Knowledge Management Issues in the Management of Professional Engineers

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The critical importance of knowledge as a resource and its consequent management issues are recognised critical for business success and competitive advantage. This paper, based on the author’s Ph D study and ongoing research on engineers, argues that the current systems of managing engineers are not sufficient to deal with the knowledge dimension effectively. To derive competitive advantage from knowledge and knowledge management, business organisations must develop appropriate systems and policies, which will cultivate and support such knowledge workers. This paper outlines the increasing importance of knowledge in business organisations, concepts, and issues in managing professional engineers. It highlights some of the problems in managing professional engineers and their knowledge, such as sharing and leveraging their knowledge capabilities across the entire organisation, supporting internal organisational systems, knowledge creation, acquisition, transfer, and renewal.

1 Introduction

Services and the management of knowledge are considered to be the keys to future economic success for nations as well as for businesses, whether they are in manufacturing or in service industries. Emergence of knowledge as an organisation’s key asset is considered as the most important force shaping the world of the manager in the 21st century. The phenomenal increase in the availability of information, and its ease of access is changing the world into a ‘knowledge economy’. The new knowledge economy sets new rules, and new conditions. In this new context, the individual firm’s knowledge and learning capabilities are the main source of distinctive and competitive advantage. With knowledge taking the place of capital as the leading indicator of value and power, business organisations will have to develop strategies, policies, and procedures for managing the knowledge.

Engineers at the forefront of technology design, development, and implementation aspects in businesses are the key sources of knowledge and have a critical role in this debate. With its importance recognised, the challenge now is to develop, disseminate, share, and leverage knowledge in organisations for deriving business advantage.

2 Knowledge and Its Importance

In today’s modern world the prime commodities are knowledge and information. The information age has revolutionised the traditional thinking and management processes in businesses. With so much information available for managing businesses and taking decisions, choosing the appropriate and relevant information, and managing the information usage and sharing have become challenging and overwhelming tasks for managers.

Knowledge is a key organisational asset and a weapon to derive strategic competitive advantage. In addition to being a key asset in managing businesses, information and the knowledge generated from it, is fast becoming a product. For example the cost of information in the average car is greater than the cost of the steel that goes into it today. All types of organisations, whether they are consulting, research and educational organisations, or, steel manufacturing companies, airlines, hospitals, or government departments, rely quite heavily on information and knowledge for their day-to-day operations as well as in strategic decision making. Today, almost every business is in information business and every worker is a knowledge worker1.
The rapid increase in importance of knowledge and its management in business, in a way, are reflected in the rapid increase in specialised consultancies in the modern world. Companies are trying to acquire, store, retain, and use knowledge for competitive advantage. They are adopting several strategies to achieve this. While some companies are trying to acquire knowledge by entering into strategic alliances with several other partners that have complementary knowledge, others are converting the homegrown knowledge into a commercial product and selling to others. For example, companies like Federal express sells its core products in the form of systems and advice in logistics and distribution, than delivering parcels.

Though knowledge and knowledge management has become important today, markets long realised the value of knowledge and other intangible factors in the value-creating process. It is well known that some companies were valued more than their net assets would normally justify. For example, Coca-Cola’s assets were only 4 per cent of its value, while for Microsoft it is 6 per cent. In fact, there are some other companies that trade below book value suggesting the existence of ‘intellectual liabilities’. Surveys in industrialised countries revealed that superior profits came from intangible assets such as know-how, customer relationships, brands, and superior business processes. A closer look at the way individuals such as Gates (Microsoft), Branson (Virgin), Dell (Dell computer), Eliason (Oracle), and Moore (Intel) acquired wealth in the recent past reveals the significant role played by knowledge and information.

3 Knowledge Management — History and Recent Initiatives

The word ‘knowledge worker’ was coined two decades ago by the famous management thinker, Peter Drucker. He used it to describe managers who know how to allocate knowledge to productive use. He noted that companies are shifting from command and control organisations, the organisation of departments and divisions, to the information-based organisation, the organisation of knowledge specialists. Looking back into the historical evolution of knowledge, he suggested that the three social purposes of knowledge were served in three distinct historical phases. He noted that the first phase of knowledge was the pursuit of knowledge for the sake of knowledge and wisdom, prior to the industrial revolution. The industrial revolution heralded the second phase, termed as applied knowledge. Taylor’s scientific approach to organising work ushered in the third phase.

It is argued by Allee that the shift from mechanistic engineering to social-psychological concepts as advocated by Lewin in 1930, was more self-reflective than Taylor’s work, and therefore is the real application of knowledge to knowledge itself. Later on in 1970s, several authors like, Chris Argyris and Donald Schon emphasised the self-reflection and organisational learning, and improved the understanding of knowledge creation. Likert, e.g., in early 1960s, called for the measurement of investments made in the selection, training and development of employees in businesses, and the recognition of their ‘loss’ through turnover and layoffs. While this movement of accounting human assets has waned, measuring intellectual capital and intangible assets has gained momentum.

Several initiatives such as socio-technical systems, synchronous manufacturing, concurrent engineering, quality management, and business process reengineering, in the late 1980s, and 1990s have focused on the knowledge and its management. Even recent initiatives in managing quality focus on knowledge. For example, initiatives such as quality circles, quality function deployment and cross-functional groups, quality systems, and quality award frameworks focus on operational level knowledge. For all these initiatives, teams and team knowledge of the processes, tools and techniques for improvement of productivity and quality are the underpinning factors. Similarly, business process engineering (BPR) the radical reengineering initiatives propagated by Hammer are based on knowledge. BPR
focuses on strategic level knowledge and employs information technology as the enabling tool. The teams involved in such initiatives are expected to have cross-functional outlook with a focus on processes that go beyond functional boundaries. The team knowledge about the macro-processes, and the tools/techniques are the underlying factors in successful implementation of BPR initiatives.

Other initiatives in manufacturing environment such as synchronous manufacturing systems or concurrent engineering and JIT initiatives, focus on the system level knowledge, flexible structure and product and process technologies. Similarly the adoption of socio-technical systems approach in the 90s, in Australian organisations have team knowledge as the underpinning factor. By employing self-directed work groups, semi-autonomous work groups, multi-skilling and delayering, business organisations in Australia turned their attention to the operational level and team level knowledge at the workplace.

4 Knowledge and Knowledge Management

Knowledge is different from data or information. While information represents a data that is processed, organised and integrated, knowledge represents a higher level of understanding including rules, patterns, and reflection and it is self-generative. The concept of knowledge, by its very meaning, demands deep-seated reflection and understanding.

Knowledge is inseparable from individuals. Reflection upon concepts and the distinctions among them is the essence of the process of “knowing” or learning, and hence makes it inseparable to individuals. Knowledge is about pervading data and information with decision and reflection. It is what a knower knows. There is no knowledge without some one knowing it. Though knowledge can be embedded in organisational processes, routines, networks, designs, reports and document repositories, it cannot exist outside the minds of individuals. The individual knowledge is shaped by his/her initial knowledge, his/her reflection, and inflow of new stimuli from outside in terms of policies, new knowledge, relationships, systems, processes and culture.

Knowledge can be categorised as explicit or tacit. For example, research reports, simple software code, design drawings, and market data are some of the examples of knowledge that are explicit. On the other hand, scientific expertise, product technologies, and operational know-how are examples of a company’s tacit knowledge. In fact, tacit knowledge that comprises a body of perspectives, beliefs, and values, generally plays a central role in shaping and influencing the explicit knowledge. In fact, tacit knowledge is the means by which explicit knowledge is captured, assimilated, created, and disseminated. Explicit knowledge can be transferred easily through electronic means and does not require face-to-face contact, whereas the tacit knowledge requires a great deal of face-to-face contact.

The measurement and management of these intelectual assets that includes a knowledge base is the challenging aspect in management. This knowledge base includes the legally protected intellectual property of the company, track record of customer service and the college degrees of senior executives and their training, knowledge of employees, current research and development efforts, and the time and money companies invest in creating efficient manufacturing and services processes and information technology investments.

There is lot of confusion surrounding the concept of knowledge management. From simple data bases to data warehouses, decision support systems, data mining tools, data capturing mechanism, information transfer and sharing systems, team meetings, group decision support system tools, and experiences, training and learning of individuals — everything is labelled as a knowledge management. While some think knowledge management is a sophisticated computer system where individuals share knowledge through Intranet, managers tap into online database of effective management practices and benchmarks, others view it as a way a company organises its networks of human links. Knowledge management involves organisational methods, procedures and information systems used to collect,
share, and renew the knowledge and experience of individual members in an organisation and use them for improving business performance.

This contrasting view of knowledge from different perspectives is natural, as knowledge is connected to every aspect of organisational life. Knowledge involves several disciplines — group psychology and dynamics, individual and social cognitive processes, organisational communication, economic forces, politics, structures, policies, technology, organisational culture and learning, management philosophy, systems and structures. If understood properly the knowledge management can provide an integrative framework for integrating the research in accounting, economics, entrepreneurship, organisational behaviour, marketing, and sociology. Knowledge management, therefore, involves organisational methods, procedures and information systems used to collect, share and renew the knowledge and experience of individual members in an organisation and use them for improving business performance.

Change is not the only certainty in organisational life, but it has now become more rapid and radical. Recent initiatives such as concurrent engineering, synchronous manufacturing, cross-functional teams, project teams, self-directed work groups and multi-functional working have increased the concern with managing knowledge. In fact the quality of thinking and process knowledge are considered pivotal to the success of several quality management initiatives. It is argued that quality management initiatives such as self-directed teams, productivity improvement teams, quality function deployment, cross-functional groups, quality award frameworks, and business process reengineering will leverage individual competencies and their collective knowledge for achieving improvements in overall business performance.

Information overload is the unwanted by-product of the knowledge economy. Whether measured in terms of number of journals, patents, or in terms of the volume of corporate communications, both the production and distribution of knowledge have undergone a tremendous increase. Though companies are capturing, producing and distributing more and more amount of information, less than half is useful and meaningful and only half of this meaningful information has lasting value to the company. The challenge lies in deciphering the useful from useless and using it for competitive advantage.

5 Professional Engineers and Knowledge

Engineers are the second largest professional group in Australia and make up a significant portion of the managerial/technical pool in Australian manufacturing and service sectors. Role of engineers in integrating technology with other corporate functions such as marketing, finance, production and human resources, and their role in the design and integration of information technology and information systems to the enterprise management are well recognised in the literature.

Engineers, unlike other professionals, have a special role in organisations. Engineers are targets of many organisational changes, as well as, at times, responsible for initiating changes in technology, processes, methods, products, services, knowledge and information systems. As a representative of capital, they are responsible for the production and delivery of goods and services. They also act as labour or knowledge worker in designing and operating plant, equipment and systems. This duality of roles, representing both capital and labour, and as originators of change as well as targets of change, gives engineers a special ambiguous position in organisations.

Rapid advances in information technologies, increasing globalisation, new methods of work organisation and management, in addition to the increasing emphasis to knowledge and knowledge management have significantly influenced the role of professional engineers in organisations. For example, special functional structures such as design, production, maintenance, distribution and sales have been abolished and 'integrated professional groups' with a process-focus have been created to facilitate closer integration between those structures in a ma-
The need for a change from the production-oriented, efficiency-based, stable and functionally based structures to the new order emphasising market-oriented, entrepreneurial, interdisciplinary, changing structures and processes, and innovative learning attitude has been well recognised today\textsuperscript{10,12}. Several businesses have moved in this direction recognising the need to be innovative and learn continuously\textsuperscript{13}. In view of their special and ambiguous role, engineers are likely to be most affected by the current focus on knowledge management in businesses. Engineers, as one of the key professional groups that have considerable intellectual assets and knowledge, become critical in the context of knowledge management debate. To derive competitive advantage from knowledge and knowledge management, business organisations must develop appropriate systems and policies, which will cultivate and support such knowledge workers.

Management initiatives such as downsizing, delayering and reengineering, in the late 80s and early 90s have proved to be disastrous for many companies in the world\textsuperscript{11}. The reduction of workforce consequent to such initiatives led to the loss of valuable firm’s knowledge. Engineers at the middle level positions that are responsible for the design, development and supervision have lost their positions to the restructuring. In addition the commercialisation of several engineering services and replacement of technology for engineers’ expertise have exacerbated the delayering and loss of jobs. Several engineering/technical services such as design, maintenance, research, development, some manufacturing processes, and other technical functions have been outsourced in many companies, while attempting to wind back businesses to its core competences.

The consequent reduction of professional engineering workforce led to the loss of valuable knowledge developed over a long period of time. In addition the subsequent upheavals in the organisational structures, management processes and culture, led to the inadvertent loss of members and consequent loss of organisational knowledge. Several skills and the associated knowledge base disappeared in organisations with the engineers who have left. For example, when Qantas outsourced its aircraft maintenance, and several road transport corporations in Australia outsourced the design and construct functions, several engineers left the organisations. These companies started reversing their decisions after realising the enormous loss of knowledge to the organisation. These companies since then realised that this loss is irreplaceable in the short-term and affected their ability to compete in today’s marketplace, where knowledge is the key source of competitive advantage\textsuperscript{11}.

In many service businesses people are the product and can be the single greatest asset. The wealth creating capacity of the enterprise will be based on the knowledge and capabilities of its people. Therefore, the capacity to manage knowledge-based intellect is the critical organisational skill of this new era\textsuperscript{14}. In this environment, individual firm’s knowledge and learning capabilities are the main source of distinctive capability and competitive advantage\textsuperscript{13}. Knowledge is inseparable from thinking and acting. If the knowledge is disconnected from its uses, its relevance for decisions and actions gets lost in the debates about methodologies and technologies.

6 Problems and Issues in Managing Engineers’ Knowledge

In spite of the centrality of engineers and management in industrial organisations and modern society, engineers are generally viewed to be unsuccessful in management roles in Australia\textsuperscript{9}. Many firms find that their engineer-managers lack ‘soft’ skills such as interpersonal skills, communication, and group working skills, required for competent performance. Several studies conclude that the general lack of ‘soft’ skills among engineers is a significant barrier for their career growth, whether they move into managerial roles or stay in engineering roles\textsuperscript{15}. Soft skills are considered important for engineers at all responsibility levels and in all roles, whether they are specialist technical engineers, gen-
eralist engineers, engineer-managers or general managers. The technical skills and knowledge gained through professional training and/or enterprise specific experience within organisations are considered important and influence the contribution made by the engineers to the organisational performance.

It is generally believed that there is at least 5 years of knowledge gap between the information acquired during the university course and its industrial application. With the increasing pace of changes in technology and systems, the knowledge acquired by the university graduate would have become obsolete and irrelevant by the time they join industry. Similarly, the transfer of innovations in practice emerging out of the workplaces into the theoretical concepts into academic institutions and their classrooms is also affected by the barriers between the practitioners and the academics. Thus the perennial criticism of the university education, that it is not responsive to the changing needs of the business organisations, and the widening gap between theory and practice, is increasingly heard in the current debates.

In order to make the knowledge workers such as engineers effective, it is necessary to design appropriate business processes that support knowledge management initiatives. Knowledge is an integral part of the business process and not something to be managed separately. If it is viewed as an object, engineers do not see themselves as part of the knowledge process, and see them happening outside of them. Studies reveal that the existing processes that are functional-focused and individual-based are not effective in the knowledge era where teams and processes are the underpinning factors.

Literature on learning suggests that there is a need for good organisational climate to support the learning and acquisition of behavioural and affective competencies and new knowledge for professional engineers. An organisational climate that is conducive to self-development and willingness to take risks and make mistakes, and a supportive management, are essential requirements for effective learning and knowledge renewal on the job. Studies in Australia reveal that the responsibility for learning and knowledge renewal for engineers left entirely to the individual and no formal mechanisms or systems are in place to support this process. By developing appropriate compensation systems, career plans and management policies, organisations can support engineers in acquiring those new soft skills and ability to learn.

Knowledge creation takes place best in a team environment. In today’s business context the focus must be on developing team and group knowledge rather than individual engineer’s knowledge, so that the skills and knowledge newly learnt will complement those of other team members. If the team has experts from different functional specialisations, like in several cross-functional groups the cross-fertilisation of ideas, will further enhance the quality of knowledge creation. With organisations breaking the traditional functional barriers, and moving towards more process-oriented group working, the need for team working is significant for engineers. Today, teams are viewed as the key performing units within the organisational structure, and not the functions or departments. The knowledge today is not created by individuals, but by groups of people sharing their knowledge and experience throughout the enterprise network. Engineers in Australia, like several other professional groups, are not known to be team workers. Their inability to work in teams effectively may cause some problems in knowledge creation, sharing and transfer.

Knowledge is inseparable from individual engineers who create, develop, transmit and use it. In contrast, information exists on its own, that can be captured, stored and transmitted within organisations, separated from individuals. If knowledge is viewed as something similar to information the organisation encourages its employees to treat it as a stock. In fact, this view of knowledge as a stock is very much ingrained in our educational system starting from primary schools to universities. The emphasis in our educational system is to learn the
facts and reproduce them in the relevant examination, with no scope for reflection and deeper understanding and refinement. This is especially true in engineering education in Australia as it is observed to be 'technically narrow' and narrowly technical in its content and delivery. Extending the concept, engineering based organisations, view knowledge as a stock, and emphasise on capturing and storing it and not on improving and creation of new knowledge through reflection.

The present focus on knowledge management emphasizes acquisition. The traditional assumption that the ownership of knowledge will derive power is expected to lead to hoarding and prevents sharing of knowledge. In fact, this new knowledge era, brings the power back to the individuals from organisations. It gives them the power to take their knowledge with them. However, if the individuals do not share the knowledge he/she has with others, it might quickly become obsolete and consequently might make the owner powerless. Today, no one can successfully hoard the knowledge. On the other hand, if the individual shares the knowledge, it will multiply and regenerate new knowledge. In fact the individual must continuously renew, replenish, expand, and create more knowledge.

New knowledge cannot be acquired unless the old knowledge is removed. To build new organisation with knowledge as the focus, some unlearning must take place. Unlearning is a process through which people understand that they should no longer rely on their current beliefs, methods, and practices. This renewal of knowledge requires deleting the old knowledge. It calls for continuous inquiry, self-reflection and experiential learning by the employees. Engineers, with their traditional narrow technical focus will find it difficult to make this transition.

Codifying all the organisation’s knowledge into computerised databases is a problem. Knowledge is generally stored in the heads of engineers. Though attempts are made to codify, it is mostly the explicit knowledge such as material specifications, processes, product specifications, drawings, performance features and measures, routine problems and solutions that are stored in the databases. While codifying this explicit knowledge, the final solution at best is recorded, but not the process of arriving at such solution. Thus, a valuable component of knowledge for solving the problems is not fully articulated and perhaps not possible to articulate it. The assumptions built into those specifications or measures the logical process employed in arriving at a particular solution, and the complex relationships between reflection, intuition, logical thinking process, and previous knowledge and experience are tacit and stored in the heads of engineers. With engineers generally known to be inadequate in communication, codification of engineers’ knowledge might become more complex and difficult.

One of the important benefits of working in teams is ‘learning from each other’. In order to ensure that engineers learn from each other, it is necessary to foster an organisational climate that encourages them to engage in regular reflection, feedback and to encourage networking to exchange ideas and experiences. Literature suggests that the non-routine, non-programmable, knowledge work poses major problems for organisations as it involve extensive learning. A learning style that involves constant assessment of what one has done and achieved is necessary across the whole organisation. The professional mentality of engineers, however, makes this process difficult. In professions like engineering, the process of socialisation into a profession becomes an intense experience that instils not only knowledge and skills but also a fundamental orientation of one’s identity. This professional mentality gives rise to several problems to engineers. Some of them include lack of interdisciplinary point of view the lack of ability to work in teams and with other professionals, and importantly the inability to learn continuously throughout their careers.

Knowledge creation and utilisation is a collaborative process. Engineers traditionally would not
prefer to work in teams and rather work independently reflecting a true ‘individual professionalism’\textsuperscript{15}. Recognising the need to work in collaboration with other professionals, other functions and other enterprises, they should move now towards ‘interdependent professionalism’. Though there is some evidence in manufacturing sector for such type of move\textsuperscript{15}, engineers still have a long way to go to reach such level of professionalism. Without such collaborations that recognise the need to work together without holding back any pieces, knowledge-based approaches cannot succeed. Such collaborative effort will help achieve a level of innovation and knowledge improvement that cannot be reached individually. Organisations must develop systems and policies that facilitates and encourages collaborative working both within the organisations as well as with engineers from other organisations.

Dissemination of knowledge depends on personal networks and contacts, and on the willingness of individuals to share knowledge\textsuperscript{13}. It is well known that the willingness to share individual knowledge is, in a way, part of the personal identity and individual personality. Sharing the knowledge is not an easy task. Many engineers tend to view their knowledge as a part of their personality. Therefore, consider sharing, depending upon their perception of being valued by the company. Studies on engineers reveal that they have a low self-image and their contribution to the organisation is generally highly underrated\textsuperscript{9,15}. It is easy for them to share their knowledge with others in the organisation if they perceive that their position and role is secure and they are valued as an important asset in the organisation. If they perceive their status and value to be relatively low from the management point of view, there is a tendency to hoard the knowledge\textsuperscript{15}. Thus the status and its perception within the organisation has a significant influence on the management of engineer’s knowledge. The way that knowledge is stored is also dependent upon this perception. In general, there is a tendency towards holding knowledge tacitly in their minds, rather than explicitly in the form of databases or case studies.

It is argued in the literature that professional engineers cannot articulate their knowledge and their opinions in a clear and logical way. While it is not possible for some knowledge to be exactly articulated and codified on paper, in other cases the problem, in general, relates to lack of willingness of engineers. Many companies use information technology to link people together and facilitate communication. However, designing a magnificent Intranet connection to everybody in the organisation, cannot guarantee knowledge transfer. It is important to ensure that this system contains meaningful information and is easy to use and is integrated with the company’s processes\textsuperscript{11}. In addition, it is important to create an organisational climate that encourages knowledge sharing and transfer.

Though data sharing has been simplified by the technologies such as distributed databases, electronic reports, Lotus notes, Internet and internal webs, developing the culture of knowledge sharing among professional engineers is another problem. Using technology to organise information efficiently is only one component that enables knowledge the other being a knowledge sharing culture.

Knowledge sharing involves both putting the knowledge into the system, and taking the knowledge out for specific purposes. The effectiveness of this process generally depends upon the attitude of engineers towards knowledge sharing, compatibility of technology and systems with their needs, competencies in knowledge mining and codification, ability to select right knowledge and its effective usage in decision making. While process and skill-related issues can be solved by carrying out proper needs analysis and imparting them, other problems such as attitude towards knowledge transfer are not easy to resolve. Unless a positive attitude towards knowledge sharing is developed, knowledge base cannot be developed.

There is a tendency for engineers to generally use the knowledge that is already there, rather than putting any knowledge into the system. Though it is
not easy to change these attitudes, some generic strategies are available to counter this problem. To ensure effective and efficient knowledge sharing, organisations must find out whether engineers know the value of their knowledge or not, whether they trust the organisation to place their knowledge into the system, whether they have the skills to mine and use the knowledge, whether they see value in using the knowledge base for their day-to-day work.

Knowledge management is to be viewed as a mechanism for continuous improvement. Knowledge is created on a continuous basis. The creation of new knowledge is self-generated. The more individuals ask questions, seek feedback, measure variation, the more knowledge is created. While this is a formal process of knowledge creation, the informal process takes place in work groups and offices, which are not recorded. Individuals collect, compile and generate knowledge for their personal use, for carrying out day-to-day decisions and may simply ignore or put away in their memory. Engineers must learn to work in teams and use experiential learning strategies for developing knowledge and using it for problem solving. In order to achieve performance improvement, business organisations must ensure that the professional engineers maintain and improve their knowledge and professional credentials by meeting continuing professional education requirements.

In day-to-day problem solving, many times, new knowledge that may not have immediate relevance to the job on hand may be generated. If this new but different knowledge is recognised and stored, it may be useful at later stage. Identifying this and codifying it for future use is an important step for the incremental improvement in knowledge. In addition, reflection on the existing knowledge and experiences, adoption of trial-and-error approaches to the day-to-day problem solving, feedback from others, learning from interactions, personal mastery of the issues, and the effect of cognitive processes support the learning and help in the incremental advancement of knowledge. Though quality management initiatives and benchmarking practices denote some aspects of this knowledge advancement the influence of the tacit elements of knowledge on the process is not known. Further research is clearly needed in this area.

As a first step towards managing their knowledge the existing software and network infrastructure in many companies is sufficient to deliver the right information to the right individuals. Organisations must be able to identify the knowledge the organisation requires, the way it can be captured and verified, and make it accessible to the right individual. However the current level of technology may not be powerful enough to capture and retain all the organisational knowledge, particularly the tacit knowledge. The useable tacit knowledge is in most cases incremental and intuitive, rather than radical and systematic. While some organisations are trying to capture data on who knows what, about what and in what context on databases, other qualitative mechanisms such as documenting stores, events and processes and learning from these are some of the other approaches explored by several business organisations. Knowledge management must be viewed beyond the technological constraints.

7 Conclusions

In the knowledge era, we are at a nascent stage. Traditional view of products, services, technology and capital as assets is undergoing a change. Companies are increasingly viewing knowledge, individuals, processes and learning projects as assets. It is not enough if the knowledge resources are just allocated, channelling the organisation’s knowledge into corporate initiatives is the challenging aspect in knowledge management.

Real knowledge management is much more than managing information flows and technologies. It involves identification, nurturing and facilitation of acquisition, self-renewal, transfer and sharing among employees. The challenge for the companies is to motivate professional engineers for knowledge renewal and sharing and importantly to retain them
with appropriate rewards, compensation and performance appraisal systems. The challenge for individual engineers is to keep them prepared for lifelong employability, by leaving old knowledge, and continuous self-renewal through reflection, experiential learning and continuous learning. It is necessary for professional engineers and their organisations to develop solutions that are achievable beyond the 'individual professionalism' to 'interdependent professionalism'. Eventually, companies will have to develop competitive ability to manage know-how and build processes that make full use of intellectual assets and knowledge. Experts predict that knowledge will take the place of capital as the leading indicator of value and power in the new millennium and professional engineers will be at the forefront of that development.

References


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