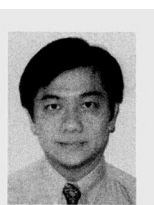


Harnessing knowledge for innovation: an integrated management framework

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Abstract

Purpose – The purpose of this article is to examine, develop and establish understanding of the management of knowledge innovation (KI).

Design/methodology/approach – This article first describes the emergence of knowledge management (KM) as the next likely source of competitive advantage. It then explains why innovation management (IM) should not be viewed as mutually independent from KM, but instead should involve concepts on how to harness KM practices for executing IM processes. Next, it elaborates the definition of KI and describes the economic transition from “information revolution” to “knowledge revolution” – wherein various forms of knowledge-based assets may be absorbed, assimilated, shared and utilised for innovation. It then turns to the role of knowledge creation and the value of knowledge capital in support of the significance of knowledge to innovation. Siemens, a highly successful company that strongly integrates KM and IM, is highlighted as an exemplar for discussion.

Findings – The article proposes an integrated management framework for managing KI in relation to perspectives on knowledge-centred principles, knowledge-sharing infrastructures and knowledge-based initiatives. Finally, it concludes with the future challenges for organisations to exploit better the full benefits of KI.

Originality/value – The management issues raised in this article are expected to be of interest to industry planners, business executives and academic researchers.

Keywords Innovation, Knowledge management, Knowledge sharing, Knowledge processes

Paper type Conceptual paper

Introduction

Emergence of knowledge management as a hot discipline

In the last decade or so, with the significant role played by the internet in businesses and other applications, the term “knowledge management” (KM) has generated a lot of interest in the corporate sector. Yet, there is no universal definition for KM, just as there is no agreement as to what constitutes knowledge in the first place. For this reason, KM is often conceived in the broadest sense, for example, as a generic process through which organisations generate value from knowledge. But it must be acknowledged that KM embodies critical management issues surrounding organisational efforts that seek synergistic combination of information processing through the use of appropriate technologies, as well as the creative and innovative capacity of human beings (Barth, 2000; Amidon, 1997). With the internet evolving steadily over the last two decades since its origins in the US APRAnet project, KM has also gained in tandem widespread business acceptance and has now emerged as a “hot discipline”. As a result, many see it, in the context of today’s knowledge-intensive business environment, as the next likely source of competitive advantage.

Innovation management: mutual independence from KM?

Innovation management (IM) – which is a field of discipline that deals primarily with issues relating to how the innovation process could be managed effectively, has attracted much attention too[1]. With technological innovations as the mainstay of today’s business, IM has

increasingly become an integral function of organisations. However, both KM and IM represent areas of management that seemed to reside in separate spheres of influence, with little or almost no impact on one another. One major difficulty confronting organisations involved in various KM activities lies in the need to improve innovation strategy continuously – to make the most efficient use of knowledge to create, better, faster and more cost-effective innovations so as to remain competitive. The immediate concern, in the relentless pursuit of innovation within a knowledge enterprise, appears to be more than just identifying and resolving issues on KM or IM independently. Rather, it involves acquiring the capability to employ KM practices for executing IM processes as a deliberate business strategy that would bring about a higher level of innovation performance.

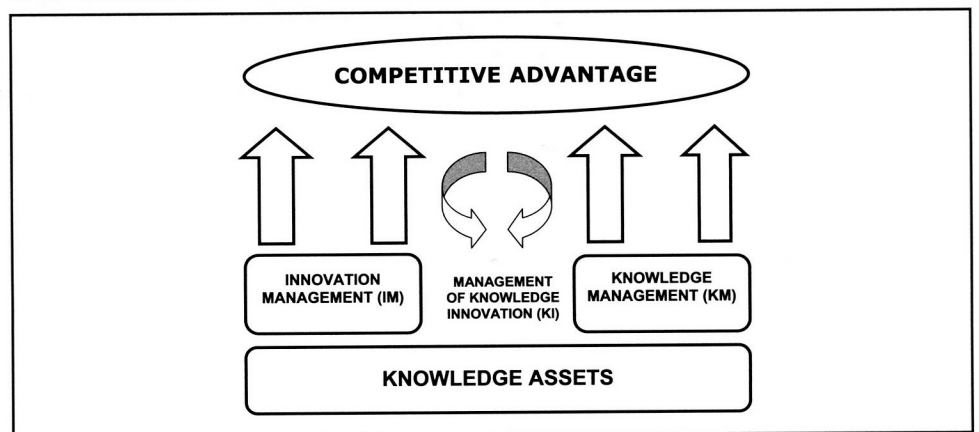
Management of knowledge innovation

As a consequence of the successes of technological innovations in securing long-term sustainable business growth, the strategic focus is now on: "how does knowledge innovation (KI) enable organisations to embrace competition in the new business world?" One has to first know: "what does a knowledge innovation constitute?" Since KI covers a diverse range of management issues (e.g. creativity or process improvement), a definition needs to be specified to put in perspective of its impact on enterprises, economy and society. Besides, one needs to identify the key elements that underscore the critical importance of knowledge and the associated management actions required for innovation. Without going into specific physical systems or activities, Amidon (1997) has defined KI as follows:

The creation, evolution, exchange and application of new ideas into marketable goods and services, leading to the success of an enterprise, the vitality of a nation's economy and the advancement of society.

In gist, two key elements are important in the definition. One, it recognises that knowledge is the core component of innovation – not technology or finances. Two, the actions associated with managing the flow and use of knowledge in an innovation process is another core component. However, it is often less clearly delineated as to what extent the literature between KM and IM has overlapped to draw insights (Harkema and Browaey, 2002; Miller and Morris, 1999; Rogers, 1995). While there may be extensive literature written on IM and KM as independent areas of concern, limited research has dealt specifically on the management of KI as an area of concern. Given the universal role of the internet, electronic commerce and wireless technologies as the main drivers of innovation and knowledge strategies, it seems opportune to connect the two strands of thinking behind KM and IM. To establish possible integration of concepts, this article explores the linkages between KM and IM to shed light on how they can be drawn closer. With this objective in mind, this article aims to contribute a more profound understanding and better appreciation on the management of KI. Figure 1 provides a pictorial view for the potential integration of IM and KM that would shape how businesses compete in the future.

Figure 1 Knowledge innovation (KI) as a competitive tool



The significance of knowledge to innovation

Transition to knowledge revolution

Despite the importance of knowledge, the apparent confusion between the significance of knowledge and information has caused organisations to sink billions of dollars in information technology (IT) investments that have yielded marginal economic results[2]. This may be attributed to the economic transition from an era of competitive advantage based primarily on information to one based on knowledge (Malhotra, 2000a, 1997). In a knowledge economy, knowledge is the primary resource for economic development; and land, labour and capital – the economist's traditional factors of production – do not disappear but they simply become secondary (Drucker, 1994). Traditional factors of production are limited by a threshold of scale and scope as every marginal increase in land, labour or capital results in diminishing returns on additional investment. By contrast, the returns arising from knowledge seem to be governed by a different law of economic returns: investment in every additional unit of knowledge created and utilised results in a much higher return[3]. Under such a scenario, it is ostensibly clear that the "information revolution" has been superseded by "knowledge revolution" as depicted in Figure 2.

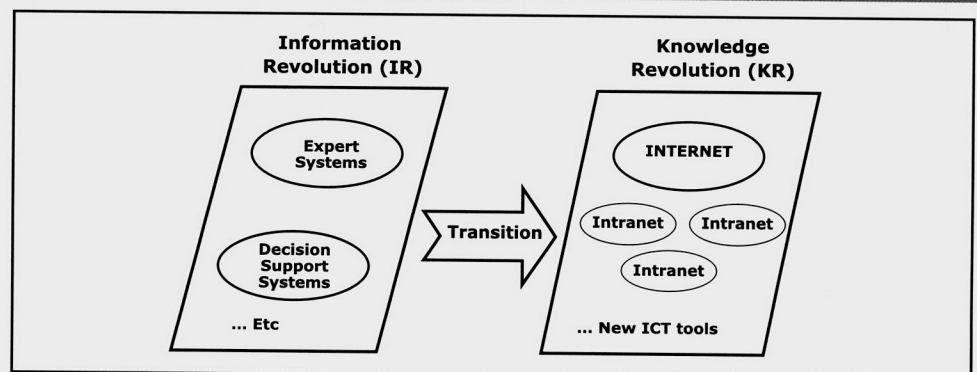
Role of knowledge creation

As early as in the 1980s, there were great expectations that knowledge-based systems (e.g. expert systems or decision support systems) should exploit the use of IT as a tool for knowledge creation. For almost two decades, the search for these tools was centred on stand-alone information systems (IS) such as expert system shells. But now, the internet offers a means for enterprise-wide knowledge-based initiatives to be better accomplished through groupware conferencing systems like Lotus Notes or intranets. In retrospect, part of the problem was that developers have focused too much, perhaps overly so, on developing "thinking machines" using, for instance, artificial intelligence (AI) techniques, rather than designing these "machines" to augment "human thinking". Actually, the roles of information management and knowledge creation should be separated and be played by machines and humans respectively. Researchers now came to the realisation that only human beings can play the central role of knowledge creation, not computer systems even with the most powerful information-processing capabilities[4] (Stewart, 1991, 1993, 1995; Nonaka, 1991; Nonaka and Takeuchi, 1995). Moreover, IT investments do not necessarily lead to knowledge creation (Lindgren and Henfridsson, 2002; Storey and Barnett, 2000; Fahey and Prusak, 1998). Thus, an important aspect of KM research is to contribute findings that may help practitioners understand, implement and improve the role of knowledge creation.

Value of knowledge capital

In the new knowledge age, organisations that are able to capitalise on the opportunities arising from knowledge-based assets and ultimately derive the most value from them will be the industry winners. To harness value from these assets, organisations must identify the

Figure 2 Towards a knowledge revolution



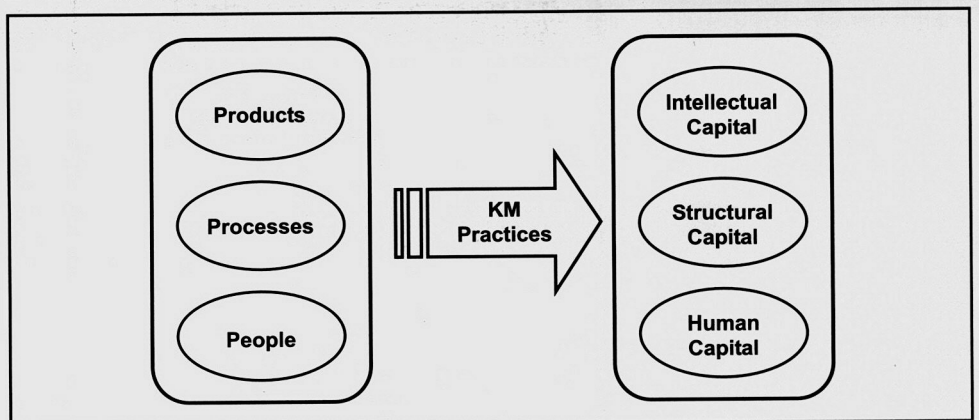
different types of knowledge-based assets that benefit businesses and understand how KM practices can be implemented effectively[5]. Knowledge adds value to a business through its contribution to products, processes and people, while KM transforms knowledge-based assets associated with products, processes and people into knowledge capital (O'Dell, 1996). One example of knowledge in products is the intelligent car whose engine management systems monitor the functions of vital engine parts and could "predict" in advance which engine part needs servicing to improve the car performance. An example of knowledge in processes is the sharing of best practices such as in semiconductor fabrication plants, which bring about huge savings in capital investments. One example of knowledge in people is the "skills" of experienced persons in commercial negotiation – which contributes to whether businesses will fail or succeed. The different types of knowledge capital are manifested in products like patents or technology licences (intellectual capital), processes like financial procedures or manufacturing methods (structural capital) and people like professional manpower or specialised talents (human capital) as illustrated in Figure 3.

Siemens – an exemplar of integration of KM and IM

With mounting pressure to acquire KM capability for IM, organisations are now fast working towards being recognised as an exemplar of KM practices. For instance, setting up a corporate intranet or creating knowledge communities or redesigning a business function around knowledge sharing. Yet, a majority of KM programmes are still predominantly centred on building databases or computerised repositories for documenting and disseminating best practices. For organisations to benefit fully from their KM efforts, the real payoff lies in the ability to harness knowledge for innovation. Siemens, which is hailed as a company that places strong emphasis on integrating KM and IM, has been widely known as a leading industry player in the management of KI. For several decades, Siemens has enjoyed an internationally enviable reputation in world-class innovations, which contributed towards the company's position as one of the world's largest electronics groups. The company firmly believes that if one wishes to introduce successful innovations in the marketplace, it needs knowledge to create new ideas and good KM practices to innovate effectively.

To do that well, Siemens makes full use of the internet to enable the company to bring together employees' abilities and all available areas of technical expertise by exchanging knowledge at a pace previously unimaginable. To enhance the role of knowledge creation, KM practices are highly regarded in Siemens as an essential component of how employees should work. Within the company itself, knowledge networks constitute the organisational framework that enables the company to exist. Intense market competition forces all parts of the knowledge networks, right down to each individual employee to do their best in the pursuit of innovation. This is particularly inherent in IM processes, where KM practices are

Figure 3 Benefits of KM practices



extensively deployed to utilise the individuals' abilities in an optimal way, as innovations are the results of knowledge assets put to good use. For example, Siemens monitors and disseminates its patent portfolio as a way to enhance corporate competitiveness. To cope better with competition and fill gaps in its innovation pipeline, KM is deliberately incorporated in the internal processes of the company's IM structure. This begins with the generation of new ideas, experimentation of prototypes, followed by product launches – which are collectively considered as a key success factor for the company's innovation performance. The integration of KM practices into IM processes has thus helped Siemens safeguard its leadership position as an innovation trendsetter in electronics.

An integrated management framework

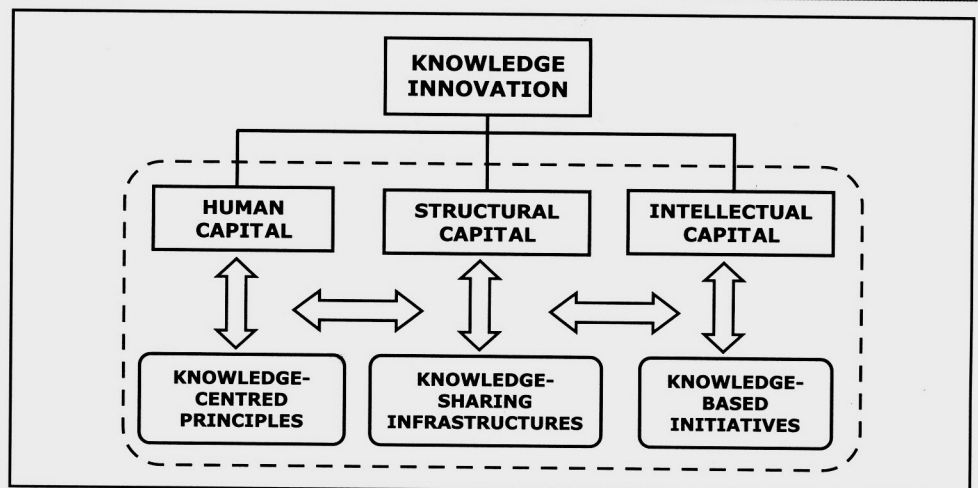
Motivation

The emergence of KM has heightened the interest of management writers, academic thinkers and business practitioners. Organisations are now investing heavily on *ad hoc* projects to harness knowledge for business use. Virtually every organisation is seen to be enthusiastically grappling with the opportunities presented by KM, including new and novel ways to acquire, assimilate and share knowledge for innovation. In other words, the keen interest on KM has been propelled alongside that of IM. By now, it is evident that the "management of knowledge innovation" is offering immense potential for firms to gain a comparative edge over rivals[6]. Hence, an integrated approach is proposed to guide aspects of management that strategically affect the creation of KI. By developing an integrated management framework as illustrated in Figure 4 – in terms of perspectives on knowledge-centred principles, knowledge-sharing infrastructures and knowledge-based initiatives, the objective is to focus on how organisations could better fulfil their roles in these strategic areas. Based on a comprehensive overview of KM literature, the proposed framework extends beyond isolated technological tools, business activities and physical systems. While the actual KM implementation may be firm-specific, the framework offers an integrative view of management thinking that would help managers merge KM concepts for IM processes.

Fresh perspectives

Today's organisations are in an unending struggle to differentiate themselves from competitors as markets become saturated with new innovations all the time. The ability to differentiate depends on how organisations effectively integrate KM practices in their IM activities – to harness knowledge for innovation. Indeed, since Drucker first coined the term "knowledge worker" in the 1950s, corporate leaders, entrepreneurs and technical managers have acknowledged that successful innovations are increasingly

Figure 4 An integrated management framework



knowledge-intensive. Yet, on the one hand, most writers concerned with KM issues tend not to exhibit the same degree of understanding on the economic significance of innovation. On the other hand, innovation writers are often less able to articulate strategies that employ KM practices as a competitive tool. So far, the lack of a convergent view of managing KI between these two groups of writers seems apparent. To offer fresh perspectives, two questions relating to KI need to be addressed. First, what is the role of knowledge-based assets in KI? Second, since a comprehensive model for understanding the management of KI is yet to be evolving in extant literature, integrating KM and IM within the same framework is necessary.

Role of knowledge-based assets

It is well understood that not all information can be considered as "knowledge-based assets". In general, they fall into two categories: explicit or tacit. Included among the former are patents, trademarks, business plans and marketing research – any information that can be documented, archived and codified, often with the help of IT. In the case of the latter, it is much harder to grasp as the information is contained in people's heads and the real difficulty is figuring out how to document, share and manage it effectively. Even if technologies like groupware, electronic mail, and instant messaging tools can be used to manage tacit knowledge, identifying it is itself a major hurdle in most organisations. Very often, it is up to organisations to determine what information qualifies as knowledge-based assets, depending on the context and business objectives. But since the role of knowledge-based assets is directly linked to innovation performance, it also means that a highly systematic and structured approach to managing the processes for creating and capturing it, classifying it and storing it, disseminating and using it for innovation, should be adopted (Amidon, 1997; Drucker, 1988).

Comprehensive model for the management of KI

Organisations have been trying to differentiate themselves in IM-based on unique production processes, rare and distinct skills, creativity, and now on initiatives such as supply chain management and customer relationship management (Gold *et al.*, 2001). In recent years, the applications of KM techniques in innovation is also undergoing radical changes given the diverse choice of digitised repositories, IT tools and communities of best KM practices. As the management of KI involves human exchanges and continuous learning, and is dynamic in response to changing environments and market conditions, organisations are racing to revolutionise their approaches to all types of knowledge. Owing to the tacit nature of an organisation's knowledge and the need to sustain competitive advantage through KM, current thinking points to an integrated approach of managing KI to support organisational performance (Gupta and MacDaniel, 2002; Clarke and Rollo, 2001; Probst *et al.*, 1999). Specifically, since KIs are strongly guided by knowledge-centred principles, with necessary knowledge-sharing infrastructures deployed to facilitate knowledge-based initiatives from the input of human responses, decisions and experiences, an integrated management framework is proposed.

Knowledge-centred principles

Insofar as management of KI is concerned, it is basically seen as involving unique, highly sought-after, professional skills – which are difficult to be trained and learned. However, applying available KM tools alone that ran the gamut from standard, off-the-shelf e-mail packages to sophisticated software designed to support KM activities alone is clearly inadequate. Instead, if KM practices were to be incorporated into innovation management thinking as a competitive tool for supporting the creation of KI, organisations must re-examine its role within a larger framework of management thinking. What corporate leaders need to do is to build on the mindset of these knowledge-centred principles for the entire community of knowledge workers. To make headway along this line of new emergent thinking, six knowledge-centred principles have been identified which distinguish the management of KI from the other conventional management approaches (Harkema and Browaeys, 2002; Davis and Botkin, 1999; Miller and Morris, 1999; Skyrme and Amidon, 1997; Davenport, 1993).

“ One major difficulty confronting organizations involved in various KM activities lies in the need to continuously improve innovation strategy. ”

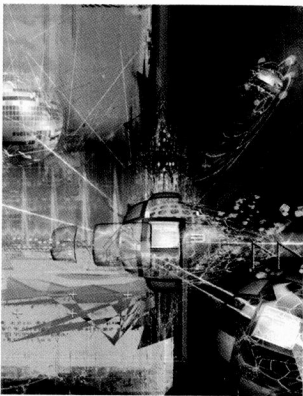
Through a distillation process of current literature, these knowledge-centred principles were identified as new approaches to harnessing knowledge, in contrast with traditional approaches of management, for KI as shown below:

1. Innovation thinking: value system versus value chain.
2. Strategy: collaborative knowledge versus competitive innovation.
3. Management: knowledge networks versus business units.
4. Solutions: human technology versus machine-based.
5. Process improvements: bottom-up versus top-down.
6. Customer focus: success.

They are summarised as follows:

1. *Understanding innovation value system (not value chain).* Value chain thinking is linear and static, while the innovation value system consists of non-linear and dynamic knowledge processes and represents interdependent relationships that need to be understood, considered and developed for successful KI.
2. *Formulating collaborative knowledge strategy (not competitive information strategy).* Competitive information strategies create win-lose scenarios due to competition for a share of the same information pie, while collaborative knowledge strategies encourage win-win situations through symbiotic relationships by sharing knowledge-based assets and growing the knowledge pie for all.
3. *Developing strategic knowledge networks (not strategic business units).* Strategic business unit management tends to apply isolated islands of information assets, while the strategic knowledge networks foster the flow of knowledge-based assets between partners, customers, suppliers, internal and external units and other stakeholders, including competitors, in the innovation process.
4. *Constructing hybrid human technology KM solutions (not machine-based KM solutions).* Human beings are better at “knowledge skills” while computers are more adept at “information tasks” such as collecting and categorising highly structured information that changes rapidly. To interpret knowledge within a broader context or to combine it with other types of information, or to synthesise unstructured knowledge, humans and machines must complement each other.
5. *Fostering bottom-up knowledge process improvements (not top-down “re-engineering” of knowledge management approaches).* Highly creative and useful knowledge work carried out by autonomous knowledge workers often require less top-down intervention and more bottom-up spontaneity.
6. *Focusing on customer success (not customer satisfaction).* Customer satisfaction meets today's needs only, while a deliberate focus on customer success helps identify future requirements and unmet needs, which form the source of organisational growth and business expansion.

While acknowledging the relevance of knowledge-centred principles in all management situations, KM facilities such as expertise access tools, e-learning applications, web portals,



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discussion and chat technologies, electronic message boards, synchronous interaction tools, and search and data mining tools could also help facilitate, to a certain extent, the management of KI. However, it should not be noted that while they may be able to support the management of KI, decision-making processes should still be based on who (people), what (knowledge-based assets) and why (business objectives).

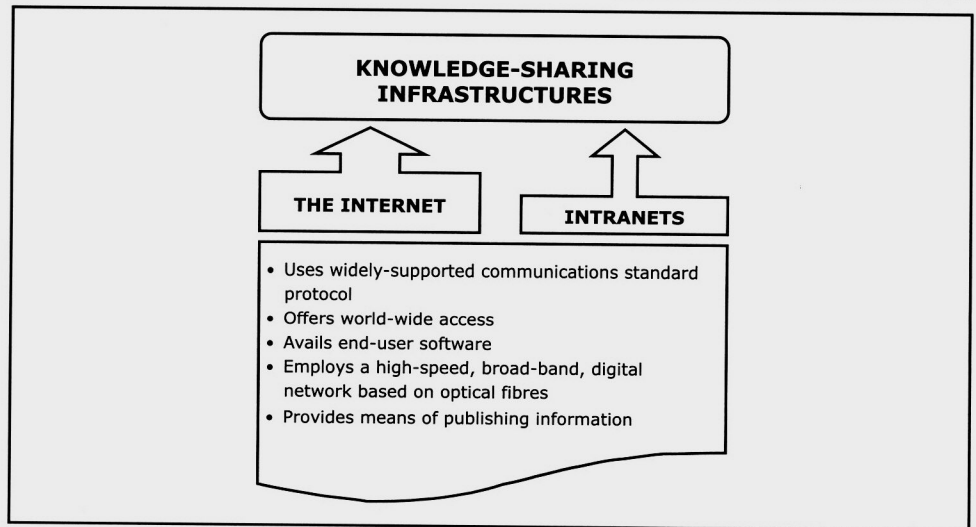
Knowledge-sharing infrastructures

The driving force behind the transformation to greater inter-connectivity, accelerated data transmission and reduced costs of communications is no other than information and communication technologies (ICTs). In most developed nations, ICT has been the key driver of the knowledge economy – providing faster ways of delivering and accessing information and real-time communication. Undoubtedly, the greatest benefit of ICT is its reach and one of its most important roles in KM is its knowledge-sharing benefits. While ICT support may vary depending on resource constraints, it enhances knowledge-sharing processes to promote a flourish of innovations. Currently, of all the ICT tools and technologies available in the workplace that have the most profound impact on KM practices is that of the Internet and related technologies – which offers an incredible information source direct to the end-users without the need to involve an intermediary such as information professionals (CIO, 1996).

Although the internet is growing in stature and impact, its knowledge-sharing considerations have almost been entirely confined to its information role. Whether it really shares “usable” knowledge to develop new innovations is still subject to debate. While the cost of building national level knowledge-sharing infrastructures may be very high, there are hardly any equally cost-effective technological alternatives; and the costs of not investing in such infrastructures are sometimes even higher. In countries where the knowledge-sharing infrastructure is weak (no optical fibre link to world’s information superhighway, for instance), the dial-up access charges may be even higher than the internet usage costs itself. However, once the infrastructure is established, the low cost of propagation technology will help countries leapfrog ahead in areas such as distance learning and access to market information. To implement knowledge-sharing infrastructures effectively for the internet that would harness collaborative sharing of knowledge-based assets for KI, organisations should consider, at a minimum, ample support for codifying and storing knowledge, creation of knowledge maps (or corporate directories), sharing of best practices, and developing knowledge networks (Maryam and Leidner, 2001; Davenport and Prusak, 1998). For organisations to exploit better the use of the internet in the management of KI, a highly structured approach to its knowledge-sharing structures of ICT is recommended. Viewed from KM perspectives, the knowledge-sharing infrastructures of the internet and its related technologies should possess the following characteristics (Barth, 2000; Miller and Morris, 1999; Strassmann, 1997) as shown in Figure 5:

- It uses a widely-supported communications standard protocol – which means that it is universally accessible from multiple locations and through different computer platforms.
- It offers world-wide access, with increasingly more international service providers – which means that individuals, who travel a lot, can use the internet like a corporate network without building an in-house option.
- It avails end-user software, such as electronic mail and browsers to be universally available at low cost (and often free) – which means that it is cost-effective to implement on an enterprise-wide basis.

Figure 5 Knowledge-sharing infrastructures



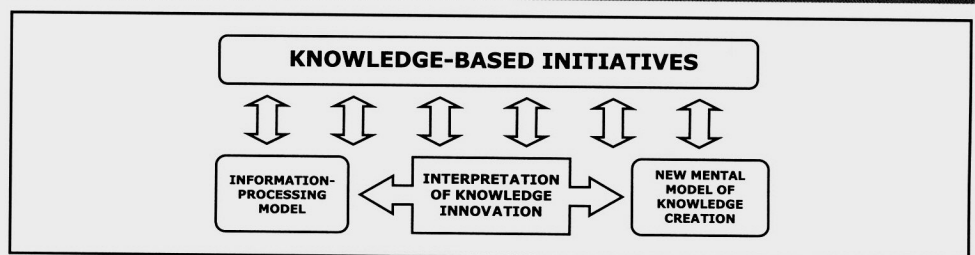
- It employs a high-speed, broadband, digital network based on optical fibre cables with limitless bandwidth – which means that it provides quick access at an affordable cost.
- It provides a quick means of publishing information, through the world wide web, that can be shared world-wide – which means that the universal repository of information resources can be updated and widely shared at an attractive cost.

Additionally, due to the growing interest to share information, knowledge-sharing infrastructures have expanded to include the use of intranets for better accessibility in a corporate environment. The benefits of using intranets are largely similar to those that use the internet in external information access and communications. Because end-users are familiar with browser interfaces, information can be shared across different local area networks and computer platforms, and published information is instantly available over the entire network. Besides, information may be presented in different formats such as word-processed documents or rich-text layouts. Intranets may also host transaction and database applications with the web browser being the universal interface to different “back-end” systems.

Knowledge-based initiatives

While the role of knowledge-based assets in business activities is important, what is more crucial is whether organisations are able to implement knowledge-based initiatives that would yield knowledge capital in products, processes and people. Thus, organisations must always be on the lookout for “knowledge gems” from a “sea of information” and ultimately, whether a knowledge-based initiative contributes to innovation success depends on one’s interpretation of KI – which determines the ways in which these initiatives harness knowledge for innovation as shown in Figure 6. Take, for example, the information-processing model assumes that

Figure 6 Knowledge-centred initiatives



innovations are based statically on pre-specified information that needs to be processed beforehand. Another model – the new mental model of knowledge creation supports the notion that innovations are dynamically created from knowledge available at a certain point in time and context (Malhotra, 2000a, b, 1997; Yoneji, 1990).

Since the internet provides an attractive platform for end-users due to quantum improvements in access efficiency using browsers, search engines and intelligent software agent, a review of literature on KM practices centred on organisations which host information in the internet is conducted. Nine knowledge-based initiatives have emerged to be of significance to knowledge innovation in products, processes and people (Amidon, 1997; Skyrme and Amidon, 1997; De Long and Davenport, 1996; Skyrme, 1991) as listed below:

1. *Products:*

- structuring and mapping knowledge – such as developing typologies or synthesising different knowledge types;
- developing knowledge databases – documenting best practices, expert directories, market intelligence and so on; and
- embedding knowledge in new products and services – such as the introduction of smart products.

2. *Processes:*

- capturing and re-using information as knowledge – such as utilising old project deliverables as source materials to develop specifications for a new project;
- sharing of knowledge or lessons learned about knowledge processes – from one part of the organisation to another, through distribution, dissemination or personal interactions; and
- measuring and managing the value of knowledge-based assets – such as attaching an economic worth to ownership of patents and managing the rights of these patents.

3. *People:*

- creating knowledge or intellectual capital teams – to help identify and audit intangible knowledge assets using people from multiple disciplines and to develop new KM practices;
- forming people-oriented knowledge centres - focal points for the development of knowledge skills, managing and enhancing knowledge databases and facilitating knowledge flow; and
- using collaborative technologies for knowledge exchange between people – the implementation of intranets (internal internet), electronic mail, Lotus Notes, groupware for multiple-user access.

Concluding remarks

In today's highly competitive business climate, it has become commonplace that much effort, time and money are invested by organisations to improve aspects of their IM processes and KM practices. This article attempts to integrate KM and IM into one singular focus to show that its convergence offers new thinking in terms of strategic advantage for enhancing organisational performance. By fostering thinking along the line of "which strategic aspects of management should knowledge innovation focus on?" rather than "what goes into the bolts and nuts of managing knowledge innovation?", this article sheds new insights into the management of KI by proposing an integrated management framework to help organisations better fulfil their role in managing KI.

In summary, to harness knowledge for innovation, three aspects of management should be integrated as a whole. One, organisations should embrace a mindset of knowledge-centred principles to enhance their role of knowledge creation for innovation. Two, organisations should build knowledge-sharing infrastructures through the use of ICT to enhance better the

“The ability to differentiate depends on how organizations effectively integrate KM practices in their innovation management activities.”

opportunities of knowledge collaboration in the pursuit of innovation. Three, organisations should implement knowledge-based initiatives to facilitate better the generation of knowledge capital for innovation. In addition, to exploit the benefits of KI, three challenges have been identified that merit attention. They are as follows:

1. Although the objective of KI is to improve organisational performance, it should not be viewed as the “magic cure” for ailing organisations. Paradoxical as it may sound, the fewer KM practices an organisation requires in its pursuit of innovation, is also a reflection that it has championed knowledge-centred principles adequately in its business. The challenge posed to organisations is identify, create and acquire new knowledge continuously, and to make it readily available, transparent and freely mobile for individuals involved in creating knowledge innovation.
2. For KI to flourish, it must be fostered within an enabling environment of collaboration. Since KI constitutes the “discovery of new knowledge-based assets”, oftentimes based on competencies and talents inside and outside an organisation, collaboration between enterprises should be recognised, encouraged and valued. Ultimately, the challenge lies in strengthening the role of all stakeholders in a knowledge enterprise towards collaboration – nurturing a knowledge-oriented culture and cultivating a knowledge-sharing ecosystem. After all, the success of any knowledge innovation depends on the extent of collaboration amongst individuals who have created the knowledge – the very trait that make knowledge useful, beneficial and valuable to society.
3. As KI encompasses the use of various types of knowledge; and social, economic and other forms of tacit knowledge, the innovation process requires the assimilation of human imagination, intuition and creativity at all levels. To unleash the potential of KI, the challenge is to permeate knowledge-based initiatives to various layers of society – industrial, organisational and humanistic structures. This would then enable organisations and individuals to utilise knowledge capital to participate in the activities of KI.

In conclusion, like any form of innovation, KI, too, is often created with business objectives under “imperfect conditions”. It is thus acknowledged that the ultimate goal of managing KI effectively is perhaps one for all “knowledge workers” to strive for, but never to be completely addressed. Clearly, an integrated management approach dependent on organisational context, business objectives and constraints, consisting of knowledge-centred principles, knowledge-sharing infrastructures, and knowledge-based initiatives, stands a better chance of success.

Notes

1. Like KM, IM has been consistently demonstrated to be a key value creator in organisational growth and business performance (Goh, 2004; Harkema and Browaeys, 2002; Giget, 1997).
2. IT economist Paul Strassmann concluded that there is no relationship whatsoever between computer expenditures and company performance (Strassmann, 1997). John Seely Brown, director of Xerox Parc also observed that despite more than US\$1 trillion in technology investments over two decades, US industry has achieved marginal improvement in the efficiency and effectiveness of its “knowledge workers”.
3. This is often attributed to “externalities” of the network, as the strength and utility of the network increases with increasing membership in the information or knowledge network.

“ With mounting pressure to acquire KM capability for innovation management, organizations are now fast working towards being recognized as an exemplar of KM practices. ”

4. Nonaka and Takeuchi (1995) have emphasised that only human beings can take the central role in knowledge creation. They argue that computers are merely tools, however great their information-processing capabilities may be. While information generated by computer systems is not a very rich carrier of human interpretation for potential action, knowledge resides in the user's subjective context of action based on that information.
5. Take for example, an effective KM programme should enable an organisation to improve operational efficiency, reduce costs, achieve higher productivity and boost revenues.
6. Leveraging KI successfully as a competitive tool would require a focused business strategy that harnesses KM in ways that offer a new approach to innovation strategies (Blumentritt and Johnston, 1999; Skyrme and Amidon, 1997).

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