format result in effective searching, so exploitation of knowledge becomes easier (KPMG Consulting, 1998). Another study shows that organization still view KM as a purely technological solution. Use of internet, intranet, data warehousing and mining technologies, document management system, decision support system and extranet was common among organizations but very few had systems integrated and configured for KM (KPMG Consulting, 2000). An organization and its employees cannot benefit from knowledge unless they have absorbed new knowledge, applied it and disseminated the lessons learnt. Singh and Soltani (2010) found that even though people in Indian IT companies are aware of the importance of documentation, only critical information is documented, whereas, general information which accounts for 30-40 percent of daily work input is not documented. Since IT companies are knowledge intensive, the role of IT in capturing tacit knowledge and transforming it into explicit form is even more important.

With regard to the dimension KMM among three industry pairs, IT enabled services is better than the other two. However, there is a need to invent ways to link Knowledge Management to financial results, develop specific set of indicators to manage knowledge and maintain a balance between financial and non-financial indicators. Pillania (2005) found that there is a lack of participation by Indian firms in industry based research groups for creating new knowledge. A continuous academia-industry interaction for new knowledge creation is

"An analysis of the dimensions of Knowledge Management based on the mean raw scores shows that IT Enabled service organizations are ahead of both manufacturing and power generation and distribution companies."

needed. Our findings emphasize the importance of benchmarking and audit for developing indicators for measuring the impact of KM initiative.

To sum up, if organizations have to compete effectively in the knowledge economy, it is essential to develop organizational capabilities involving systems, procedures, technology, culture and leadership. Leadership plays a crucial role in creating, developing, and managing the organizational capabilities by creating effective teams within a diverse workforce; tap talent throughout the organization by recruiting, retaining, and developing people at all levels; build and integrate cultures as mergers and acquisitions become common; use IT to enable and integrate KM processes; develop rewards and recognition systems for employee commitment toward organizational vision. Finally, the ability to of human resources to manage the attributes of KM will differentiate good and great organizations and in turn its long term success and sustainability.

References

Bollinger, A.S. and Smith, R.D. (2001), ''Managing organizational knowledge as a strategic asset'', *Journal of Knowledge Management*, Vol. 5 No. 1, pp. 8-18.

Bukowitz, W.R. and Williams, R.L. (1999), *The Knowledge Management Fieldbook*, Pearson Education, London.

Chadha, S.K. and Kapoor, D. (2010), ''A study on knowledge management practices of auto component manufacturing companies in Ludhiana City'', *The IUP Journal of Knowledge Management*, Vol. 8 Nos 1/2, pp. 68-76.

Chatzkel, J. (2004), ''Establishing a global KM initiative: the WIPRO story'', *Journal of Knowledge Management*, Vol. 8 No. 2, pp. 6-18.

Chong, S.C. (2006), ''KM critical success factor'', *The Learning Organization*, Vol. 13 No. 3, pp. 230-56.

Chong, S.C. and Choi, Y.S. (2005), ''Critical factors in the successful implementation of knowledge management'', *Journal of Knowledge Management Practice*, Vol. 6.

Dalkir, K. (2007), *Knowledge Management in Theory and Practice*, Elsevier, Noida.

Davenport, T.H. and Prusak, L. (1998), *Working Knowledge: How Organizations Manage What They Know*, Harvard Business School Press, Cambridge, MA.

Davenport, T.H., Delong, D.W. and Beers, M.D. (1998), ''Successful knowledge management projects'', *Sloan Management Review*, Vol. 39 No. 2, pp. 43-57.

Drucker, P.F. (1995), *Managing in a Time of Great Change*, Truman Talley, New York, NY.

Economist Intelligence Unit Report (2007), ''Economist Intelligence Unit Report'', *The Economist*, available at http://a330.g.akamai.net/7/330/25828/20070628141731/graphics.eiu.com/upload/portal/KNOWLEDGE_MANAGT_WEB.pdf (accessed October 16, 2008).

Ensign, C.P. and Hebert, L. (2010), ''How reputation affects knowledge sharing among colleagues'', *MIT Sloan Management Review*, Vol. 51 No. 2, pp. 79-81.

Grossman, M. (2006), ''An overview of knowledge management assessment approaches'', *The Journal of American Academy of Business*, Vol. 8 No. 2, pp. 242-7.

Hansen, M.T., Nohria, N. and Tierney, T. (1999), ''What's your strategy for managing knowledge'', *Harvard Business Review*, Vol. 77 No. 2, pp. 106-18.

Hariharan, A. (2005), ''Implementing seven KM enablers at Bharti'', *Knowledge Management Review*, Vol. 8 No. 3, pp. 8-9.

Hislop, D. (2007), *Knowledge Management in Organizations – A Critical Introduction*, Indian ed., Oxford Press, Delhi.

Kamalavijayan, D. (2005), *Information and Knowledge Management*, Macmillan India, New Delhi.

Khanna, A., Mitra, D. and Gupta, A. (2005), ''How shop-floor employees drive innovation at Tata Steel'', *Knowledge Management Review*, Vol. 8 No. 3, pp. 20-3.

Knowledge Management Assessment Toolkit (KMAT) (1995), ''Knowledge Management Assessment Toolkit'', developed by American Productivity and Quality Center (APQC), Houston, TX and Arthur Anderson Consulting, Chicago, IL.

KPMG Consulting (1998), *Knowledge Management Research Report*, KPMG Consulting, available at: www.brint.com/papers/submit/knowmgmt.pdf (accessed January 5, 2008).

KPMG Consulting (2000), *Knowledge Management Research Report*, KPMG Consulting, available at: www.providersedge.com/docs/km_articles/KPMG_KM_Research_Report_ 2000.pdf (accessed April 3, 2008).

McDermott, R. (1999), ''Why information technology inspired but cannot deliver knowledge management'', *California Management Review*, Vol. 41 No. 4, pp. 103-17.

McDermott, R. and Archibald, D. (2010), ''Harnessing your staff's informal network'', *Harvard Business Review*, March, pp. 1-7.

Maier, D.J. and Moseley, J.L. (2003), *The Knowledge Management Assessment Tool (KMAT), The 2003 Annual: Training*, Vol. 1, John Wiley & Sons, New York, NY.

Major, E. and Cordey-Hayes, M. (2000), ''Knowledge translation: a new perspective on knowledge transfer and foresight'', *Foresight*, Vol. 2 No. 4, pp. 411-23.

Natarajan, G. and Ganesh, U. (2008), *Unleashing the Knowledge Force*, Tata McGraw-Hill Publishing Company, New Delhi.

NASSCOM (2006), *IDC Study on the Domestic Services Market Opportunity*, NASSCOM, New Delhi.

Nonaka, I. (2007), ''The knowledge creating company'', *Harvard Business Review*, July-August, pp. 1-10.

Nonaka, I. and Takeuchi, H. (1995), *The Knowledge-creating Company: How Japanese Companies Create the Dynamics of Innovation*, Oxford University Press, New York, NY.

Oxford English Dictionary (1989), Oxford University Press, Oxford.

Pillania, R. (2005), ''New knowledge creation scenario in Indian industry'', *Global Journal of Flexible Systems Management*, Vol. 6 Nos 3/4, pp. 49-57.

Rajakannu, M. (2008), ''Wipro collaboration and KM journey'', Wipro Technologies whitepaper, available at: www.wipro.com/webpages/insights/kmjourney.htm (accessed August 18, 2008).

Rao, M. (2005), *Overview of KM Tools, in Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate KM Solutions*, Elsevier Butterworth-Heinemann, Oxford.

Singh, A. and Soltani, E. (2010), ''Knowledge management practices in Indian information technology companies'', *Total Quality Management*, Vol. 21 No. 2, pp. 145-57.

Singh, M.D., Shankar, R., Narain, R. and Kumar, A. (2006), ''Survey of knowledge management practices in Indian manufacturing industries'', *Journal of Knowledge Management*, Vol. 10 No. 6, pp. 110-28.

Singh, S.K. (2008), ''Role of leadership in knowledge management – a study'', *Journal of Knowledge Management*, Vol. 12 No. 4, pp. 3-15.

Soo, C., Devinney, T., Midgley, D. and Deering, A. (2002), ''Knowledge management: philosophy, processes, and pitfalls'', *California Management Review*, Vol. 44 No. 4, pp. 129-49.

Suresh, J.K. and Mahesh, K. (2008), ''Managing the knowledge supply chain at Infosys'', *KM Review*, Vol. 11 No. 4, pp. 14-19.

Wiig, K.M. (1999), ''What future knowledge management users expect'', *Journal of Knowledge Management*, Vol. 3 No. 2, pp. 155-65.

About the authors

Deepak Chawla is Professor of Quantitative Techniques and Marketing Research at the International Management Institute, New Delhi, India. He has over three decades of teaching, research and consulting experience. His areas of academic interest include business statistics, marketing research, business forecasting, applied econometrics, managerial economics and actuarial science. Deepak Chawla is the corresponding author and can be contacted at: dchawla@imi.edu

Himanshu Joshi is Senior Lecturer of Information Technology at the International Management Institute, New Delhi, India. He has over three years of experience in teaching and research, as well as six years of experience in the IT industry. His areas of interest include electronic business, enterprise resource planning, knowledge management, etc.