A Methodology to Manage Intra-organisational Knowledge Sharing

Kwok-Tung Yeung
Churchill College
Cambridge

A dissertation submitted for the degree of Doctor of Philosophy

Decision Support Group
Cambridge University Engineering Department

January 2003
*Wise men store up knowledge...*  
(Proverb 10:14)  
Dedicated to Lai Lee
Abstract

In the 1990s, the level of research into knowledge management increased greatly. Nowadays, knowledge is widely regarded as the key competitive resource, more significant even than traditional factors of production such as land, labour and capital. Hitherto there have been four main thrusts to knowledge research: (1) theoretical research: emphasising the epistemology of knowledge, (2) measurement-oriented research: measuring the stock of intellectual assets, (3) technology-oriented research: employing information management systems to increase the efficiency of knowledge workers, and (4) organisational research: investigating such knowledge processes in terms of organisational learning and knowledge flow.

Organisational knowledge research centres on the investigation of two key problems: how knowledge is created and how knowledge is shared. This research focuses on knowledge sharing and specifically on identifying the most effective means for intra-organisational knowledge sharing. A management framework and methodology have been developed and embodied as tools for enabling companies to effectively leverage their critical knowledge resources across multiple organisational units with the aim of enhancing and sustaining their competitive advantage in the marketplace. This research is motivated by: (1) the fact that hitherto there has been no theoretically sound managerial framework that integrates the diverse and yet inter-related theories of knowledge, and more importantly, (2) the need for a practical conceptual tool to help practitioners put their knowledge-sharing strategies into operation in order to realise the benefits of managing knowledge.

The novelties of this research are twofold. Firstly, a new holistic management framework – the Knowledge Sharing Management Framework (KSMF) – has been developed to integrate theories of organisational learning and cognition, communication and media selection, culture and motivation, organisational structure, information management and knowledge networks. This new holistic framework establishes knowledge-based competitive advantage as the conceptual foundation for
justifying the value of a knowledge sharing initiative. It consists of a five-stage process model (adoption, adaptation, absorption, integration and dissemination) and four generic knowledge-sharing strategies (concentrating on sharing channels, organisational infrastructure, human factors and technology provision). Secondly, knowledge research has, on the whole, moved from investigating ‘what’ knowledge is to investigating ‘why’ and ‘how’ it should be shared. This work contributes to the next phase of knowledge management development by designing a new methodology – the Knowledge Sharing Management Methodology (KSMM) – as a practical ‘how-to’ guide for practitioners. This novel methodology establishes the crucial link between strategic and operational level decision-making by examining an organisation’s current knowledge sharing practice from a business process perspective. The KSMM provides a structured method of identifying areas of an organisation’s knowledge sharing practice for improvement so that managers can have a tool for guiding them when putting knowledge strategies into practice.

The application of the KSMM is demonstrated by means of two case studies. These take the form of collaborations with industrial partners in the manufacturing engineering sector. In these, the firms’ current organisational knowledge sharing practices were systematically examined in order to investigate the enablers and blockers influencing knowledge sharing between organisational units, and to identify areas for improvement. These two case studies provided empirical evidence for researching the multi-faceted and ‘sticky’ nature of organisational knowledge sharing and for identifying the key factors for success in its management.

Key words: Knowledge management, knowledge sharing, knowledge process, organisational learning, intellectual assets, methodology

Acknowledgements

This research could not be completed had I not had the support from the following people. I want to thank first and foremost my supervisor Dr. Tony Holden for his encouragement and guidance throughout my years in Cambridge. His help in arranging the two case studies have been critical to the completion of this work. I also want to thank colleagues from the Decision Support Group, Minsoo Shin, Steve Chong, Tengku Shahrir Tengku Adnan and Matee Serearuno, for the numerous sessions of discussions I had with them, for their comments on some of my research papers and for their friendship. Dr. Godfrey Yeung and Jeff Wood’s help in proofreading the manuscript is also very much appreciated.

Due to the confidentiality agreement with our industrial partners, the names of the companies and the staff who were involved in assisting the two case studies cannot be revealed. In particular, I wish to express my gratitude to the Director of Business Development, the Corporate Development Manager and the Strategic Planning Manager at PowerSys; and the Director of R&D, the Group Information Officer and the General Manager at PrintCo and many others whom I cannot name individually. Without their participation in interviews, their help in providing the necessary data and their interest in this research it could not be completed.

This research would not have been possible in the first instance without generous funding from the Cambridge Overseas Trust and the Churchill College. I am most grateful to both organisations for their financial support.

I am immensely indebted to my family and friends for their continuous support. I want to thank my wife Lai Lee for her understanding and patience for the past four years. My parents and my brothers Michael and Godfrey have been an invaluable source of encouragement over the years. Last but not least I want to thank especially Johnny and Alice Wong for their friendship and the help they have given and continue to give to both Lai Lee and myself.
Declaration

This dissertation is entirely the result of my own work and includes nothing which is the result of work done in collaboration. Any reference to the work of other researchers is clearly indicated in the text. This dissertation has not been submitted in whole or in part as consideration for any other degree or qualification at this University or any other institute of learning.

This dissertation contains 301 pages and fewer than 65,000 words.

Kwok-Tung Yeung
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1. Introduction

The increase in productivity in general, and that of knowledge workers in particular, holds the key to sustainable economic development and wealth generation for nations (Mathews, 1996; World-Bank, 1999). This is true for developing countries and even more so for developed and matured economies (Drucker, 1991). Globalisation and the establishment of free trade zones have gradually dismantled national boundaries and market entry barriers (Fraser & Oppenheim, 1997). Corporations are facing increasingly stiff local and global competition. World-class efficiency and quality have become the minimum requirements for entering, let alone succeeding, in an increasingly competitive global market. In the midst of all these changes, knowledge and intellectual capability have become a company’s dominant economic resource and the fundamental source of its competitive advantage (Drucker, 1995; Drucker, 1998). What is less widely known is the fact that epistemological philosophers have been trying to understand the nature of knowledge, of knowing and of the knower. For generations masters of various crafts had been passing down secrets of their trades to apprentices. However, not until the mid-1990s that it suddenly dawned on researchers and practitioners alike that a company’s capability to make more effective use of its critical resource – knowledge – is vital to its competitiveness and performance.

Modern companies depend upon two fundamental intellectual capabilities to derive competitive advantage from their knowledge resources: knowledge creation and knowledge sharing (Kogut & Zander, 1992). Having realised the importance of knowledge resources, a substantial amount of research has been conducted by academics (Blackler, 1995; Conner & Prahalad, 1996; Fransman, 1994; Kogut &

")In order to generate extraordinary value for shareholders, a company has to learn better than its competitors and apply that knowledge throughout its businesses faster and more widely than they do.”
Sir John Browne, Chief Executive of BP

"Knowledge has become the key economic resource and the dominant – and perhaps even the only – source of comparative advantage.”
Peter Drucker, 1995

Knowledge creation develops new problem-solving capabilities that, by generating the technological know-how needed to design the next generation of products, increase a company's likelihood of attaining its goals. Knowledge creation is important to a company because it generates opportunities for future growth. But having a knowledge creation capability alone is not enough. Newly created intellectual capabilities that lay dormant and are left unused do not contribute to a company's economic performance. It is not uncommon for companies that have high knowledge creation capability to generate myriad innovative technologies that remain hidden away in their research laboratories. Furthermore, the relationship between a company's knowledge creation capability and its profitability can be uncertain (Arrow, 1969; Kim & Mauborgne, 1999; Markides, 1998; Nemeth, 1997).

Knowledge sharing, on the other hand, is concerned with knowledge flow and knowledge utilisation. When knowledge flows smoothly in a company, the organisational actors will be connected in such a way that critical knowledge is being transferred to those who require it using the most effective channels. Knowledge utilisation facilitates the transformation of innovative ideas into products in the marketplace; by spreading best-in-class practices from one business unit to other parts of the company, it increases the overall performance of the company.

1.1 Managing Knowledge Sharing

Much confusion in knowledge sharing (KS) literature has been caused by the interchangeable use of several related terms. It is useful to distinguish terms such as "knowledge transfer", "knowledge flow" and "knowledge sharing" from one another.

Knowledge transfer is a dyadic exchange between a provider and a seeker where knowledge held by the provider is (partially) replicated by the seeker (Szulanski, 1996). Knowledge transfer is intentionally directional with set routes and pre-defined recipients.

Knowledge sharing is more than a dyadic exchange or provision of access to valuable knowledge. In KS, the provider imparts his knowledge and experience to the seeker. In addition to communication of the content, KS involves a learning process that enables the seeker to understand and interpret the received knowledge properly. Thus effective KS connotes internalisation, that the seeker can apply and use the received knowledge to effect actions. KS is a performance-oriented applicative approach, where the seeker's intellectual capability will be enhanced.

Knowledge flow is used to describe the collective state of knowledge movement in an organisation where knowledge resources and intellectual capabilities are being mobilised to attain organisational goals. Knowledge flow may be described as either stagnant or flowing to indicate the effectiveness of an organisation's use of its knowledge.

Another major confusion is due to the advancement of the argument that knowledge cannot be managed (McDermott, 1999; Takeuchi & Nonaka, 2000). This argument is based on two points: the philosophy of knowledge and the nature of knowledge creation activities. Traditionally, Western philosophy champions the separation of knowledge from the knower in order to detach 'objective knowledge' from 'the
subjective self" (ibid.). Such a point of view regards knowledge as packets of objective knowledge. Once knowledge is externalised it can be separated from its human bearer, forming artefacts of representations that are machine-process-able as computational objects. By contrast, Japanese thinkers have traditionally viewed knowledge as a bodily experience. Since bodily experience is an embodiment of knowledge, knowledge and its human knower are inseparable (ibid.). Since the two are inseparable, the Japanese view does not attempt to "purify" knowledge from the 'subjectivity' of the knower. It regards knowledge and the knower as a whole – knowledge can only be created, received, interpreted and analysed through human bodily experience. The Japanese idea that knowledge is inseparable from its knower leads to the conclusion that knowledge per se cannot be managed (ibid.). It was postulated by Nonaka that an individual's knowledge could not be managed without managing his bodily experience, and that knowledge of an organisation could not be managed without changing its path of historical development. However, from a Western perspective, managing knowledge is to manage the entities of externalised knowledge representations in computational machines. Failure to distinguish knowledge from activities that create or transfer knowledge causes this 'unmanageability' confusion. Dependent on which school of thought is adopted, knowledge per se may or may not be manageable. But the organisational actor's activities associated with knowledge creation and KS are always manageable.

The third cause of confusion is the failure to recognise the dichotomy between knowledge creation and KS activities. Knowledge creation is about innovation and creativity, but creative and inventive activities can be resistant to management co-ordination and control (Nemeth, 1997). Knowledge may be acquired as a result of deliberate seeking, but it is equally likely to come about by chance, without any dedicated allocation of resources; serendipity plays a major role in research and in scientific discovery (Arrow, 1969). The inconsistent correlation between knowledge creation outcome and management co-ordination leads organisational advocates to call for less management control and more leeway for creative knowledge workers (ibid.). However, it is different for KS activities. KS requires trust, and resources must be allocated for people to expend time and effort in building relationships and mutual trust. A KS organisational culture must be established, with management leadership and guidance. Management cannot leave KS to its own course.

1.2 The Motivation For This Research

It is one thing for a company with superior knowledge creation capability to know more than its competitors, but it is quite another to be able to utilise that knowledge and translate it into competitive advantages in the marketplace. The main problem of modern knowledge-intensive companies is not that they suffer knowledge drought, but they do not have an organised system to apply the knowledge they possess in a co-ordinated and effective manner (Ruggles, 1998). It is not uncommon for companies to have islands of knowledge scattered around different parts of the organisation whilst this knowledge remains trapped in local business units risking under-leverage and obsolescence (Prusak, 1997). Evidence indicated that the variation in intra-firm KS was substantial (10:1 to 2:1 difference), even when confidentiality or legal obstacles were minimised in internal knowledge transfer between peer organisational units (Szulanski, 1996). General Motors was reported to have great difficulty in transferring manufacturing practices between divisions, and IBM had limited success in transferring re-engineered logistics and hardware design processes between business units (ibid.). Consistent evidence also showed that 80% of companies were ineffective in sharing knowledge or exploiting the full potential of their intellectual capabilities (KPMG, 1998b; KPMG, 2000). When they coined the famous phrase "if only we knew what we know", both Lew Platt, the former chairman of Hewlett-Packard, and Jerry Junkins, the late chairman and CEO of Texas Instruments, recognised the fact that the vast potential of their organisations, with their pockets of excellent practices, remained untapped (O'Dell & Grayson, 1998). If only a company "knows what it knows", can it derive full value from its intellectual assets (Davenport & Prusak, 1998). No less than 90% of the 431 US and European corporations surveyed agreed it was important to deliberately manage the way existing knowledge was being leveraged within organisations in order to improve performance (Ruggles, 1998). This high level of consensus was substantiated when 85% of senior European corporate executives in another survey, claimed that organisations would be far more productive if everyone who worked in a company shared their expertise and could capitalise on each other's knowledge to increase productivity, save costs and improve customer satisfaction (Murray & Myers, 1999).
When an organisation does not share knowledge effectively, its productivity suffers (Lotus, 1998). Organisations risk duplication of effort, repeatedly expending resources to re-invent the wheel. Common symptoms as a result of KS failure include inability to learn from past experience, or incapacity to leverage best practices to reuse expertise gained in one business unit in other parts of the organisation. When a company does not share its knowledge, gaps develop between what is known within the company and what is put to use. This phenomenon, where substantial difficulty is associated with intra-firm KS among internal business units, is described by Szulanski (1996) as ‘stickiness’. This ‘stickiness’ constrains an organisation’s ability to apply its most critical resource to establish a competitive edge in the marketplace and derive higher economic return. Previous attempts have been made by companies to mitigate KS stickiness, with huge investments in information technology that were meant to improve knowledge flow (Covin & Stivers, 1997; Davenport et al., 1998; KPMG, 1998a; KPMG, 1998b; KPMG, 2000; Lotus, 1998; Murray & Myers, 1999; Ruggles, 1998). Many of the companies regard KS improvement as simply a matter of successfully implementing Intranet- or Web-based portal systems. But the results showed that the majority of systems implemented were either ignored or under-utilised. Ironically, knowledge workers’ productivity actually fell whereas the technology was meant to increase it (McDermott & O’Dell, 2000; McDermott, 1999).

Though making effective use of telecommunication infrastructure and IT systems is one necessary condition for KS to succeed, the availability of technology per se is an insufficient condition. The bigger question of how KS can actually be improved in the broader sense needs to be addressed. Why do organisations continue to suffer from KS ‘stickiness’? Why do organisations still not know what they know when huge resources have been invested? How can companies mitigate the problem? These are the questions this research sets out to address.

On the theoretical side, it is useful to bridge the gulf between KS management theories and industrial practices. Many knowledge management (KM) projects undertaken in industry have hitherto concentrated mainly on the technological aspect (Davenport et al., 1998). A majority of the initiatives were driven by IT departments which failed to address the more difficult human and cultural aspects of the problem. This research bridges this gap between practice and theory by providing a theoretically sound holistic methodology for practitioners. A methodology is a comprehensive, step-by-step approach that guides the development of a business system or process, detailing what the steps have to be taken and how problems may be solved (Nissen et al., 2000). Hence, it is a useful practical conceptual tool to help practitioners put their KS strategies into practice and realise the promised benefits of KS management. Secondly, the holistic approach adopted suits the multi-faceted nature of the KS stickiness problem. Hitherto, there has been a deluge of discrete theories examining various aspects of organisation behaviours relevant to KS management. This research builds on this established foundation to integrate these diverse yet inter-related theories and strengthen the link between them.

1.3 The Scope and Domain of the Case Studies

The KSMM was applied in two comprehensive case studies in collaboration with industrial partners in the manufacturing engineering sector.

The first case study applied the KSMM to analyse the KS practice of a power system provider’s (PowerSys) business intelligence community. Studies have demonstrated that a company’s profitability is closely linked to the level of satisfaction with its business intelligence programs (Groom & David, 2001) and those companies that had well-organised programs to monitor their competitors’ activities performed better in the marketplace than those without such programs (Subramanian & IsHak, 1998). A business intelligence program contributes valuable inputs to strategic and tactical decision-making in the areas of formulating corporate strategy, long-term planning, and marketing or business development by scanning external environments for new market entrants, competitor manoeuvres, novel technologies, new routes to customers, other market opportunities and threats. The main challenge senior executives face with business intelligence is not their companies’ inability to gather intelligence, since 70% – 90% of their intelligence required is already held by employees somewhere within the organisation (Fuld, 1991; Groom & David, 2001), but to be able to disseminate crucial competitor and customer knowledge to key decision-makers (Groom & David, 2001; Metayer, 1999; Prescott & Smith, 1989) so that actions can be taken in time to pre-empt imminent threats and exploit market opportunities. Of the

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1 Names are disguised in order to protect the identities of our industrial partners.
large corporations that have an intelligence program in place, 50% of them lack aormal process to share intelligence (Groom & David, 2001). Business intelligence is
by nature fuzzy, incomplete, inaccurate and full of confusing and contradictory
signals. Although intelligence may be gathered on a regular basis, more often than not
it may be demanded on an ad hoc and unpredictable basis, in response to
unanticipated changes in external conditions. But when it is required, relevant
intelligence must reach decision-makers timely before narrow windows of
opportunities disappear. This need to provide timely intelligence is complicated
further by the fact that most intelligence flow involves inter-business unit KS that cuts
across organisational boundaries. An effective business intelligence community must
be able to filter relevant documented and anecdotal intelligence and yet disseminate it
throughout the organisation in a timely and reliably fashion. It must deal with a wide
spectrum of subject matters: customers, competitors, suppliers, markets and
technologies. Any failure on the part of the community to share intelligence
effectively could pose a real risk to marketing and strategic planning departments. In
the case study the KSMM provided PowerSys managers with a structured and
systematic approach to analyse the current KS practice of its business intelligence
community so that specific improvement could be recommended.

The second case study applied the KSMM to analyse the problem of sharing technical
product knowledge and implementation experience between the engineering and sales
units of a specialist printing company, PrintCo. PrintCo’s hi-tech industrial printing
equipment is a key component in their clients’ production lines. The printing
equipment has to inter-operate seamlessly with the myriad permutations of hardware
and software configurations encountered at clients’ factories. Compatibility with
different kinds of equipment is a prerequisite. With intense competition, it is critical
for PrintCo to be able to deliver printing solutions that worked flawlessly when their
products are first installed in clients’ premises. This ‘right-first-time’ approach was
crucial in keeping to the minimum the costs and time involved in product sales and
delivery, as well as ensuring customer satisfaction and thus the company’s continued
growth and success. The case study investigated ways of sharing lessons learnt during
after-sales implementation in order to integrate that knowledge back into the product
design and sales operations so that implementation experience gained could be
leveraged to support the process of recommending and delivering correct workable
printing solutions to customers more fully.

1.4 Research Objectives and Contributions

In view of the pressing need for effective KS management tools, the objectives of this
research are:

- To identify a common set of KS practices observable in modern knowledge-
  intensive companies; to assess critically the observed practices in order to draw
  out key strengths and weaknesses so that a generic template can be formed to
  characterise the criteria of success.

- To clarify the relationship between KS, operational risk, intellectual capabilities
  and competitive advantages. The investigation should examine the means by
  which the crucial linkage between KS and business value might be
  conceptualised.

- To develop a practical KS management methodology as a conceptual ‘how-to’
  tool to support managers’ decision-making to improve organisational KS practice.
  The tool should be easy to learn and should, as far as possible, make use of
  concepts that are familiar to practitioners.

- To include a systematic procedure within the methodology to identify and
  compare an organisation’s current state of KS. Managers should be able to
  compare the KS performance of different units at a glance and juxtaposition the
  strengths and weaknesses of their KS practices.

- To devise a structured method within the methodology to help reveal the gap
  between existing and targeted KS practices so that a strategy may be formulated
  for managers to take forward their business operations.

The novelties of this research are twofold. Firstly, the holistic approach adopted in the
development of the KSMM applies hitherto diverse yet inter-related sets of theories of
organisational learning and cognition, communication and media selection, culture
and motivation, organisational structure, information management technology and
knowledge networks in a cohesive and integrated way. The KSMM consists of three
components: the business context, the KS process model and the four KS strategies.
The business context establishes knowledge-based competitive advantage as the conceptual foundation for justifying the value of a KS initiative. It grounds knowledge-based competitive advantage on mitigated operational risk and enhanced core knowledge-based competence. The KS process model consists of the five progressive stages of adoption, adaptation, absorption, integration and dissemination, which are supported by the four strategies concentrating on sharing channels, the organisational infrastructure, human factors and the provision of technology. The process model describes an idealised KS process while the strategies denote the four approaches managers can adopt. With each strategy, there is a group of key factors that managers can leverage to improve a company’s KS practice. Secondly, the KSMM establishes the crucial linkage between strategic and operational level decision-making by examining an organisation’s current KS practice from a business process perspective. This novel methodology provides a structured way of identifying and closing gaps in organisational KS practice so that managers can have a guided tool in putting their KS strategies into practice. Knowledge research in general has moved from investigating questions of ‘what’ to questions of ‘why’ and ‘how’. This research contributes to the next phase of KM development by providing a practical ‘how-to’ guide that practitioners can use to improve KS practice and effect changes.

1.5 Research Questions and Assumptions

This research addresses specifically the following questions.

- What is the conceptual relationship between operational risk and KS management? This research clarifies the relationship by arguing that organisations may appreciate the value of their knowledge resources and intellectual assets more by linking them to the operational risk mitigated and competitive advantages accrued as a result of effective knowledge resources mobilisation.
- What are the different KS strategies observable in modern knowledge-intensive organisations? What are the key enablers and blockers to effective KS?
- How does an organisation assess its current KS practice? Knowledge activities in general, and KS in particular, are often described as omnipresent as knowledge work is so ubiquitous and KS is manifested in so many different ways. Managers often find themselves distracted and lose sight of their primary objectives when they do not know where a KS project should start and what to focus on. Many examples of failed KS initiatives are due to the inappropriate selection of business areas (Davenport & Prusak, 1998) and ignorance of the wider impact a KS program will have on the organisation (McDermott & O'Dell, 2000). This research develops a methodology to focus managers’ attention on the most critical business processes in support of their effort to evaluate their organisation’s current KS practice.
- How does an organisation improve its current KS practice? Gaps are often discovered between an organisation’s current practice and its strategic objectives. In addition to supporting an organisation’s self-assessment of its KS practice, the methodology also guides decision making in implementing KS improvement initiative. In effect, the methodology helps to identify effective ways to harness, sustain and enhance intellectual capabilities. Organisations may increase performance of their knowledge-intensive functions and extract more value from their intellectual resources.

It is assumed that target users of the KSMM (middle managers) are sufficiently well informed about their businesses, though they may be less well versed in KM. The KSMM does not require users having prior experience in any knowledge-related program of study, even though in reality many are already familiar with KM to a certain extent and therefore, the concepts may not be completely novel to them.

There has been lively epistemological debate about the nature of knowledge, what knowledge is and is not, in particular, how knowledge differs from information. Hitherto there has been no consensus on a generally accepted definition that clearly distinguishes the two, causing enormous confusion. However, it is widely accepted that understanding and interpretation of knowledge requires tacit knowing, and hence, tacit knowledge. Since tacit knowledge is embedded in the mind and embodied with the experience of the knowledge worker, it is assumed that knowledge interpretation is a human act.

While intellectual capability has been shown to relate positively to the productivity of a knowledge-intensive company, industry and economy (DeCarolis & Deeds, 1999; Drucker, 1991; Dyer & Nobeoka, 2000), the relationship between the long-term
market valuation of these knowledge-intensive companies and the quantity of the
knowledge they possess as suggested by some (Edvinsson & Malone, 1998; Leonard-
Barton, 1995; Stewart, 1997) is less clear. In fact, there is counter evidence suggesting
that traditional factors (e.g. earnings, inflation, or interest rates) are the dominant
determinants of capital market valuation, which in the long run follow closely the
predictable economic performance (Koller & Williams, 2001). One of the reasons that
break the chain of relationship between intellectual capabilities, productivity
improvement, profitability and market valuation in the long-term is the introduction of
extraneous variables (e.g. market positioning, pricing, demand-supply elasticity,
interest rates, or industry performance, etc.), which are outside the scope of this
research. Thus, in order to limit the number of variables, improvement in performance
as a result of increase in intellectual capability is taken as improvement in
productivity (as opposed to profitability or earnings), since this relationship has been
well established.

1.6 The Research Methodology

The research methodology can be described along four dimensions: (1) the type of
evidence used in the inquiry, (2) the research strategy employed, (3) the chosen data
collection method (Eisenhardt, 1989; Yin, 1981) and (4) the philosophical perspective
(Myers, 1997). Each aspect is discussed below with justifications for the rationale
behind choosing one approach over others.

- **The type of evidence.** This research used qualitative evidence to examine KS
  practices observed in industrial partners. Qualitative data enables the researcher to
  understand and explain the observed phenomena (Myers, 1997) from cognitive,
cultural and socio-economical perspectives. Due to the inseparability between
knowledge and knower, ‘hard’ quantitative analysis and statistical data has its
limitations in providing insights (Bell, 1987) into how knowledge may be
processed by cognitive functions in human minds, and how organisational culture,
professional praxis and social milieu may influence people’s willingness to
engage in KS. The limitations of a ‘hard’ quantitative approach in organisational
studies have also been noted in the related area of organisational learning (Argyris
& Schón, 1996). Furthermore, for the ‘measurability difficulty’ (Fahey & Prusak,
1998) and the ‘valuation problem’ (Miles et al., 1998), that due to the intangible
nature of knowledge, quantification is still facing great difficulty and direct
measurement of intellectual asset is still open to much debate (Teece, 1998).
Much work is required before these difficulties may be resolved.

- **The philosophical perspective.** This concerns the underlying epistemology and
  assumptions about what constitutes ‘valid’ research, and how any understanding
  of reality may be obtained (Myers, 1997). The philosophical perspective adopted
  influences one’s research design and the selection of appropriate research
  methods. This research adopted an interpretive approach, which takes the stand
  that access to reality is through social constructions of language and shared
  meanings (ibid.). To understand KS one must first understand, specific to a given
  context, the meaning of knowledge to an individual, and the meaning of
  knowledge shared among people in social constructs such as teams and
  communities and organisational constructs such as workgroups and business units.
  Hermeneutics (the study of the methodological principles of interpretation)
  provides the philosophical foundation to understand KS phenomenon through the
  shared meanings of knowledge that people assign to and derive from various
  social interactions.

This research consists of a descriptive and a prescriptive component, following the
logic of “first observe and describe ‘as it is’, then prescribe design ‘as it ought to
be’” (p. 61) (Keen & Morton, 1978). Describing an organisation’s current KS
practice ‘as it is’ grounds the results of the research empirically, while
prescriptions for organisational designs ‘as they ought to be’ provide the basis for
making theoretically sound recommendations for improvement. Both components
are informed by and consistent with the interpretive approach. The positivist
approach, characterised by the assumption that reality is objectively given and can
be understood by quantifiable properties independent of the researcher (Myers,
1997), is rendered inappropriate due to the ‘measurability difficulty’ and
‘valuation problem’ discussed above. For the critical approach, characterised by
deliberate dialectic to highlight the oppositions and contradictions in order to
reveal the fallacious status quo and the need for change (ibid.), is rendered
inappropriate given the approach is confrontational that can potentially cause too much conflict.

- **The research strategy.** This refers to the "strategy of inquiry which moves from the underlying philosophical assumptions to research design and data collection" (Myers, 1997). This research employed case study strategy to investigate in-depth the KS practices of the two companies. Case study as a research strategy is particularly suitable for investigating empirically a "contemporary phenomenon within its real-life context" (ibid.) especially when "boundaries between phenomenon and context are not clearly evident" (p.59) (Yin, 1981). While other experiment-based strategies may deliberately separate a phenomenon from its context into control variables, a case study is particularly suitable for KS research, since knowledge is situated and context sensitive. Proper interpretation of received knowledge relies upon effective communication of the context. Furthermore, knowledge research in general has moved from questions of 'what' to questions of 'why' and 'how'. A deeper understanding of knowledge activities is required in order to develop a prescriptive methodological procedure as a 'how-to' guide to improve KS in organisations. Case study research enables the researcher not only to identify the relationship but also explain the factors involved (Eisenhardt, 1989).

Although both case studies involved close collaboration between the researcher and practitioners (Argyris & Schön, 1996), and the prescriptive results of both cases contributed to resolving the informants' practical concerns and immediate problematic situation (Myers, 1997), it should be emphasised that the research strategy employed could not be considered action research because it was non-participative and no change in actions was pursued on the part of the practitioners. Furthermore, although many knowledge-related studies employed ethnography to understand the questions of 'how' and 'why' (for e.g., the study of face-to-face brainstorming meetings to generate new knowledge (Sutton & Hargadon, 1996), the shift of power to knowledge holder (Zuboff, 1988), or the investigation of knowledge work processes (Davenport et al., 1996)), the ethnographic strategy was not chosen due to the pragmatic consideration of the significant amount of time which would be required to immerse oneself in the case organisation (Bell, 1987; Myers, 1997). But more importantly, a purely descriptive narrative of the phenomenon, often the result of ethnographic participant observation, would not satisfy one of the research objectives: that of producing prescriptive recommendations for KS improvement.

- **The data collection method.** A well-structured and clearly-defined research framework not only makes research reports easier to read and write, it also systematises data collection and enhances the reliability of 'within-case' analysis by focusing attention on the research questions (Yin, 1981). Based on literature reviews, the Knowledge Sharing Management Framework (KSMF) was first developed to guide the design of the rest of the research as well as the selection of research instruments.

The analysis was made at the organisational unit level, i.e. intra-firm KS among formal business units or informal workgroups. A total of fifteen and five interviews were conducted with PowerSys and PrintCo between 2000 and 2001, involving a total of seventeen and six informants respectively.

The descriptive component of the research employed semi-structured interviews with senior executives and middle managers as well as content analysing internal reports and email correspondence to gather primary data. In order to reduce interview bias (Cochrane, 1973; Williams, 1964), documentary evidence was cross-referenced with interview data, providing a triangulation of the two research instruments to further enhance the reliability of 'within-case' analysis (Eisenhardt, 1989). Research results were then presented to informants to verify that the findings were realistic and objective accounts, reflecting the actual KS practice in place. Assessment scores were then calculated, based on practitioners' input summarising the strengths and weaknesses of their current KS practices. The prescriptive component of the research involved discussions and critical assessment of case companies' current practices in order to identify effective ways of improving KS. Sets of guidelines were drawn up and recommendations were made with regard to the practical steps that informants could implement to take forward their business operations. The KSMF was evaluated based on the feedback from informants.
The principle of theoretical sampling (Eisenhardt, 1989) was used instead of statistical random sampling, i.e. cases were chosen based on theoretical needs to examine the polar (extreme) types of phenomena, in order to achieve better generalisation, case replication and better conceptual understanding (Yin, 1994). The business intelligence community of the PowerSys case involved mostly unstructured knowledge that comprised a substantial amount of judgement and opinion. PowerSys was mostly dependent on its analysts' human network to share intelligence with one another. The sharing of technical knowledge and implementation experience between the engineering and the sales units of the PrintCo case involved a more clearly defined subject domain, with emphasis on accurate and reliable knowledge of the company's own products. PrintCo was mostly dependent on its telecommunication infrastructure to facilitate knowledge flow.

Due to the limited number of samples, and in order to reduce the bias of specific idiosyncrasies found in the unique context of a single case study, findings from the two cases were compared to achieve 'cross-case' generalisability (Yin, 1981). Comparative case studies should aim to maintain a coherent 'chain of evidence' from data collection to within-case analysis to cross-case comparison to overall findings and conclusions (ibid.). This coherency may be preserved by maintaining within-case similarities and inter-case differences (Eisenhardt, 1989). Both case companies were selected from a population that indicated interests in KM and had various forms of KS practices already or about to be in place. Both case companies were hi-tech manufacturing engineering companies and leaders in their respective fields that thrived on their technological know-how and excelled at capitalising that know-how in R&D to produce innovative products to maintain their market leadership. The two however were different in size (one a large FTSE-100 corporation, the other a medium-size enterprise) and at different stages of development (one a well-established incumbent, the other a growing organisation). The juxtaposition of different company sizes, stages of development and types of knowledge activities enables the researcher to examine 'cross-case' patterns of KS among formal business units and informal workgroups. The comparative case study approach allows research results to be generally applicable for organisational KS in the manufacturing engineering sector.

1.7 Thesis Outline

Chapter 1 introduces the latest developments in KS management and discusses the motivation and business case for this research. This chapter sets forth the objectives, the scope of the program, and nature of the problem, followed by descriptions of the research method and the case studies domain. The problem domain discussion should serve to provide a clear scope for who should benefit from results of this research.

Chapter 2 reviews KS management literature. This chapter brings us up-to-date with the latest concepts and theories relevant to KS management, argues why now is the pivotal moment to manage sharing in light of the wider changes happening in the business world, as well as being the precursor to introducing the terminology and fundamental concepts that serve to build the foundation for later discussion.

Chapter 3 describes the Knowledge Sharing Management Framework (KSMF) as the theoretical foundation for the development of the Knowledge Sharing Management Methodology (KSMM). In explaining the detailed components of the KSMF, this chapter delineates the relationship between KS and operational risk and the critical organisational factors contributing to the design of successful KS programs. This chapter is the platform that establishes a common frame of reference and explains what are the adopted framework and the problem-solving approach.

Chapter 4 describes the KSMM in detail. This chapter consists of the 'how-to' guide to operationalise the KSMF discussed in the preceding chapter. The 'how-to' guide provides managers with a tool to actually go about managing operational risk employing a KS-based solution.

Chapters 5 and 6 illustrate the KSMM by applying the methodology in two case studies with our industrial partners. The first case study in chapter 5 evaluates the effectiveness of PowerSys's KS practice in their business intelligence community in support of its corporate strategic planning unit. The second case study in chapter 6
examines the state of knowledge flow between PrintCo’s sales and R&D business units in their effort to achieve right-first-time product implementation. These two case studies also allow rigorous testing of the methodology in a real-world situation.

Chapter 7 concludes the thesis with a critical evaluation of the KSMM in the light of the feedback gathered in the two case studies. Key lessons learnt from this research are then discussed, followed by a set of generic management guidelines drawn from the experience of this research.

2. Knowledge Management Review

This chapter reviews KM literature. It brings us up-to-date with the latest concepts and theories relevant to KS management. It describes the fundamental socio-economic changes that have brought about the knowledge revolution. In addition to introducing the terminology and fundamental concepts, this chapter argues why now is the pivotal moment to manage sharing in light of the wider changes happening in the business world.

It is then followed by succinct descriptions of the four main thrusts of KM activities. They cover KM research from a theoretical and a practical point of view. The descriptions serve to outline the existing diverse state of KM theories. These interrelated theories are then consolidated to provide conceptualisations of knowledge and knowledge transfer processes. In particular, it is posited that knowledge may be conceptualised as an object or as an organisational process, and knowledge transfer process as a transaction in an exchange market between self-interest actors or as an altruistic act of helping fellow members in a community out of shared interests, common objectives, goodwill and selfless generosity.

2.1 Introduction

The idea of managing knowledge is not entirely new (Prusak, 2001). For centuries, masters of their trades have passed down secret knowledge to their apprentices (Hansen et al., 1999). But it was not until the 1990s that a phenomenal increase in research into knowledge management (KM) took place (Ruggles, 1997a). As a practice, KM has barely started to gain the attention of senior managers (KPMG, 1998; KPMG, 2000; Murray & Myers, 1999; Ruggles, 1998). Yet the knowledge companies possess is widely recognised as their key economic resource: the one which, in the 21st century, will prove more significant than traditional factors of production such as capital, land or labour (Drucker, 1995; Drucker, 1998). The intellectual capability to exploit this knowledge to solve business problems is now perceived as companies’ most valuable intangible asset in developing and sustaining their competitive edge (Senge, 1990; Stata, 1989). Organisations ignoring the implications of this knowledge revolution risk eclipse in the global marketplace.
2.2 The Knowledge Economy

The transformation of economic activity from the production of physical goods by traditional industrial organisations to the offering of knowledge-intensive products and services by modern knowledge-based companies is well documented (Alvesson, 1993; Cohen, 1998; Ruggles, 1997a; Prusak, 1997). Unlike the situation in the traditional production economy, in the knowledge economy (Neef, 1998) knowledge is hailed as the singly most important factor of economic life, the primary raw material organisations buy, sell and work with (Stewart, 1997). It is widely recognised that the foundation for creating organisational wealth is a company’s accumulated stock of knowledge coupled with the intellectual capability to exploit it (Sveiby, 1997). Evidence of the arrival of the knowledge economy is not confined to the often cited activities of the software, consultancy, pharmaceutical, health care, scientific research or professional services sectors, but can be found in the operations of almost all companies of various ages and sizes. Whether they operate in the manufacturing or the service sector, companies make use of knowledge as their fundamental resource (Drucker, 1998). The following section describes major changes that have taken place in the nature of work and in socio-economic conditions, propelling executives to address the burning issue of how best to manage organisational knowledge.

2.2.1 Socio-Economic Changes

Products are increasingly embedded with knowledge

The knowledge component of today’s products accounts for an increasingly high proportion of their cost (Ruggles, 1997a). On the whole, products are increasingly complex and capable; more and more of them are equipped with ‘smart’ capabilities to self-diagnose, to interact in a human-friendly manner and to adapt to a particular user’s preferences. This steady increase in product sophistication is paralleled by the continuing rise in the proportion of R&D expenditure (an indication of the knowledge component) in the costs of goods sold (Prusak, 1997). Today’s products not only embed a huge amount of the designers’ knowledge, but companies often bundle products with support and after-market services that further increase the knowledge component of what is sold (ibid.). Company profitability depends increasingly upon how much better than its competitors it is in gathering and exploiting its knowledge of customers, markets and technology. If we imagine activities which acquire and apply knowledge at one end of the economic production function and activities which produce physical outputs at the other, then a knowledge economy is characterised by the predominance of knowledge acquisition over physical production activities (Arrow, 1969). This shift in the emphasis in economic activities from the production and distribution of physical goods towards knowledge was observed as early as the sixties when an increase in the efficiency of utilising capital and labour resources could not account for a major proportion of the increase in the per capita income of developed countries (ibid.). While this gradual shift has been made more palpable with the continued rise of knowledge-intensive products and services, it is fundamentally different from innovations in previous generations where emphasis was on saving labour (through automation) or on saving capital (through economies of scale). Knowledge and intellectual capability determine the activities of this knowledge-based economy (Nonaka & Takeuchi, 1995; Takeuchi & Nonaka, 2000).

The nature of work

While products have increased in sophistication and in the amount of knowledge embodied, work has also become more knowledge intensive as organisations have become more aware of the value of the specialist knowledge possessed by their employees (Prusak, 1997; Myers, 1996). Compared to traditional administrative and production work that is characterised by standardised and mundane repetitions of daily routines, knowledge-intensive work is characterised by its variety, autonomy and lack of structure (Davenport et al., 1996). Knowledge work involves the cognitive activities of reasoning, analysing, thinking and problem-solving (Fahey & Prusak, 1998) and is thus largely elusive to automation (McDermott, 1999; Sviokla, 1996).

Instead knowledge work is performed by workers who possess huge bodies of specialist knowledge – the intelligent and highly qualified professionals (Quinn et al., 1996b). These knowledge workers trade in their expertise in acquiring, creating, packaging and applying knowledge (Alvesson, 1993) to their employing companies to help them develop new products, generate revenue and create shareholder value. Generally knowledge workers possess the knowledge of how best to perform a piece of work and understand intimately local conditions (Crozier, 1996; Zuboff, 1988),
Since it is impractical for individual knowledge workers to become expert in more than a handful of specialised areas, it is common to find groups of knowledge workers working in teams, collaborating to address complex problems. Knowledge-intensive work is thus often communication-intensive (Blackler, 1995) and involves the collective efforts of a number of experts. However, the sharing of knowledge among knowledge workers cannot be forced; it can be achieved only through voluntary co-operation (Kim & Mauborgne, 1997). Even when mandated to share their knowledge, knowledge workers frequently withhold their ideas and full cooperation if trust and a positive working relationship are not established (Kim & Mauborgne, 1997). Knowledge workers tend to resist prescribed and highly rigid work practices, especially when the prescribed methods fly in the face of their professional praxes, even though the methods may benefit the organisation. An example of this is the ‘not invented here’ syndrome where engineers tend not to re-use other engineers’ designs thinking re-use compromises design originality (Davenport et al., 1996; Leverment et al., 1998). On the other hand, it is more likely that knowledge workers will adopt and take ownership of necessary changes if the ideas originate from themselves or if they are intellectually ‘won over’ by critical analyses of potential benefits (ibid.). Realising this fact, managers have generally empowered knowledge workers (Bahrami, 1992; Nomaka & Kono, 1998; Senge, 1992; Tampoe, 1993) with more autonomy and freedom in designing their own patterns of work than their administrative or blue-collar counterparts (Sviokla, 1996). The style of management has shifted from traditional command-and-control to being more supportive. Rather than micro-managing the activities of production workers, managers of knowledge workers should sustain an environment conducive to innovation. The corollary of this new facilitating role is that the balance of power has shifted, from the managers to the knowledge workers who hold knowledge crucial to the organisation, and which few or if anyone else in the organisation possess (Crozier, 1996; Zuboff, 1988).

From efficiency to flexibility and effectiveness

Macroscopic changes including globalisation and the accelerated pace of change have drawn senior managers’ attention to knowledge creation and use (Ruggles, 1997a; Prusak, 1997; Myers, 1996). Globalisation has brought about opportunities to leverage technical knowledge and business skills across national boundaries (Devan & Tewari, 2001) and has opened up new markets (Frazer & Oppenheim, 1997), but it has also exposed companies to fierce global competition. Deregulation has exposed many industries to global competition, with new market entrants bringing in novel knowledge and new working practices (Sviokla, 1996). Rapidly changing market conditions time compress product lifecycles, squeeze profit margins and increase business environment uncertainty. In the process of increasing market segmentation, mass production strategies that used to work well with standardised products must be changed to mass customisation strategies that address individual customers’ requirements. With each new generation of technology, accelerated technological advances transform the way business is conducted. But it also requires new know-how to exploit such technology and realise its potential benefits. While there is less time to learn new capabilities, companies need greater agility in responding to volatile markets and dynamic customer demands. And they require increasingly specialist knowledge to cater for niche markets. World-class efficiency and product quality that used to give companies a competitive edge have now become the minimum standard required to enter the global market. To stave off the challenge posed by the dynamic global market, companies not only need process efficiency, cost discipline and quality management. They need the ability to innovate, flexibility, adaptability and speed (Magretta, 1998). The implications of all these developments are that companies must learn and innovate more rapidly and effectively than their competition in order to render their opposition’s knowledge base obsolete (the Schumpeterian “creative destruction”) (Kim & Mauborgne, 1999). Companies must be able to spot global market opportunities and become knowledgeable about customers, suppliers, technologies and markets more quickly than their competitors (Prusak, 1997).
2.2.2 Organisational Changes

Having discussed broad changes in the business environment, we turn to changes applicable to individual organisations that drive KM efforts.

The complexity of organisations

Companies have increased in scale and in the scope of their activities (Ruggles, 1997a; Prusak, 1997). Modern corporations have become too complex for a few leaders at the top to learn and know on behalf of others in the organisation (Argyris & Schöö, 1996). It is simply not feasible to depend upon a few individuals to “figure it all out” (Senge, 1990). While organisations adapt by increasing the division of labour, such as by the establishment of functional departments and business divisions, this segregation and specialisation of work creates isolated pockets of knowledge. Expertise and experience gained by one organisational unit is used solely within that unit. Efforts are duplicated and mistakes made by one unit are repeated by another when past lessons remain unlearnt.

Furthermore, organisational structures evolve to keep abreast of companies’ expansion (ibid.). It is common for companies to form alliance and partnership networks or to have remote units operating at geographically dispersed locations around the globe (Badaracco, 1996; Dyer & Nobeoka, 2000; Inkpen, 2000; Lang, 1997; Mowery et al., 1996; Quelin, 1997). Deliberate efforts to manage cross-organisational boundary knowledge flow are critical in the prevention of the under-utilisation of valuable know-how. The benefits of alliance networking cannot be realised if network members are not able to leverage each other’s core intellectual capabilities.

Clearly, knowledge transfer and inter-organisational unit communication are vital ingredients of success in the knowledge economy.

Re-engineering, workforce mobility and knowledge attrition

In the 1980’s many companies focused their attention on downsizing and cost cutting through zealous re-engineering and de-layering programs (Prahalad & Hamel, 1990). “Slack” in a worker’s day was removed, employees (often the most experienced) were laid off to reduce headcounts (Ruggles, 1997a; Prusak, 1997) and layers of middle management were pruned in restructuring initiatives designed to shed corporate overhead and ‘fat’ (Hamel & Prahalad, 1994). But then companies discovered that the removal of “slack” working hours was detrimental to knowledge creation and sharing (KPMG, 2000; Takeuchi & Nonaka, 2000). They found cutting headcount resulted in ‘work intensification’ (Leverent et al., 1998) and put a strain on organisational knowledge activities (Prusak, 1997). Re-engineering had driven away the very knowledge workers who held the key asset for competitive advantage in the knowledge economy. New recruits could not learn from experienced staff about the company’s products and history, nor socialise with them to adapt to the organisation’s culture and unique way of getting things done (Ruggles, 1997a). The knowledge embedded in the company’s routines and the models of reasoning used in decision-making were lost (Borghoff & Pareschi, 1997). Although there were valuable lessons to be learnt about re-engineering (such as process rationalisation and integrated IT infrastructure), the dogmatic belief in short-term cost cutting (Leverent et al., 1998) at the expense of knowledge workers resulted in the ‘corporate amnesia problem’ (Blair et al., 1998). Companies ended up having to re-hire some of the knowledge workers they had shed, but at a much higher cost, as they had often become highly paid consultants (Leonard & Sensiper, 1998). Furthermore, re-engineering left a harmful legacy (Prusak, 2001) of mistrust and disloyalty between a company and its knowledge workers. This exacerbated workforce mobility and knowledge attrition (ibid.).

Today, companies have to tackle the problem of workforce mobility and knowledge attrition more than ever before. On average companies lose half of their knowledge learnt from invaluable lessons every five years (Reichheld & Teal, 1996). With each instance of staff turnover, the organisational knowledge base is eroded further (ibid.) and the problem of ‘corporate amnesia’ is accelerated. In addition, knowledge workers nowadays are often more committed to their profession than to the company.
in which they are employed (Khorana, 1996). When they leave the organisation, they take their knowledge with them. The company is not left with any residue from the knowledge workers. The value of KS is to have individual knowledge workers share their knowledge with others in the company. Then that collective pool of knowledge can become a transferable organisational asset belonging to the company.

2.2.3 The Productivity and Strategic Challenges

What are the implications of all the socio-economic and organisational changes described above for business managers? They may be analysed from two perspectives: (1) optimising the operational productivity of knowledge workers and (2) addressing the strategic implications of knowledge-intensive work and organisations.

The productivity of knowledge workers

Modern companies not only engage increasingly in knowledge-intensive work, they are staffed by a higher proportion of knowledge workers than ever before (Alvesson, 1993). Research has estimated that in 2000, 85% of all jobs in the US and 80% of those in Europe were knowledge-based and generated the preponderance of value on top of conventional production activities (Quinn et al., 1996a). Once companies realise that knowledge workers are becoming the backbone of any gain in productivity and performance (Prusak, 1997), many attempt to control the knowledge workers they hire (Sviokla, 1996). Companies recognise that over an extended period of time productivity is the only true source of comparative advantage (Drucker, 1991). Since nowadays the bulk of work is knowledge-intensive, a company’s improved productivity relies heavily on the increase in productivity of its knowledge workers. Raising the productivity of knowledge workers is therefore a priority for managers than the more efficient use of capital- or labour-intensive resources.

Strategic implications

The greatest strategic challenge to managers is to extract the maximum value from their knowledge workers’ increasing productivity and to determine their companies’ competitive positions based on comprehensive reviews of their firms’ intellectual capabilities. Although knowledge is stipulated as the factor of production, its value can only be realised when it is put to use; knowledge has no ‘shelf value’. To realise the potential of organisational knowledge assets, companies must develop and exploit their intellectual capabilities better than their competitors do, utilising them to design new and distinctive ways of doing things in order to provide more value for their customers. The value of knowledge to an organisation is related to the organisation’s ability to apply the unique knowledge it possesses to solve business problems and attain goals. It is this knowledge-based intellectual capability, together with ability to acquire and develop it faster than competitors manage to (Senge, 1990; Stata, 1989), that provides companies with a sustainable source of competitive advantage in the marketplace.

Strategies are commonly formulated using a SWOT analysis of a company’s internal capabilities and external factors influencing its competitive environment (Zack, 1999a). In conventional strategic management thinking, companies are treated as ‘black boxes’ where their actions and performance are determined by external market conditions (Kim & Mauborgne, 1999). The strategy is for a company to choose a favourable industry where it can erect barriers to new entrants, undermine competitors’ efforts to market substitutable products and dictate the terms to suppliers and customers, while positioning its own products in desirable niches to achieve either product differentiation or cost leadership (Porter, 1980). To capitalise on opportunities and mitigate threats, the company is to make the best fit between internal systems and capabilities and external market conditions, conditions that are assumed to lie beyond the influence of individual companies (Earl et al., 1995).

However, the implication that a company’s strategic competitiveness and growth potential in the long run (Hamel & Prahalad, 1994) rely on its internal abilities to develop and leverage organisational knowledge resources (Quinn et al., 1996a) means strategy must focus on internal factors such as learning and other intellectual capabilities. This emphasis on internal intellectual capabilities is based on the resource-based view of the firm (Barney, 1996; Conner & Prahalad, 1996; Grant, 1991; Teece, 1984) where companies can influence their individual performance by utilising knowledge resources available to them more effectively than their competitors can. Instead of defining their strategies based on market positioning,
product portfolio or geographical location advantage, companies should strategically position themselves based on their unique combination of firm-specific, inimitable and valuable intellectual capabilities (Kim & Mauborgne, 1999; Zack, 1999a). Leveraging intellectual capabilities across many markets and products, rather than targeting specific products for specific markets, becomes the strategic driver. Thus rather than by hoarding unique knowledge resources and restricting the supply of intellectual capabilities to seek high premiums, strategic value is created through synergy of KS.

KS management is about value creation. Knowledge workers’ increase in operational productivity contributes to the realisation of strategic value of KS. The next section reviews the four main thrusts of knowledge research that attempt to clarify the relationship between these two ends (strategic and operational) of the spectrum of knowledge activities.

### 2.3 The Four Thrusts of Knowledge Research

This section reviews the four main thrusts of knowledge research: (1) the theoretical, (2) the measurement-oriented, (3) the technology-oriented and (4) the organisational thrust. The diagram below highlights relationships among different branches of knowledge research. KM research has been inter-disciplinary. This has implications for professionals practising in the fields of information technology, accountancy, general management, human resources training and education.

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**2.3.1 Theoretical Research**

Theoretical research explores the epistemology of knowledge and knowing to clarify the differences between data, information and knowledge. The ‘sticky’ inert nature of knowledge is discussed providing a foundation for the understanding of KS and why knowledge can be used as a competitive weapon.

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**2.3.1.1 The Epistemology of Knowledge**

Hitherto there has been no consensus on how to distinguish clearly between knowledge and information. This has caused enormous confusion. One of the models frequently used to characterise knowledge is the progressive one of data, information and knowledge. Data are signals about the environment collected by sensory systems (Siemieniuch & Sinclair, 1999). Data may exist as raw symbols in the form of observations, facts or figures (Ruggles, 1997b). Information is data that has been synthesised, organised and given structure so that connections and relationships...
among groups of data become apparent and useful (Brusic & Zeleznikow, 1999). Knowledge is processed information that has been interpreted, given meaning (Glazer, 1998) and combined with a relevant context to transform it into what can be applied in decision-making processes to direct actions (Davenport et al., 1998). This IT-oriented linear model describes a progressive increase in value from raw data to information to knowledge, with information as the main ingredient in knowledge creation.

On the other hand, knowledge has a cognitive dimension. Knowledge is the set of personal beliefs and values that emerges through conscious interpretation, reflection and inference from accumulated experience (Davenport et al., 1998; Wright, 1997; Zack, 1999b). The learning process of acquiring knowledge, knowing, is a human act that involves a “dynamic process of justifying personal belief toward the truth or embodying a technical skill” (p. 58) (Nonaka & Takeuchi, 1995). Knowledge is the residue of thinking and reasoning (McDermott, 1999), constantly changing in the light of the individual knowledge worker’s “fluid mix of framed experience, values, contextual information and expert insight” (p. 5) (Davenport & Prusak, 1998).

Knowledge is action-oriented. Insights generated by actionable knowledge (McDermott, 1999) represent the acquired capabilities of the knowledge worker (the knower) to act here and now (Sveiby, 1997). The capability to act and insights are embedded in a context that defines the meaning of knowledge at a certain place and time (Nonaka & Konno, 1998).

Although knowledge begins with the understanding of individuals (Sanchez, 1997), the meaning of knowledge is derived through a social communication process among individuals, not just within an individual (Nonaka & Takeuchi, 1995). The surrounding social context, organisational ethos, cultural milieu, community norms and professional praxes are the elements of a social system that delimit the set of beliefs and values that come to be adopted by individual knowledge workers. The meaning of knowledge to an individual is shaped by his interactions with the adopted social system — the system that stores knowledge outside the boundary of individuals (Polanyi, 1966). This social system that embeds the context, the meaning and the knowledge worker extends the unit of knowing from the individual to the group or organisational level. The shared mental models and the common set of beliefs held by individuals within an organisational unit (group) give rise to organisational (group) knowledge (Nonaka & Konno, 1998; Myers, 1996). Thus KS has a social dimension that transcends individual knowledge workers.

Explicit knowledge and tacit knowing

The dichotomy between tacit and explicit knowledge is well known. Explicit knowledge can be articulated relatively easily verbally, numerically or pictorially in ways that can be codified systematically in structured records, manuals, specifications, scientific formulae or computer programs employing formal representations (Nonaka & Konno, 1998). Once articulated and codified, explicit knowledge can be readily communicated and shared amongst a large number of knowledge workers (Nonaka, 1991).

Tacit knowledge, on the other hand, involves intuitions, heuristics, insights and hunches that are deeply rooted in actions and embodied in skills (Nonaka & Takeuchi, 1995). Since tacit knowledge is not easily expressible, it is hard to articulate what one knows, much less formalise it. “We can know more than we can tell” (Polanyi, 1966). We all possess both explicit and tacit knowledge, but it is difficult to articulate the latter due to the limitations of language and our inability to identify it. We rely on tacit knowledge in our decisions for actions, but our conscious attention is drawn from ‘elementary particulars’ that form the make-up of tacit knowledge to the attainment of more important goals. Thus we are unable to specify these ‘elementary particulars’ (ibid.).

The positivist view of knowledge, is that it should be explicit, detached from human emotions and opinions to eliminate ambiguity and distortion in order to achieve objectivity and verifiability (Polanyi, 1966). Explicit knowledge strives to separate “the subject who knows” (the knowledge worker) from “the object that is known” (the knowledge itself) (Takechi & Nonaka, 2000) to achieve objective and rational
knowledge\(^1\) (Leonard & Sensiper, 1998). Precise scientific knowledge or abstract intellectual knowledge that can be tested and systematically analysed is highly valued (Spender, 1996). By contrast, tacit knowledge is inseparable from the minds of knowledge workers who bring their experience, ideas and emotions to shape the interpretation and meaning of tacit knowledge. As beliefs and ideals are unstable, relative and person dependent, tacit knowledge is dynamic, subjective and idiosyncratic (Nonaka & Takeuchi, 1995). It is futile to impose strictly objective criteria to eliminate all subjective elements of tacit knowledge. Doing so would require close detailed scrutiny of the ‘elementary particulars’ that make up tacit knowledge, destroying meaning of the ‘whole’ and the ‘comprehensive entity’ that the ‘elementary particulars’ constitute (Polanyi, 1966). Instead of conceptual knowledge, knowledge that is acquired through learning-by-doing and embodied in direct experience and skills is highly valued (Takeuchi & Nonaka, 2000).

The dichotomy between explicit and tacit knowledge does not imply the two are mutually exclusive. Indeed, all knowledge is tacitly rooted, as knowing and tacit knowledge are intertwined (Polanyi, 1966). Explicit knowledge must be tacitly understood (internalised) before the knowledge worker can apply it. Absorbing explicit knowledge requires tacit background knowledge (Cohen & Levinthal, 1990). Although it is hard to articulate tacit knowledge, this does not mean that tacit knowledge is uncodifiable (Spender, 1996). Articulation may not be possible for certain tacit knowledge due to the lack of adequate means to express the ‘elementary particulars’; sometimes we are unaware of the tacit dimension, and at other times articulation is not worthwhile as detailed explication of every decision and action would be impractical (Leonard & Sensiper, 1998). But for the rest tacit knowledge may be articulated (externalised) into explicit knowledge, using the codification scheme designed for explicit knowledge. Thus there is certain overlap between explicit and tacit knowledge.

\(^1\) Explicit knowledge is not information, as some who use the two terms interchangeably, suggest. It is just that explicit knowledge may be articulated and codified more easily than tacit knowledge. The meaning of knowledge, whether tacit or explicit, is defined by its context, something that is not associated with information.

2.3.1.2 Idiosyncrasies of Knowledge

Tacitness, situatedness, path dependence and ‘sticky’ knowledge transfer

Although knowing is tacitly rooted and knowledge is embedded in the minds of individual knowledge workers (Leonard & Sensiper, 1998), knowledge transfer is still possible. While explicit KS is bounded by the knowledge worker’s language capability (Alvesson, 1993) and his verbal proficiency in communications (Allee, 2000), tacit KS requires additional cognitive skills on the seeker’s part to discover the ‘elementary particulars’ that are not explicitly communicated in words. Tacit knowledge may be transferred through observation, the experience of concrete examples, repetitive practice, trial-and-error, learning-by-doing or apprenticeship through storytelling and slow face-to-face personal interactions (Boisot et al., 1997; Leonard & Sensiper, 1998; Nonaka, 1991; Teece, 1998a; Zack, 1999b) to “emulate the master’s craft by imitating the hidden rules of the art” (Polanyi, 1966). In the case of explicit knowledge, the possibility of codification allows encoding schemes and representation formats to be devised so that explicit knowledge can be communicated through a wide range of channels, such as printed documents and voice or data networks, in addition to human coaching. Codified knowledge can be transferred economically and speedily to a large audience over long temporal and spatial distances (Boisot et al., 1997). By contrast, uncodified (uncodifiable) tacit KS requires personal interactions. This limits the size of the audience and hence limits the possibility of leveraging economies of scale by carrying out a mass volume transfer of tacit knowledge.

Knowing is not only tacitly rooted but also context dependent (Menzies, 1998). In the process of justifying true belief, knowing involves constructive cognitive thinking and reasoning that is situated in the surrounding environment and background events (Rappaport, 1998). Events are interpreted and meaning is constructed contingent not only on the values and intentions of the knowledge worker but also on his interaction with the overriding environmental, organisational and social context. Knowledge cannot convey its meaning independent of its context (ibid.) and knowledge may not be mapped from one context directly onto another without analysing the correlation between the two situations (Sanchez & Heene, 1997). Even generic knowledge must
have its context dependency specified by attributes that describe the boundaries and conditions where it may be suitably used, effectively delimiting the applicability of the knowledge to certain situations (Menzies & Clancey, 1998). If knowledge is ever separated from its context, it turns into information (Nonaka & Konno, 1998), and the knowledge worker will lose his ability to discern whether such “decontextualised knowledge” is relevant to the tasks in hand. Human knowing is governed by the principle of situatedness – situated cognition (Rappaport, 1998) – it is therefore futile to decontextualise knowledge.

Situated cognition has two implications for KS. Firstly, the seeker must interpret both the content and the context of the knowledge transferred to derive accurate meaning. Secondly, there is no one model of knowledge that can fit all situations. The dichotomy between general and specific knowledge (Zack, 1999b) is useful here. General knowledge is generic knowledge with its context and background commonly shared, often publicly, among different organisational, professional and social groups. Conversely, specific knowledge that derives from particular events or incidents requires explicit definition of the relevant context that is meaningful across different groups. Since the seeker knows something about the context and the background, it is less expensive to transfer general knowledge as it can be more readily communicated (Jensen & Meckling, 1995). In the case of specific knowledge, the context must be explicitly communicated along with the main content. Specific knowledge is hence more expensive for KS (ibid.).

Knowledge is not only context but also path dependent. Since justified true belief is constructed on the basis of reflecting on and inferring from accumulated direct experience, knowledge is experiential. Direct experience from previous encounters together with the context of the present situation shape the formation of new knowledge (Rappaport, 1998). The intellectual capability held by the knower is a result of knowledge accumulated through a sequence of irreversible events and historical choices made in the past. Today’s decisions and lessons learnt of the current situation will in turn influence the direction of future knowledge development (Quelin, 1997). So even if a piece of knowledge is transferred, it may seem obscure to the seeker because he may not have relevant experience or sufficient background knowledge (Cohen & Levinthal, 1990) to relate to the specific historical events that characterise the content or the context. Ambiguity regarding the received knowledge may hinder the KS process. KS is very much constrained by the knowledge workers’ shared experience and background.

This incapability to achieve perfect understanding at the same level as the original knowledge worker highlights the fact that KS is less than an ideal process and always involves a degree of distortion (Smallman & Weir, 1999), fragmentation (Day & Wendler, 1998) or loss of meaning (Arrow, 1969) as a result of ill-transferred content or context. The reasons are as follows. Since knowing is tacitly rooted, the KS process entails the transfer of cognitive beliefs and mental models. Indeed, it effectively requires transporting the knowledge worker’s individual vision of the world (Nonaka, 1991). As it is unlikely for two knowledge workers to have identical values, beliefs, experience and background knowledge, the seeker cannot replicate the provider’s knowledge (Polanyi, 1966) due to disparate mental models of the two (Walsh & Ungson, 1991). Secondly, in reality the environment is dynamic, is in a constant state of flux. The context is likely to have changed between the time the knowledge worker acquired his knowledge and the time he transferred it to others. Due to the situated cognitive nature of knowing, KS always involves a process of adapting received knowledge to the current situation. The seeker may not establish effectively the linkages between the content and the surrounding context as well as the causality between actions and performance (Levitt & March, 1988). Since responses to the same signal received are not necessarily identical in light of the dynamic context, knowledge can hardly be transferred absolutely free of ambiguity, without misunderstanding or misinterpretation. Thirdly, communication breakdown may occur as a results of the mismatch between the language and vocabularies used (Alvesson, 1993; Nissen et al., 2000; Sanchez, 1997), the knowledge workers’ different cognitive styles (Hayes & Allinson, 1994; Sadler-Smith et al., 2000), and their disparate manners of presentation and expression (Leonard et al., 1999; Simon, 2000).

Knowledge is frequently described as ‘sticky’ (Szulanski, 1996), suggesting that it is difficult to transfer knowledge even between knowledge workers within the same company. The tacitness, situatedness, specificity and path dependence of knowledge explain why knowledge is inert. Tacit knowing and background knowledge also have
implications for KS strategy. KS cannot be flawless and there are limitations to leveraging tacit and specific knowledge to a large audience.

**Value through infinite application, appreciation through utilisation and depreciation through commoditisation and decay**

The amount of knowledge which can be transferred is always limited by the finite capacity of the business system (either because of limited bandwidth communication channels, or the bounded rationality of human cognitive capability to assimilate and absorb received knowledge (Arrow, 1969)) and because of the costs incurred. As with information, there is no gain in transferring the same piece of knowledge twice, which is fundamentally different from the production of physical goods where successive items can be qualitative identical (ibid.). But unlike information transfer that incurs minimal transmission cost, knowledge transfer is costly for the parties involved in the process (e.g. master and apprentice). Once knowledge has been transferred, the cost of applying it to solve problems decreases as the knowledge worker increasingly internalises and accumulates experience in the use of the received knowledge as he ascends the ‘learning curve’ (Levitt & March, 1988). The more a piece of knowledge is put to use, the more its value appreciates, rather than depreciates (Boisot et al., 1997). Unlike physical assets such as machinery or natural resources, where the value is highest when new and depreciates subsequently through use (Glazer, 1998), knowledge is not consumed in any way through use (Rayport & Sviokla, 1995). On the contrary, knowledge use follows the power law, where the performance in carrying out a given task improves as a power of the number of times the task is performed (Huberman & Hogg, 1995). If anything, the value of knowledge rises due to the increase in competence of utilising the knowledge effectively.

As knowledge is infinitely extensible (Spender, 1996), it may be used in an infinite number of transactions without being consumed. Since the cost of knowledge creation is fixed, once it had been generated, and the cost of applying a particular piece of knowledge declines through repeated reuse, the majority of the cost in leveraging knowledge falls on knowledge transfer (costs incurred to externalise knowledge for communication and internalise received knowledge (Teece, 1977)), especially where the knowledge is complex, tacit, specific and the seeker does not have the background experience and intellectual capabilities to absorb it. The law of diminishing returns is replaced by the law of increasing returns (Teece, 1998a), as knowledge reuse generates increasing returns at increasingly insignificant marginal cost (Kim & Mauborgne, 1999). To realise the maximum potential value, knowledge should be leveraged effectively throughout a company.

Knowledge is a ‘public good’ (Spender, 1996) (or ‘non-rival good’ (Kim & Mauborgne, 1999)) in that its use by any single knowledge worker does not deprive or limit others of its use. Knowledge can be sold and yet the seller still keeps it to himself, unlike tangible goods where physical delivery signifies the transfer of ownership preventing the seller from further benefiting from the goods (Stewart, 1991). Moreover, knowledge is largely ‘non-excludable’ (Kim & Mauborgne, 1999), in that it is hard, at least over the long term, to prevent knowledge from leaking, diffusing or spilling over to competitors (Dyer & Nobeoka, 2000; McEvily et al., 2000; Quelin, 1997; Teece, 1998a; Zack, 1999a; Zack, 1999b). It is difficult to erect physical barrier to eliminate competition imitation from replicating a company’s proprietary knowledge. This tendency for appropriation not only lets the competition ride freely on proprietary knowledge, but it also risks depreciating the value of knowledge by commoditising the foundation concept (Hamel & Prahalad, 1994; Hansen et al., 1999). Furthermore, knowledge depreciates through decay as it becomes obsolete and loses its relevance over time (see §3.1.3 for detailed discussion).

**Know-how, resource, competence, asset and competitive advantage**

Having analysed the synergistic value of reuse and leverage, KS is recognised as crucial in realising the strategic value of knowledge. However, it is paradoxical that knowledge is also ‘sticky’ and KS is the major cost component in leveraging knowledge. How can knowledge provide companies with a sustainable source of competitive advantage? What role does KS play in this? To answer these questions we need to clarify the relationship between skills, knowledge resources, intellectual

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2 See §2.3.2.1 for the difference between intellectual property and intellectual capital management, where certain legal protection is afforded to knowledge belonging to the former category.
capabilities, knowledge-based core competencies and competitive advantages. The pyramid of value creation (Brush et al., 2001) employs a hierarchical relationship to explain the transformation of know-how and knowledge resources ('raw materials') into unique competitive advantages in the marketplace ('performance outcome').

The know-how of individual knowledge workers, such as knowledge about customers, products, technologies, competitors (KPMG, 1998) and relationships with suppliers and partners, is the fundamental element that supports an organisation's intellectual capabilities. Knowledge practices are recognisable and repeatable patterns of action where skills and knowledge are utilised in a specialised context. Know-how and knowledge practice must be upgraded whenever an organisation decides it needs new capabilities to compete.

Knowledge resources refer to the collective set of distinctive skills and know-how brought to bear by a company's knowledge workers. Knowledge resources are like 'raw materials' and describe the current stock of accumulated knowledge that an organisation may call upon. Knowledge resources may be audited and mapped with the use of a knowledge taxonomy.

When complementary knowledge resources (Klavans & Deeds, 1997; Lang, 1997) are effectively combined (Kogut & Zander, 1992) and integrated (Grant, 1996; Quelin, 1997), they form intellectual capabilities that utilise knowledge resources in a co-ordinated manner to enhance the organisation's task performance to attain its goals.

- When intellectual capabilities are utilised consistently well and are critical to achieving the organisation's goals, they become knowledge-based core competencies that contribute to developing and sustaining the organisation's competitive advantages.
- When the collection of institutionalised knowledge-based core competencies enables the organisation to out-perform competitors in the marketplace, they become strategic knowledge assets.
- When strategic knowledge assets are scarce, inimitable, valuable, unique and non-substitutable, they confer distinctive competitive advantages on the organisation (Conner & Prahalad, 1996; Grant, 1991; Prahalad & Hamel, 1990; Quelin, 1997).

Since individual knowledge is path dependent, the company's organisational knowledge is similarly path dependent on its own experience and development trajectory. Knowledge assets (Barney, 1996; Conner & Prahalad, 1996; Grant, 1991; Mata et al., 1995; Zack, 1999a) are therefore unique to the company's history (Beinhocker, 1999; Cohen & Levinthal, 1990; Quelin, 1997). Secondly, proprietary knowledge is in scarcity, at least when it is newly invented before competition imitation and appropriation, as it is not widely available and cannot be easily purchased in the market (Zack, 1999a). Thirdly, complex, tacit and specific knowledge is difficult for competitors to imitate since it is idiosyncratic to the creating organisation (Prähalad & Hamel, 1990) and is inert to knowledge transfer. Such knowledge is combined and integrated with complementary resources that are highly inter-connected with the creating organisation. The resulting intellectual capabilities are so tailored to the specific needs and characteristics of the creating organisation that it would be of limited use to outsiders. The "sticky" nature of KS certainly does not make imitation easy (O'Dell & Grayson, 1998; Powell, 1998; Sorensen & Stuart, 2000; Szulanski, 1996; Woodman, 1985). Fourthly, a knowledge asset is valuable when its utility value is higher than the cost of acquiring or developing it (i.e. the knowledge resource concerned contributes to the organisation's outcome by adding value to products that customers perceive as beneficial, and as a result the premium that they are willing to pay far outweighs the costs of KS activities) (Teece, 1998a).
By fulfilling the above four criteria, knowledge becomes the fundamental source of distinctive competitive advantage in the marketplace (Drucker, 1995; Drucker, 1998) that allows the company to reap above-normal returns (Spender, 1996; Teece, 1998a).

2.3.2 Measurement Research

Knowledge measurement research emphasises quantifying the stock of knowledge possessed by a company, based on the premise that “what gets measured gets managed” (Eccles, 1991; Glazer, 1998). The measurement approach is favoured by practitioners as a means of visualising and tracking a company’s intellectual assets. Research activities in knowledge measurement can be categorised under two headings, intellectual asset management and non-financial performance measurement.

2.3.2.1 Intellectual Asset Management

Intellectual asset management (IAM) is based on the observation that a huge amount of a company’s value is hidden in intellectual assets (Leonard-Barton, 1995; Stewart, 1997). Most mergers and acquisitions (an indication of market valuation) during the 1980’s and 1990’s were valued at 2 – 9 times their book value (Edvinsson & Malone, 1998; Edvinsson, 1997). Balance sheets prepared under the generally acceptable accounting principles are an inaccurate guide to the value of modern knowledge-based companies as they represent mostly only the companies’ tangible assets (except goodwill) (Teece, 1998b). Although increasingly larger proportions of organisational resources are allocated to acquiring new knowledge, upgrading intellectual capabilities and developing human resources and information technology infrastructure, the value of these investment is not reflected in traditional accounting systems, and thus is not shown on the balance sheet, as other capital investments in plant, equipment and machinery are. Traditional accounting principles are incapable of supporting knowledge investments since these investments incur negative cash flows (expense) but do not contribute to building any form of assets. This realisation led to efforts to explain the significant gap between the reported net worth of a company (based on its tangible physical assets) and its market value (determined by the stock market). Intellectual assets (IA), the term used to denote knowledge-based intangible assets that contribute to the future earning ability of the business

(Edvinsson & Malone, 1998; Edvinsson, 1997; Skandia, 1997; Wiig, 1997), is put forward as one of the key components that explains the gap.

IAM augments traditional accounting systems with a knowledge measurement capability so that shareholders may objectively assess the value of an organisation’s strategic intellectual assets. IA are to be managed as part of the organisation’s asset management strategy such that these ‘soft’ intangible assets may play a role as equally important as ‘hard’ financial assets. The capitalised value of IA is not meant to replace but to supplement financial reporting with information meaningful and useful to shareholders in decision-making. IAM quantifies knowledge through objective valuation so that investors can, for example, employ conventional methods to evaluate the return on assets.

There are two IAM approaches: intellectual property management (IPM) and intellectual capital management (ICM). The former emphasises valuing intellectual properties that may be legally protected to a certain degree from imitation, while the latter emphasises internal intellectual capabilities that are beyond the current legal protection framework (KPMG, 1999).

IPM is concerned with the defensive management of exclusive rights to meticulously specified intellectual properties (Kim & Mauborgne, 1999), such as patents, copyrights or trademarks, against infringement and misappropriation (Torres, 1999). Under IPM, the value of intellectual properties is capitalised on the balance sheet as intangible assets based on such indicators as licensing fees and royalty revenues (Teece, 1998b).

ICM, on the other hand, is concerned with knowledge and know-how that are critical to the organisation (ibid.) but which cannot be meticulously specified or easily traded in a market (such as knowledge held in people’s minds and embedded in organisational routines and culture). There are three generic methods of measuring intellectual capital (IC), earning capability, market capitalisation and non-financial measurement indicators (Abdolmohammadi et al., 2000). Earning capability is based on the return on assets concept by dividing the average earnings of a company for a pre-defined period of time by the average tangible asset value of the company over
the same period, and then comparing the ratio against the industry average. Market capitalisation is based on the premium valued by the stock market on the IA by directly calculating the excess of a company’s market value over its book value (the Tobin’s Q ratio (Teece, 1998a)). The non-financial measurement indicator method is based on the use of a suitably selected set of key performance indicators to quantify the valuation of IA (see next section).

One example is Skandia’s ICM Navigator Model (Edvinsson & Malone, 1998; Edvinsson, 1997; Skandia, 1997). The company’s IC is sub-divided into human and structural intellectual capital. Human IC is the know-how, experience and customer relationships held by knowledge workers. Structural IC denotes the organisational knowledge that remains with the company when knowledge workers depart, such as its business processes, organisational culture, knowledge repositories, product technologies and customer base. As human IC is considered volatile because of the mobility of knowledge workers, the challenge is to manage the transformation of human IC to structural IC so that, from a shareholder’s perspective, the value of IA stays with the company independent of staff turnover. Within the ICM, each elementary IC is a building block that contributes to the creation of market value and is measured by a set of indicators (e.g. customer capital indicators may include customer satisfaction rating, service expense per customer, rate of repeat customers, etc.). IC indicators are then combined to form a consolidated measurement of the overall IC value. IC is then regarded as a debt item borrowed from stakeholders of the company (employees, partners or customers, etc.) and IA are reflected as intangible asset items.

2.3.2.2 Performance Measurement

Business performance measurement is the second approach to quantifying knowledge. Performance measurement systems have for a number of years been embracing a broad set of non-financial measurement indicators, such as quality, market share or customer satisfaction, to provide management with a comprehensive view of the status of the business (Eccles, 1991). Traditional measurement systems are built around financial indicators (e.g. quarterly earnings or profitability) to report business units’ performance. These financial-oriented measurement systems were widely criticised for focusing too much on short-term results that reflected the consequences of past decisions (Kaplan & Norton, 1992). They were not seen as necessarily accurate indicators of future performance. Secondly, financial measures are often unable to support strategic initiatives intended to acquire knowledge assets or develop the intellectual capabilities needed for future growth (Kaplan & Norton, 1996b). Financial measures are too narrow an indicator to provide useful feedback to management as to whether knowledge strategies are working as designed. Another set of measurement indicators was required to reflect the key variables that are vital to the performance of modern, knowledge-based companies.

The balanced scorecard represents one method that employs a set of key performance indicators to measure a business’s financial as well as its non-financial performance in three knowledge-related areas: customer service, internal business processes and learning and innovation capabilities (Kaplan & Norton, 1996a; Kaplan & Norton, 1992; Kaplan & Norton, 1993). Financial indicators focus on short-term measures that report the outcomes of business actions already taken. Customer satisfaction rating and business process effectiveness are operational indicators that monitor the current status of strategy implementation. Measures of development in learning and innovation are long-term strategic indicators that track the progress of intellectual capabilities vital to future growth. The balanced scorecard puts an equal emphasis on knowledge and financial measures. The two are meant to complement each other to provide executives with a tool linking short-term results to long-term strategies, balancing operational revenues (financial measures) and future success (knowledge measures). The selection of specific measures is dependent upon the organisation’s strategic objectives, with managers choosing a core set of critical success factors (Rockart, 1979) that describes the strategic vision. Key performance indicators for each of the four measurement areas are then derived from the critical success factors. Quantitative values of all the performance indicators are then combined on the scorecard to provide an aggregate view that juxtaposes financial results, the current operational health of business processes, and the development of intellectual capabilities. Knowledge is attributed to the strategic value of innovation, learning and business improvement that builds the foundation for future growth and performance.
2.3.2.3 Discussion

A knowledge measurement tool such as the balanced scorecard is useful for comparative analysis, benchmarking the performance of different business units of a company. The inclusion of intellectual capability measures makes knowledge more visible, enabling managers to visualise and monitor the progress of the stock of knowledge (and organisational capabilities to apply that knowledge) that so crucially affects a company’s economic health. Knowledge measures may be used as a basis for compensation to influence people’s behaviours in the organisation (Kaplan & Norton, 1992; Kaplan & Norton, 1993). They may also be used to identify areas where improvement is needed and leverage best practices that were previously hidden across different parts of the organisation. However, the drawback is the propensity for imitation, that organisational units will tend not to transcend the level of competence established by other units’ knowledge measures, which confines development of intellectual capabilities and results in incremental rather than a breakthrough improvement in performance (Kim & Mauborgne, 1999; Nattermann, 2000).

The second more important issue is ‘valuation difficulty’. There are two reasons for valuation difficulty: the problem of measurability and the difficulty of attributing value to IA.

A knowledge measurement system relies on quantifying tangible artefacts that describe the accumulated stock of knowledge in an organisation (e.g. the scope of the corporate business intelligence database). The result can be an under-representation of tacit knowledge, as tacit knowledge is by nature fuzzy, intangible, embodied in people’s minds and elusive to direct measurement (Holtshouse, 1998; Miles et al., 1998; Takeuchi & Nonaka, 2000; Teece, 1998b). Even if suitable indicators could be found it would be difficult to maintain objectivity; since tacit knowledge cannot be pinpointed easily, its measurement is at least partially based on subjective assessment, either in the selection of measurement criteria or the grading used, and is therefore open to bias (Levitt & March, 1988).

Secondly, many valuable knowledge processes are subtle, informal and subject to continuous change. It would be laborious to collect necessary data and cost ineffective for the knowledge measurement system to catch up. Some have developed proxy indicators that, rather than measuring knowledge directly, measure the outcomes or consequences of knowledge activities (e.g. the number of intellectual properties held, customer retention rate, etc.) (Fahey & Prusak, 1998).

However, the use of proxy indicators begs the question of how one may attribute value to knowledge. Economic theory attributes value to typical commodities based on ‘use’ and ‘exchange’ (e.g. water is high in ‘value in use’ but low in ‘value in exchange’, while it is vice versa for diamonds, due to their scarcity) (Glazer, 1998). But knowledge valuation is different. The economic value of knowledge is realised only when knowledge is used, and its value is dependent upon the intellectual capabilities of knowledge workers – the meaning a knowledge worker assigns to a piece of knowledge he knows and how well he puts it to use (ibid.). Hence, knowledge does not have an intrinsic but a utility value only, and the utility valuation is dependent upon the subjective evaluation of the application context and how well the knowledge is internalised by the knowledge worker. Different knowledge workers may attribute vastly different value to the same piece of knowledge, since they may derive different meanings from it, interpret it differently, understand it to varying degrees and have disparate intellectual capabilities in applying it. Any risks and rewards analysis of knowledge needs to measure the impact of knowledge on the specific task in hand, thus subjecting the valuation to fluctuations as a result of changing application context. Hence it is difficult to attribute consensual financial value directly to knowledge, since there is no stable correlation between measures of knowledge and the attributed valuation of knowledge.

It is methodologically challenging to establish objective measures to value knowledge and intellectual assets. Much work remains to be done on the conceptualisation of knowledge measurement. In addition, as the ICM and balanced scorecard demonstrated above, the previous lack of a consistent framework of knowledge measurement categories and a systematic methodology commonly applicable across companies (much less across whole industries) make comparison of intellectual assets between companies difficult.
2.3.3 Technological Research

Technology-oriented research emphasises employing information technology (IT) to augment an organisation's communication and memory capabilities to locate, transfer, store and apply knowledge. IT's chief aim is to aid knowledge workers to better understand and use the knowledge at their disposal to solve business problems. This gives rise to a new category of knowledge management systems (KMS) that amalgamates functions previously available in multiple standalone information management and collaboration applications.

2.3.3.1 Information Management

Information management tools contribute mainly to two areas of KMS: (1) the capturing and codification of knowledge into various forms of electronic representation, and (2) the extraction of useful information from the huge volume of data commonly possessed by companies.

Knowledge capture is concerned with recording the disembodied and persistent representations of knowledge in organisational memory (Dieng et al., 1999) so that valuable knowledge may be preserved in the company to prevent attrition. Organisational memory is an amorphous repository of information about current events and past decisions (Walsh & Ungson, 1991) that reflects a company's accumulated knowledge (Borghoff & Pareschi, 1997), such as its records of past projects, case studies or lessons learnt. Organisational memory systems (OMS) make use of technologies from document management, relational databases and data warehousing systems to provide the information storage, searching, retrieval and categorising functions that can augment organisational capabilities to capture and distribute explicit knowledge over time and across organisational boundaries (Ruggles, 1997b). Document management systems can handle not only textual records in a fixed format but also electronic documents without imposing rigid structures, providing the flexibility to store highly unstructured knowledge. Relational database and multimedia systems enable the efficient storage and retrieval of knowledge in multimedia formats including graphics, audio and video as well as plain text. Data warehousing systems enforce data integrity and housekeeping rules that ensure that the data gathered from multiple sources for the OMS are accurate and current, correctly reflecting the organisation's most up-to-date stock of knowledge (Brusic & Zeleznikow, 1999). Information filtering technologies seeking to find specific information in the OMS focus on two approaches: (1) search and locate, and (2) browse and navigate. The following are examples of technologies of the former category (Borghoff & Pareschi, 1997; Decker & Maurer, 1999; Dieng et al., 1999; Homan & Klima, 2001; Koulopoulos, 1999; Mack et al., 2001; Marwick, 2001; Ruggles, 1997b):

- Software agents ('spiders' and 'crawlers') that automatically index electronic documents;
- Search engines that poll personal profiles to identify domains of interest in order to optimise search strategies across multiple data sources and to customise the presentation of results;
- In addition to textual searching, interactive image, audio and video query systems that perform searches on multimedia data;
- Citation analysers that rank the quality of a document's content according to the frequency of hyperlinks, making reference to the article concerned in the OMS;
- Systems that use meta-data (e.g. document annotation), a thesaurus or an ontology (a restricted vocabulary employing formal axioms that allow an explicit specification and unique interpretation of the shared conceptualisation and the semantics of filtering criteria (Gruber, 1995; Gruber, 1993; Uschold & Gruninger, 1996; Uschold et al., 1998)) to increase the amount of contextual information available to the system in order to enhance the filtering precision by pinpointing relevant records and documents.

Example technologies for the latter approach of browsing and navigation include (ibid.):

- Knowledge taxonomy classifying documents into categories of a well understood schema so that the structure of the taxonomy acts as a 'drill-down' directory to guide knowledge workers' navigation through the subject domain. The taxonomy may be constructed manually or automatically through regression or document clustering techniques;
• Corporate portal providing a single point of access to otherwise discrete information with the use of a knowledge directory. The directory (which may follow the structure of the knowledge taxonomy) pilots knowledge workers according to the content of the documents rather than the location of the sources (e.g. Internet, Intranet, Extranet or MIS).
• Document summarisation to generate automatically a compact description (summary) containing sentences judged to represent the key concepts of a document to reduce the chances of knowledge workers sifting through documents that are likely to be irrelevant.

Codification is concerned with encoding knowledge elicited from knowledge workers into machine-readable representations. Elicited knowledge may be encoded in informal or semi-formal formats (from plain text to SGML or XML), or in formal representations such as production rules, semantic networks or cases that enable automatic processing by knowledge-based systems (KBS) (e.g. expert systems or case-based reasoning systems). While OMS provides increased access to explicit knowledge captured in the repository (Decker & Maurer, 1999), it leaves interpretation of that information to the knowledge worker (Kuhn & Abecker, 1997).

KBS, on the other hand, takes the encoded knowledge representations as input to manipulate the internal state of the abstract machine in accordance with certain information processing procedures (algorithms). Knowledge of the real world is encapsulated as the collective state of the knowledge representations contained within the abstract machine. In this way, KBS is said to interpret codified knowledge and to perform cognitive tasks, mimicking the human thinking and reasoning process (Dieng et al., 1999; Dorfman, 1998).

The second contribution of KMS is to reduce the size and the complexity of the huge volume of data commonly possessed by companies. In addition to avoiding information overload, this compaction might help to reveal hidden patterns, inter-relationships and other valuable information that knowledge workers can use to construct higher-level knowledge. Data mining systems commonly employ machine learning and information inference methods such as neural network, pattern recognition, decision tree pruning, clustering or statistical correlations to extract useful information from a massive volume of data (Brusic & Zeleznikow, 1999).

### 2.3.3.2 Communication & Collaborative Tools

While information management tools focus on enhancing knowledge workers' access to knowledge codified in an electronic repository, communication and collaborative technologies bring knowledge workers closer together by connecting them across spatial and temporal distances. Instead of emphasizing automation and the capturing of knowledge, this category of KMS supports KS between knowledge workers. The interpretation and transfer of knowledge is down to the human actors involved, rather than machines. The role of technology becomes a communication and collaborative tool to connect knowledge workers so that may engage in KS with colleagues who may be located at remote offices in different time zones.

The ability to communicate the content of an idea with an intact context is degraded over distance (Ruggles, 1997b). Distance may be due to spatial separation (ibid.), where face-to-face interactions, the most effective form of knowledge exchange, are becoming a rare experience as global corporations operate in geographically disparate locations. Distance may also be due to temporal separation (ibid.), where time becomes a barrier to KS, either as a result of work intensification with insufficient time being allocated to KS, or knowledge workers' busy schedules making it difficult for them to co-ordinate meetings long enough for KS to take place. Technology may provide a common virtual space to reduce the spatial and temporal distances between knowledge workers, making continuous dialogue easier regardless of where they happen. The following are examples of tools grouped according to the mode of communication supported (Borghoff & Pareschi, 1997; Dieng et al., 1999; Dorfman, 1998; Homan & Klima, 2001; Koulopoulos, 1999; Lipnack & Stamps, 1997; Mack et al., 2001; Marwick, 2001; Milton et al., 1999; Nissen et al., 2000; Pervan, 1998; Tung & Turban, 1998; Turban, 1995):

• Synchronous communication: CSCW (Computer Supported Collaborative Workbench) and GDSS (Group Decision Support System) such as online virtual meeting systems, instant messaging, shared desktop, video- or
teleconferencing, virtual brainstorming war room, and groupware (e.g. Lotus Notes) that organises online discussion forums into chat rooms over local and wide area networks;

- Asynchronous communication: bulletin boards, email, newsgroups, groupware, workflow software and expertise location systems that map the skill sets and experience profiles of knowledge workers.

2.3.3.3 Discussion

The key benefits of KMS are enhanced accessibility to codified knowledge and connectivity among knowledge workers. The activities of searching, filtering, classifying, storing and retrieving codified knowledge are at least partially automated by KMS, saving the scarce resource – the highly paid knowledge workers – to concentrate on higher value added tasks. Crucial knowledge captured from key individuals may be diffused more widely throughout the organisation with increased ability to locate relevant documents. In analogy to human memory, KMS enables a company to build on its previous experience and steers it away from repeating past mistakes while guiding it towards likely success (Kuhn & Abecker, 1997). The virtual space provided by KMS also enhances workers' communication capability so that they can exchange knowledge over longer distance (Dieng et al., 1999), supporting the social communication process in bringing people together to build trust and shared understanding (Marwick, 2001). Experience and know-how is better leveraged with knowledge maps to help identify experts across the organisation more easily.

Although the information management and collaborative systems described above in support of explicit knowledge activities are well established, the technology for tacit knowledge activities is still in its infancy (Marwick, 2001). KMS can only deal with representations of codified knowledge (Ruggles, 1997b) in support of basic capturing and communication activities. Few can support the sharing of complex knowledge, especially the interpretation and use of tacit knowledge (Nissen et al., 2000). KMS may have incorporated capabilities to convey a new dimension of contextual information that was not available in traditional information systems, but three barriers remain.

Firstly, KS management must transcend information management, but not all knowledge can be articulated. Although tacit knowledge is vital to any company's success, it is difficult and time consuming to capture and codify, if at all possible (Nonaka & Takeuchi, 1995). One cannot simply change from units of information to units of knowledge and expect information management methods to be effective in the same way to enable tacit KS. Since tacit KS involves transferring individual beliefs, visions and people embracing one another's ideals and values, it is less clear how these activities may be codified. Furthermore, the mechanisms of human thinking and reasoning in the application of common sense (Hall, 1997), intuition (Dreyfus et al., 1986), experience (Leonard & Sensiper, 1998; Nahapet & Ghoshal, 1998; Polanyi, 1966) and hunches (Sutton & Hargadon, 1996) are not understood well enough to be replicated by machines. Zealous knowledge capturing may diminish the role of tacit knowledge (McDermott, 1999), turning it into fossils of inert information and negating its value (Borghoff & Pareschi, 1997).

Secondly, corporations contain such a vast amount of knowledge that mapping and capturing all of it would be a futile endeavour (Davenport & Prusak, 1998). Moreover, knowledge useful to an organisation is always in a state of flux as it keeps abreast of a dynamic business environment. One of the lessons learnt from the KBS and expert systems experience is that the costly maintenance required to continually renew knowledge repositories of those systems could outweigh the benefits (Kuhn & Abecker, 1997).

Thirdly, information is close-ended but knowledge is open-ended, as the human interpretation of knowledge is tolerant of imprecision and incompleteness (Fransman, 1994). Knowledge workers can exchange their know-how using natural language in dialogues and discussions full of jargon, assumptions and ambiguities (Allen, 1990). During the process of transferring knowledge, they seek clarifications and align their mental models to arrive at a common frame of reference with mutual understanding. Furthermore, apprentices can imitate their masters' skills through observation and repeated practice, emulating subtleties of the craft without explicit articulation. By contrast, machine processing is precise and exact, based on an 'all-or-nothing' binary system manipulating symbols that represent a fixed conceptualised model of the world. The semantics of the model must be comprehensively encapsulated, allowing
one and only one precise interpretation to attain deterministic computational results. Although fuzzy logic and analogue processing can be used to enhance a machine's capability to deal with ambiguity (Glazer, 1998), and machine learning and pattern recognition are used to extend dynamically the conceptualised models, computers cannot actually think or reason, and hence cannot replace knowledge workers’ flexibility in the interpretation and application of knowledge.

The value of KS will be lost in the knowledge transfer process if received knowledge cannot be absorbed and used to effect actions. Managers should therefore be mindful that the role played by KMS is to assist knowledge workers’ understanding and use of organisational knowledge. The value of KMS is to enable accessibility and connectivity so that explicit knowledge can be leveraged on a larger scale over greater spatial and temporal distances.

The paragraphs above discuss the limitation of KMS with respect to supporting the cognitive aspect of the KS process. It assumes that KMS once installed will be used enthusiastically by knowledge workers to bring about improvements in KS. However, many KMS that were implemented either were not used or did not realise the anticipated benefits (Donoghue et al., 1999; McDermott & O'Dell, 2000; McDermott, 1999; Ruggles, 1998). This applies to KMS across the range that employ a whole host of sophisticated technologies.

Two reasons were suggested. Firstly, many organisations employed IT methods familiar to them, investing heavily in IT (Tochtermann & Maurer, 2000) and undertaking KM projects with too narrow a focus on technological aspects (Davenport et al., 1998) that did not suit the nature of the problem (KPMG, 2000; Ruggles, 1998). Secondly, KS involves wider organisational and motivational issues that are beyond any technological solution (Borghoff & Pareschi, 1997; Decker & Maurer, 1999). Indeed, a study of 431 multinational corporations found that although technology might augment knowledge workers’ capability to share knowledge, technology per se does neither encourage nor discourage people to actually engage in KS (Ruggles, 1998). Technology simply reinforces existing organisational cultures and norms; it seldom changes them (McDermott, 1999).

The application of technology has broadened from automating highly structured and repetitive back-office administrative and production work (Davenport et al., 1996) to KMS that supports complex, dynamic and autonomous knowledge work (Sviokla, 1996). Technology is an enabler, but without other critical support factors, it cannot deliver improved KS. IT should be a part of the solution but not drive the KS initiative at the expense of investment in other ‘soft’ areas. The lessons of BPR’s failure to recognise the importance of the human dimension and the lack of sensitivity to ‘soft’ issues (Blair et al., 1998; King, 1994; Leverment et al., 1998) should be learnt. An effective KS methodology should broaden management’s focus from targeting digitised information processing to a balanced concern not just with technology but with organisational actors, structures and cultures (Donoghue et al., 1999; Prusak, 2001; Sveiby, 2001). This is the topic to which we now turn.

2.3.4 Organisational Knowledge Research

Organisational knowledge research concentrates on investigating the multi-faceted organisational factors influencing knowledge workers’ decisions and behaviours in sharing their knowledge. Since knowledge is such an important strategic resource, companies need to be organised around their knowledge activities instead of functional, product or market divisions. While knowledge itself is ‘sticky’ and resistant to transfer, organisational factors add another dimension of complexity to the problem. Managing organisational KS is to manage the processes of learning, knowledge transfer and use as well as creating an environment that nurtures trust and motivation in order to foster positive interactions and knowledge flow.

2.3.4.1 Organisational Knowledge Sharing Management

Knowledge embedded in organisational artefacts

Due to the limited cognitive capabilities of individuals, groups of knowledge workers are formed in organisational units to tackle more complex tasks. Modern organisations are so complex that it is not feasible to depend on a few ‘know-it-all’ persons at the top who think and learn for the whole organisation (Argyris & Schön, 1996). From a KS perspective, this progression from individual to organisation as the unit of analysis gives rise to emergent issues of organisational knowledge artefacts.
and co-ordination capabilities that are distinct from individual cognitive capabilities and independent KS activities.

Firstly, an organisation's capacity to share and apply knowledge is anthropomorphic. Organisational KS analysis is meaningful only when there exists a separate layer of knowledge that transcends those held in the minds of individuals. KS between individual knowledge workers is about transferring skills and know-how on subjects such as customers and competitors. Organisational KS, in addition to transferring knowledge on subject matters, must also transfer practices and the unique ways of working an organisational unit has developed. This emergent layer of knowledge is embedded in organisational artefacts such as organisational routines (Cohen & Levinthal, 1990; Levitt & March, 1988; Nelson & Winter, 1982), vocabularies (Allee, 2000; Nissen et al., 2000; O'Dell & Grayson, 1998) and jargons (Alvesson, 1993; Sanchez, 1997), narratives and stories (Blackler, 1995; Brown & Duguid, 2000; Nahapiet & Ghoshal, 1998; Siemieniuch & Sinclair, 1999), norms and praxes (Leonard & Sensiper, 1998; Polanyi, 1966), social milieu, ethos and organisational culture (Davenport & Prusak, 1998; Davenport et al., 1998; McDermott & O'Dell, 2000; Schein, 1996).

The language and vocabularies used by an organisation encapsulate its knowledge. Jargons can make KS among people in the organisation much easier since it brings people to the same common frame of reference and can instantly convey the unique meaning understood within the organisation, though it may make external KS more difficult. Organisational narratives that tell tales, that give accounts of legends, pass on the beliefs and values of the company. Norms and praxes are the unique and distinctive ways of working practiced within the company that have demonstrated superior performance. Social milieu, ethos and organisational culture condition the collective KS practice and define what is acceptable to the organisational unit by shaping the fundamental tenets, implicit assumptions, espoused values and overt behaviours of people (Schein, 1996). When knowledge is embedded in this separate emergent layer of artefacts independent of individual knowledge workers, it becomes organisational (Argyris & Schön, 1996). Organisational KS then becomes an act where knowledge is transferred not only between individual knowledge workers but also back and forth between the knowledge workers and organisational artefacts that embody collectively the accumulated knowledge of the company.

The network synergy effect of organisational KS and meta-knowledge

When knowledge is leveraged effectively through organisational KS, the network synergy effect emerges (Quinn et al., 1996a) where the holistic value of a network of knowledge workers taken together can grow faster than the sum of value contributed by individual members separately (Glazer, 1998; Stewart, 1991). When KS combines effectively and integrates complementary knowledge from different units into a cohesive 'blend' to enhance the organisation's capabilities, the sum of the network is greater than its parts. Combinative (Kogut & Zander, 1992) and integrative capabilities (Grant, 1996; Quelin, 1997) to co-ordinate the sharing activities of otherwise independent knowledge workers are therefore necessary for effective organisational KS. And in order to co-ordinate KS activities, the organisation must know the whereabouts of its valuable knowledge. Awareness of the whereabouts of organisational knowledge is a form of meta-knowledge (Glazer, 1998), and it is relational (Zack, 1999a). It is about "who you know" and "where the knowledge resides" rather than "what you know". A knowledge map (or yellow pages or directory of expertise) is a good example.

The manageability of organisational knowledge and KS

Given that organisational knowledge is embedded in artefacts such as routines, jargons, stories, norms, ethos and culture, this separate layer of knowledge cannot be managed directly, short of micro-managing every action and decision taken by knowledge workers, which is inefficient if not futile. From an organisational level of analysis, the focus should be on influencing the activities of knowledge workers, i.e. the process of how people learn and share what they know, how people interact and socialise in the system of the organisation, more than on the stock of knowledge itself.
2.3.4.2 Organisational Forms

Let us consider the common organisational forms used to institute KS, as shown in the following pyramid in order of formality (Figure 2-3). A strategic alliance network (and virtual organisations, joint ventures or mergers and acquisitions) can be used to share knowledge among partnering organisations (Badaracco, 1996; Ching et al., 1996; Donlon, 1997; Lang, 1997; Mowery et al., 1996; Quelin, 1997; Savage, 1996; Tuma, 1998). Participating organisations can strengthen their respective market positions by leveraging each other’s valuable knowledge using the alliance network as an inter-organisational KS mechanism. Complementary know-how may be combined to create new capabilities, while explicit terms of the partnership reduce the risk of unwarranted knowledge imitation or appropriation. It is not uncommon for only a few senior executives to have the authority to establish such entities. These organisational forms are determined formally with clearly defined guidelines and rules stipulating what may or may not be shared across company boundaries (Badaracco, 1996).

![Figure 2-3 Organisational forms](image)

Less formal organisational entities used to share knowledge include teams (e.g. the project-based team (Savage, 1996), the cross-functional integrated team (Wenger & Snyder, 2000; Wenger, 1998) or distributed virtual teams (Lipnack & Stamps, 1997)).

3 This is true except for tacit knowledge embedded in the specific idiosyncrasies of the originating organisation, which may escape the specification since it is almost impossible to specify precisely enough the tacit knowledge involved, even if one can vaguely identify it.

and collaborative workgroups (Ciborra & Patriotta, 1998; Galbraith, 1994; Leonard & Sensiper, 1998). Teams are formed to accomplish specified tasks assigned by management. Workgroups are formed to perform a function or to deliver a service that requires cross-organisational-boundary expertise, with members selected on the basis of their knowledge and experience rather than on their membership of particular functional, product or geographic business units. Teams differ from workgroups primarily in terms of the duration that they are meant to last; teams are intended to last until a project is complete whereas workgroups may last until the next corporate reorganisation. Management (from senior executives to middle managers) may initiate the formation of teams and workgroups to enable internal KS. Although management predetermines the goals and make-up of such teams and workgroups, the content and mode of sharing is less formally specified.

While strategic alliances and collaborative workgroups are management sanctioned co-ordinated initiatives with proper allocation of resources and formal assignment of tasks, personal knowledge networks (Allee, 2000; Baker, 1996) and communities of practice (Brown & Duguid, 1998; Brown & Duguid, 1991; Denning, 1998; Sawhney & Prandelli, 2000; Wenger & Snyder, 2000; Wenger, 1998; Wenger, 2000) are bottom-up efforts contributing to the informal end of the spectrum of organisation forms. A personal knowledge network comprises personal contacts that spread across organisational hierarchy and boundaries allowing an individual to access knowledge via informal channels. Contacts and relationships comprising the knowledge network are built up in a variety of ways: through relocations, inter-department transfers, job rotations, relationships with ex-colleagues, trade-shows, conferences and external dealings with suppliers, consultants or industry experts (ibid.). By contrast, communities of practice are groups of people who join together to collaborate on a joint enterprise because of shared objectives and complementary expertise (Wenger & Snyder, 2000). Such communities generally organise themselves informally, set their own agendas, select their own members and establish their own leadership. They organise themselves around domains of knowledge, sub-dividing by the members’ expertise and experience. Members often feel passionate, committed and identified with the communities to which they belong. A community of practice can be considered an organic organisation form that evolves with the changing needs of the communities at large and is self-perpetuating, regardless of project deadlines as long...
as it continues to create value for its members and keeps them interested in maintaining the group (Allee, 2000). Due to the informality of organisation and commonality in interests, people are often more prepared to share their knowledge and experience with peers in such communities, although it does not always lead to resolving complex problems more quickly.

In comparison, a personal knowledge network exists more as a mechanism to allow individuals to access knowledge without a joint enterprise instead of combining and integrating knowledge to resolve problems collectively within a community. The former is commonly used to share ‘meta-knowledge’ about a contact or the location of a useful piece of knowledge, whereas the latter can be used in a joint KS effort to diffuse knowledge. Both are pervasive and exist in most if not all companies. Both complement formal organisational structures as effective KS and organisational learning mechanisms, enabling knowledge to flow independent of the company’s hierarchical structure. The informal channels offered by these two forms show us the actual knowledge flow paths that people like to use to access the knowledge that they require, which can sometimes supersede the formal channels.

### 2.3.4.3 Learning and Knowledge Sharing

Knowledge and learning are closely related. The term ‘learning’ may denote the product of learning (e.g. something learned), or the process of learning that yields such a product (e.g. mentoring or imitation) (Argyris & Schön, 1996). The schema used to describe learning should include (1) the learning product, (2) the learning process, and (3) the agents involved in the learning process (ibid.). The outcome of learning, i.e. the learning product, can generally be described by the ‘content’ of the knowledge gained (Argyris & Schön, 1996; Argyris, 1977). Learning is then the process that changes the stock of knowledge of an individual or an organisation (Sanchez & Heene, 1997). Any analysis of learning should also consider how the various agents, i.e. the learner and the teacher, engage in the learning process.

Employing the above schema, KS relates to learning in the following ways. The learning agent is effectively the knowledge worker whose objective is to absorb new knowledge; the teacher is effectively the knowledge worker whose objective is to impart his knowledge to the learner. Secondly, the learning process can be viewed as the knowledge acquisition and internalisation process, which is part and parcel of the knowing process. Finally, learning and KS share the common goal of augmenting the product of learning, i.e. knowledge, on the part of the learner. KS increases the accumulated stock of knowledge held by the learner – the outcome of an act of learning. As KS activities can be examined as learning activities, organisational KS should be informed by organisational learning theories.

### 2.3.4.4 Organisational Learning Impediments

**Background knowledge, cognitive blind spots and superstitious learning**

As mentioned above, background knowledge is an indispensable element of knowing. One’s ability to absorb new knowledge is a function of one’s background knowledge (Cohen & Levinthal, 1990). Opportunities for learning can also be more effectively spotted and exploited if sufficient background knowledge has been solidly established (Soremen & Stuart, 2000). Thus knowledge has a recursive influence on learning, with background knowledge accelerating the reinforcement loop effect. But due to our bounded rationality, learning must be selective. One simply cannot learn everything. Our limited cognitive capability requires the learner to focus selectively on events believed to be significant in the current context, with the rest of the events believed to be insignificant relegated to the background of consciousness. However, because of our limited background knowledge and unfamiliarity with the subject matter, this process of selection may create ‘cognitive blind spots’, as a result of causal ambiguity on the criteria used to determine significant events (Sanchez & Heene, 1997). This can result in ‘superstitious learning’, the phenomenon whereby background knowledge and subjective experience influences the interpretation of past success, resulting in a misguided causal connection being made between actions and outcomes, leading organisations to search for ‘seemingly superior’ knowledge based on superstitious (and cognitively blinded) perceptions of capabilities and attractiveness (Levitt & March, 1988).
Path dependence and the competence trap

The problem of biased knowledge development due to path dependency impedes organisational learning (Quelin, 1997; Sanchez, 1997; Teece, 1998a). Path dependency increases the likelihood of newly learnt knowledge being too similar to existing knowledge; the selective learning process inclines people towards limiting the variety of knowledge they acquire even in a changing environment. While KS processes shaped by age-old environmental and contextual effects represent the experience and lessons learnt over the years, it also represents the accumulation of the burden of firm specific history and culture that evolves with the organisation. Path dependency induces ‘the competence trap’ where, due to past successes and experiences of favourable performances, organisations stick with familiar but inferior processes, leading organisations to accumulate more experience with them whilst becoming unable to benefit from other potentially superior processes (Levitt & March, 1988). Path dependency hence impedes organisational learning by hindering its responsiveness to a changing environment. Organisational KS suffering from ‘the competence trap’ tends to dedicate resources to reproduce and duplicate capabilities already possessed by the company (Quelin, 1997). It inclines towards stability and continuity, staying in its existing market and maintaining the status quo. Effective organisational KS can introduce variation into the system to increase strategic options and flexibility for the company, keeping it from becoming complacent and unresponsive to changes.

2.4 Knowledge Artefacts

Knowledge activities, and KS in particular, are omnipresent. Taken broadly, knowledge underpins every decision a company takes. Knowledge can become everything and nothing (Alvesson, 1993). By nature knowledge is intangible, abstract, fuzzy, borderless, dynamic and invisible (Nonaka & Konno, 1998), it is difficult to grasp the concept. Furthermore, since knowledge cannot be managed directly, executives need a set of instruments to get a handle on managing KS activities. This section discusses the common artefacts of organisational knowledge which managers, based on the characteristics of these artefacts, may then design instruments to facilitate KS activities.
cultures ... around which organisations are constructed and through which they operate" (p. 320) (Levitt & March, 1988). Routines consist of "relatively simple decision rules and procedures ... used to guide action" (p. 35) (Nelson & Winter, 1982), as exemplified by the "routinised response... [that] calls forth a performance program almost instantaneously" in reaction to 'environmental stimuli', (p. 139) (March & Simon, 1958). For example, with the arrival of a customer's order, the organisational members “call for the performance of routines from their repertoires" (p. 103) (Nelson & Winter, 1982) in response to signals coming from the external environment (the customer placing an order) in order to process and eventually deliver goods to fulfill the order. Such routinised responses have “been developed and learned at some time prior to stimuli" (p. 139) (March & Simon, 1958), which result in “regular and predictable aspects of firm behaviour” (p. 103) (Nelson & Winter, 1982).

The knowledge characteristics of routines

Firstly, routines are independent of the individual actors who create, execute and administer them; thus routines are “capable of surviving considerable turnover in individual actors" (p. 320) (Levitt & March, 1988). This observation follows from the fact that routines are epistemological artefacts, created by organisations' collective tacit and explicit knowledge, and are legacy born out of individual actors’ wisdom. Secondly, routines are history-dependent in that they capture an organisation’s experiential lessons of history (ibid.) and store its evolutionary path of development. The abilities of routines to transcend their human creators and to record an organisation’s history are what make routines repositories of organisational knowledge (Fransman, 1994; Nelson & Winter, 1982; Sorensen & Stuart, 2000), acting as the most important manifested form of 'organisational memory' (Walsh & Ungson, 1991) and storing specific operational know-how. Thirdly, routines are target-oriented (Levitt & March, 1988) with goal-directing rules and codes (Earl et al., 1995) that promote activities associated with past success and constrain actions associated with previous failures (Levitt & March, 1988). It is through the combination of compatible routines that organisations develop, store and apply new knowledge on a systematic basis (Dyer & Nobeoka, 2000) to generate outputs (Sorensen & Stuart, 2000). Fourthly, given that routines can be regarded as

knowledge repositories, organisational knowledge may follow the division of routines into formal knowledge – based on formally codified rules and procedures – and informal knowledge – based on informally nurtured codes of practice and cultures.

Embedding knowledge in business processes

While both employ process-based thinking to examine the nature of knowledge, managerial researchers depart from organisational behaviourists in that they focus on developing practical definitions to facilitate practitioners to manage their organisation’s knowledge rather than merely explaining the nature of knowledge. Given valuable (tacit) knowledge is embodied in the minds of individual actors (Takeuchi & Nonaka, 2000), organisations cannot directly manage knowledge without the collective co-operation and active participation of their members in corporate undertakings. This is true even in the case of explicit knowledge. Although explicit knowledge may be captured in documents, scientific formulae, programs and rule books (Nonaka, 1991), significant amounts of knowledge remain held in the minds of individual actors due to the high costs of externalising and capturing such knowledge (Levitt & March, 1988; Teece, 1977). Organisations attempt to address the problem by putting in place motivational mechanisms (Tampoe, 1993), structures (Nonaka & Konno, 1998; Nonaka & Takeuchi, 1994; Myers, 1996) and business processes (Davenport et al., 1996; Ruggles, 1998) that guide individual actors' knowledge activities in fulfilling organisational goals. Experiential lessons, insights and expertise gained in developing, modifying and administering business processes are embedded in new processes designed to generate fresh knowledge, to access valuable knowledge from internal and external sources, to apply knowledge in decision making, and to disseminate existing knowledge to other parts of the organisation (Ruggles, 1998). In other words, the accumulated process knowledge (Dhar & Jarke, 1993), i.e. knowledge about processes, history and reasoning models used to develop the processes, influences the design of processes by affecting the adoption of alternative strategies leading to favourable outcomes (Levitt & March, 1988). Through this inclusion of process knowledge in the design stage, knowledge is embedded in business processes. Business process becomes effectively an artefact of knowledge (Dhar & Jarke, 1993; Sarvary, 1999). It is the manifested form of knowledge that actually gets managed (Ruggles, 1998; Sveiby, 2001), which KM
systems are built to implement and support (Sarvary, 1999), and at the time when knowledge is embedded in business processes that individual knowledge is transformed into organisational knowledge (Nonaka & Takeuchi, 1995).

**Process-based knowledge sharing**

Whether it is history-dependent target-oriented routines as repositories of knowledge, or business processes embedding organisational knowledge to guide institutional knowledge activities, process (routine) and collective knowledge are intertwined. The development of a process is contingent on process knowledge and process is an artifactual embodiment of accumulated organisational knowledge. From an organisational KS perspective, this means the seeking organisational units structure their processes in a similar way to the providing units (subject to differences in situated context and local contingent idiosyncrasies), and execute them with similar or even superior performance. Secondly, let us imagine both providing and seeking units possess stocks of accumulated knowledge at certain levels, i.e. performing their respective processes at certain competence. The occurrence of KS increases the stock of accumulated knowledge possessed by the seeking unit. This signifies performance changes (presumably increases in performance if the impact is positive) at the seeking unit’s ability in executing their processes. Thus process-based KS has a dimension of dynamism attached to it.

Since knowledge and process are intertwined, a clear idea is needed of how knowledge process improvement may be possible, if KS were to positively effect performance changes. In general, there are two types of process knowledge – knowledge about the outcome and knowledge about the content of processes (Davenport & Beers, 1995). Process outcome knowledge refers to the know-how on key indicators used to measure process performance. Process content knowledge refers to the best practices of technology applications, organisational structures, human resources and environmental innovations that can be leveraged upon to improve standing processes. One may improve knowledge about a process by designing better measurement indicators, or by more effectively leveraging known best practices. Knowledge process improvement thus entails as a prerequisite an increase in knowledge about process design and execution. KS to increase the process knowledge of seeking units therefore becomes a necessary condition for improvement in process performance. In conclusion, this discussion provides the theoretical foundation for process-based KS management.

### 2.4.2 Knowledge Transfer

How should we conceptualise the process of transferring knowledge between knowledge workers? Knowledge transfer can be conceptualised as a transaction of knowledge exchange using the market mechanism, or an altruistic act of helping fellow members in a community.

#### 2.4.2.1 Knowledge Transactions and Exchange Market

From an economic perspective, KS involves stakeholders such as knowledge buyers, sellers and brokers who exchange knowledge through an internal market mechanism (Cohen, 1998). The price system that governs KS transactions is reciprocity; where both the knowledge buyer and seller expect to benefit from KS transactions by getting valuable knowledge in return for sharing their own knowledge (Davenport & Prusak, 1998). In neoclassical economic theory, “markets as institutional settings are epitomised by impersonal, arm’s length and spot transactions” (Nahapiet & Ghoshal, 1998). This knowledge market conceptualisation implies KS is used purely as a means to fulfil the self-interest of individual knowledge workers, that the relationship among knowledge workers will be kept at arm’s length, and that knowledge workers will engage in opportunistic behaviours to further their own goals and exploit their privileged positions if given scarce and valuable proprietary knowledge. KS management then becomes managing the efficient functioning of the internal knowledge market. Rather than leaving KS activities alone in the expectation that knowledge will simply flow through the organisation, motivating the knowledge workers to share their knowledge and aligning the objectives between the principals (management and company) and agents (individual knowledge workers) has to be emphasised, so that people believe it is worthwhile and in their own interest to engage in KS in the knowledge market. Management’s task is to remove monopoly, artificial scarcity and trade barriers (ibid.) that hinder the efficient utilisation of resources and execution of transactions in the knowledge market. Examples of monopolistic activities include the hoarding of crucial knowledge and the wielding of power that
has accrued to a privileged position as a result of holding valuable knowledge. Artificial scarcity is when knowledge becomes inaccessible, either because the buyer does not have something to ‘trade with’ the seller, or the seller wants to hold on to his knowledge in the expectation of higher ‘bids’. A trade barrier is a lack of transparency as a result of an imperfect knowledge market, such as when the seller/buyer is unable to locate a counter-party to exchange knowledge with or a trade embargo as the result of infighting where knowledge is not passed over to colleagues in other hostile departments. KS management emphasises the use of incentives and rewards to discourage these hindering behaviours (ibid.).

However, although there is a market for intellectual properties, there is not a conventional market for intellectual capabilities (Glazer, 1998). The difficulty is that traditional market thinking is not entirely applicable here. Firstly, fewer interactions among knowledge workers are transaction-based than connections and relationships that involve sharing risks and benefits (Ruggles, 1997a). Secondly, given the utility value of knowledge is subjective to individuals and situated at the task in hand, there is inherent ambiguity in evaluating the worthiness of exchange. Thirdly, in order for the buyer to assess the value of knowledge, the seller needs to disclose his knowledge to the buyer prior to the transaction. But disclosure reduces the value of scarcity (Sanchez & Heene, 1997). Fourthly, knowledge is a non-rival public good. Over time, the scarcity value of knowledge will diminish and become commoditised. The internal knowledge market and KS will cease to function if no new knowledge is injected.

2.4.2.2 Knowledge Sharing Communities

From a sociological perspective, KS is an altruistic act of helping fellow members in a community (Davenport & Prusk, 1998). People are motivated to help because they are committed to shared success, they care not only about themselves but also about their fellow members and about the welfare of the community (Cohen, 1998). People are willing to share their knowledge out of passionate motives because they regard KS as bringing mutual benefits to enrich both the community and its members. They focus on personal connections and relationships within the community; hence they act on the basis of trust, goodwill and selfless generosity in addition to incentives and rewards (ibid.).

This conceptualisation believes KS is an aspect of human nature, that people will share their knowledge willingly if they are not hindered from doing so (Ives et al., 2000). When people can identify with the shared objective of the community, they see themselves as part of a larger caring community, and they feel a sense of belonging to it. Once the community is able to provide a safe conducive environment where people can feel comfortable with sharing their knowledge with fellow members, KS will occur spontaneously and people will become more willing to engage in KS openly (Huberman & Hogg, 1995). KS management becomes a task of maintaining the community as the collective custodian of organisational knowledge and the effective mechanism for co-operative problem solving where KS occurs. Management can facilitate the growth of the community by (1) ensuring everyone is obliged to contribute knowledge to remain as part of the community and receive help from it (Denning, 1998) (2) allocating sufficient time for the community members to cultivate relationships (3) providing support in terms of telecommunication infrastructure, meeting space and bringing the right mix of people together, and (4) promoting and nurturing the community through encouragement to participation and contribution (Wenger & Snyder, 2000).

2.5 Summary

This chapter has reviewed the fundamental socio-economic changes that brought about the knowledge economy. The influence of the advent of the knowledge economy on management thinking and organisation of companies is both broad and deep. The widely observable increase in knowledge embedded in products and services, and the substantial increase in knowledge intensity in the nature of work have been reviewed. It argues that for any modern organisation to succeed it is critical to focus on the productivity of its knowledge workers, and take into account the strategic implications of the resource-based theory of the firm. Competitive strategies should be formulated with careful considerations of the internal intellectual capabilities possessed by the company. A successful strategy needs to leverage the distinctive knowledge-based core competencies a company has in order to derive an edge over competitors. Companies need to look for ways to leverage strengths and
compensate for weaknesses in their internal intellectual capabilities, in addition to scan for opportunities and mitigate threats posed by the external environment.

The four main thrusts of KM research, i.e., theoretical research looking at the epistemology of knowledge, measurement research looking at the management of intellectual capital, technological research looking at the support of KM systems, and organisational research looking at learning and organisational forms, have also been reviewed. From an information management perspective, knowledge is conceptualised as computational objects process-able by machines. From an organisation and learning perspective, knowledge is conceptualised as artefacts of routines and processes. Since this research focuses on the latter, one of the guidelines is that a KS management tool should be process-based. Ideally the tool should have a process model that describes the various stages of a typical KS process, showing how knowledge is transferred from one party to another. In summary, the following key issues have been identified from literature. The implications of these issues on the design of an effective KS management tool are briefly discussed with each issue.

Issue #1: Relationship Between Time and KS

Knowledge is a ‘public good’ (or ‘non-rival good’) that its use by any single knowledge worker does not limit others of its use. It does not depreciate through ‘wear and tear’, but rather appreciates through repeated use. That is, the value of knowledge increases as a result of the increase in competence of utilising the knowledge effectively over time. On the other hand, knowledge decreases in value as knowledge leaks over time and imitations by competitors start to replicate the inventor’s know-how. Knowledge also becomes obsolete, decayed and commoditised over time. The value of knowledge is thus time dependent, and KS has a temporal dimension. We need to understand the relationship between time and KS.

Issue #2: Feedback Mechanism - Mechanism That Underpins KS

The mechanism underpinning a typical knowledge transfer process may be conceptualised in one of two ways: as a ‘trading’ transaction of knowledge exchange using the market mechanism between self-interest actors at an arm’s length, or as an altruistic act of helping fellow members in a community with common interests and shared objectives out of compassion, goodwill and selfless generosity. A KS management tool should provide help in revealing and understanding which of these two underlying mechanisms is (or both are) actually employed in a KS situation. Furthermore, knowledge transfer is not an ideal process. It invariable involves a degree of distortion, fragmentation, or loss of meaning. Knowledge is ‘sticky’ and KS is inert. It is therefore important for a KS management tool to incorporate a feedback mechanism such that any misunderstanding or misinterpretation in the KS process can be detected and corrected.

Issue #3: Knowledge Worker at the Centre of Attention

Knowing is tacitly rooted and knowledge is inherently embedded in the minds of individuals. Explicit knowledge may be transferred through articulation, but tacit knowledge entails context-dependent ‘elementary particulars’ that are transferred only through non-verbal cues. Knowledge cannot and should not be separated from human actors. A KS management tool must put the human stakeholders at the centre of attention.

Issue #4: Holistic Factors Influencing KS

KS is not just ‘sticky’ but also multi-faceted. The diversity of KM theories and research activities reviewed indicates a simplistic singular approach to KS is unlikely to succeed. A holistic approach that is able to integrate the diverse yet inter-related set of theories is required.

Issue #5: Different Types of Knowledge Requires Richness of Communication

There are different types of knowledge: tacit and explicit; structured and unstructured; general and specific. While there are many types, all knowledge is context dependent. Its meaning is dependent upon historical events and its interpretation is situated in the surrounding environment. It is futile to separate knowledge from its context. A KS management tool must take into consideration the characteristics of different types of knowledge, without losing sight of the fact that tacit knowing underpins all KS
activities, while supporting the ‘richness’ of communication required by knowledge transfer.

**Issue #6: ‘Measurability Difficulty’ and ‘Valuation Problem’**

The ‘measurability difficulty’ and the ‘valuation problem’ remain to be resolved. The former refers to the selection of a suitably set of measurement indicators that can be used to quantify the stock of knowledge accumulated by a company. The latter refers to the unstable relationship between measures of knowledge and the valuation attributed to knowledge, as a result of the utility value of knowledge and the subjective evaluation of the application context. It is thus difficult to have a single ‘fair value’ attributing to intellectual asset that is both objective and independent of the context it is put to use. Hence, a proxy that is able to measure the consolidated effects of knowledge have on the outcome of certain measurable performance of a company is needed. Since a KS management tool should provide an approach to justify the costs and benefits of a KS programme, the use of a proxy as a means to measure the potentially realisable value of intellectual assets may fulfill this purpose.

These key issues set the requirements for the development of a new framework, the Knowledge Sharing Management Framework (KSMF), and a new methodology, the Knowledge Sharing Management Methodology (KSMM), which are to be described in the next two chapters.

### 3. The Knowledge Sharing Management Framework

This chapter describes in detail the Knowledge Sharing Management Framework (KSMF). This new framework consolidates the diverse set of KM theories reviewed in the last chapter by providing in a coherent way a conceptual linkage between them. It provides a theoretical foundation for the development of the Knowledge Sharing Management Methodology (KSMM) later in the next chapter.

In particular, this chapter begins by discussing the three key aspects of KS: (1) identifying the various knowledge stakeholders in a KS process; (2) identifying the various types of knowledge and their characteristics; and (3) articulate the effect of time on knowledge, illustrated by a knowledge development lifecycle. They are followed by a detailed description of the KSMF. The KSMF presents the conceptual relationship between KS and knowledge-related operational risk, so that operational risk may be used as a proxy to justify the business case of a KS programme. It is followed by the Knowledge Sharing Process Model (KSPM) – a part of the KSMF that describes a five-stage model of a typical KS process (that is, adoption, adaptation, absorption, integration and dissemination). The chapter ends with a description of the four sets of organisational factors (that is, sharing channels, organisational infrastructure, human factors, and technology provision) that are critical to successful KS.

#### 3.1 Aspects of Knowledge Sharing

Improving organisational KS is a multifaceted problem. It can be analysed under three headings: (1) knowledge stakeholders, (2) knowledge property, and (3) the knowledge lifecycle. Knowledge stakeholder analysis looks at the various roles played by knowledge workers in the KS process. Knowledge property analysis is concerned with the taxonomy of knowledge. Taxonomy classifies knowledge content according to its characteristics, and enables a systematic audit of the company’s knowledge assets to be made. Knowledge lifecycle analysis is concerned with the dynamic development of knowledge over time. The sections below elaborate on each of these three aspects of KS.
3.1.1 Knowledge Stakeholders

Knowledge stakeholder analysis examines: (1) the various roles played by knowledge workers in the KS process and (2) the units of knowledge associated with higher-level organisational units.

Since communication is inseparable from the KS process, it inevitably involves at least two stakeholders: the knowledge provider (the seller or source of knowledge) and the knowledge seeker (the buyer, recipient or consumer of knowledge).

The knowledge provider may not know the person who seeks his knowledge, nor the content of the request, until the seeker has been put in touch with him. The provider’s role is to select from the pool of knowledge he has access to and select what he deems will best satisfy the seeker’s request. During this selection process, the provider will use a set of attributes (which can be different from those used by the knowledge seeker) to describe the seeker’s request for knowledge, which he then employs in an attempt to find the most closely matching item(s), filtering out irrelevant knowledge and passing on what will be useful knowledge to the seeker. In order to facilitate the transfer process, the provider may adjust the language he uses, based on his estimation of the seeker’s background knowledge and relevant experience of the subject in order to convey his knowledge as effectively as possible.

The knowledge seeker’s role is to search for the best provider, the optimal source of knowledge and formulate his request to him as clearly as possible. However, the seeker’s ability to ask the right questions will depend upon how familiar he is with the subject matter (Holtshouse, 1998). Even if the knowledge already exists, the seeker may not know whom to ask or where to find the knowledge (Cohen & Levinthal, 1990). Furthermore, even if the seeker locates the relevant knowledge, he may have difficulties in understanding it due to the cognitive limitations on his absorptive capability (Cohen & Levinthal, 1990). From the knowledge provider’s perspective, filtered pieces of knowledge are ‘pushed’ (Holtshouse, 1998; O’Dell & Grayson, 1998; Waite&Company, 1997) through the selective process to the seeker – effectively a knowledge supply view (Scarborough et al., 1999; Zack, 1999b). From the knowledge seeker’s perspective, relevant knowledge is ‘pulled’ through the searching process from the provider – effectively a knowledge demand view (ibid.).

A third stakeholder – the knowledge broker – sometimes plays an intermediary role here and administers the KS process. The knowledge broker is an optional role, but an especially valuable one where the seeker is a novice, unsure where to start searching for the knowledge he needs. Like a market-making agent, the broker ‘matches’ providers and seekers. The broker may be able to leverage knowledge across a larger network of experts than the seeker, and be in a better position to locate appropriate knowledge and thus expedite the searching process.

These three roles can be extrapolated. Instead of looking at the activities of individual knowledge workers we can look at the behaviour of groups, business units, communities and companies. Borrowing the idea of extending the unit of analysis from individual level to collective level from organisational learning (Argyris & Schön, 1996), organisational knowledge (Nonaka & Takeuchi, 1995) and organisational memory (Walsh & Ungson, 1991), organisational KS may be explained by describing a company as a business system comprising nested levels of KS activities. To explain this concept briefly, each level of organisational KS analysis is based recursively upon another more elementary level, until the irreducible level of aggregation, containing just a single individual knowledge worker is reached. This concept is similar to the recursive definition of ‘holonic’ (Mathews, 1996) or ‘fractal’ organisations (Sihn & Von Briel, 1997; Spivey et al., 1997).

This brings us to the second issue: the units of knowledge associated with complex organisational units. The diagram below relates the scale of KS activities based on the three levels of aggregation – the individual, the group and the organisational.
Chapter 3 Knowledge Sharing Management Framework

Figure 3-1 Units of knowledge

At an individual level, knowledge is embedded in the minds of individual knowledge workers (Davenport & Prusak, 1998; Dreyfus et al., 1986; Marshall et al., 1996; Takeuchi & Nonaka, 2000). The skills, experience and expertise borne by individuals to the organisation they work for form the organisation's 'human intellectual capital'. Just as at the organisational level, group level KS requires the participation of individual knowledge workers. And both group and organisational level KS benefit from ability to leverage a larger pool of knowledge of greater variety than individual level KS (Gavetti & Levinthal, 2000; March, 1996; March, 1991). Such benefits form the basis for the 'structural intellectual capital' of the organisation.

Certain organisational forms (e.g. a strategic alliance network) require KS to extend beyond the boundaries of the company to external knowledge stakeholders, such as suppliers, distributors and customers. The partnership with other companies that an organisation has within the alliance network and which may be used to enhance its intellectual capabilities is known as its 'relationship intellectual capital' (Preston & Donaldson, 1999). For informal communities of practice and personal knowledge networks, whom one knows and how much people trust one another form the 'social capital' (Nahapiet & Ghoshal, 1998) of the group of knowledge workers.

In a similar way, the unit of knowledge may take the three levels of individual, group and organisational. A higher-level unit is required when the combined knowledge exceeds the cognitive capabilities of the more elementary lower-level units to absorb, combine, integrate or apply knowledge independently in order to solve problems. A group or an organisational unit may possess knowledge that is equal to, less than or more than the sum of its lower-level units combined. If an individual worker's knowledge "fails to enter into the stream of organisational thought and action, organisations know less than their members combined" (Argyris & Schön, 1996). In this case, the higher-level unit has less than the sum of the combined knowledge of the lower-level units. When individual knowledge workers do not share their knowledge with the group (or organisation), knowledge remains locked in the lower-level units. On the other hand, KS has the network synergy effect emergent at the group or organisational unit, increasing the performance of individual knowledge workers by leveraging the diverse domains and the large pool of knowledge available.

3.1.2 Knowledge Taxonomy and Intellectual Assets

This section presents a taxonomy that categorises various kinds of knowledge according to its characteristics. This taxonomy enables a systematic audit of the company's intellectual assets.

First of all, there is that stock of knowledge possessed individually by the knowledge stakeholders and accumulated collectively by the organisation before the KS process begins. This stock of knowledge forms the basis on which further knowledge can be developed and built upon (Cohen & Levinthal, 1990; Kogut & Zander, 1993; Leonard & Sensiper, 1998; Polanyi, 1966; Sorensen & Stuart, 2000). Thus it is possible to take a 'snapshot' of the current stock of knowledge possessed by an organisation, as part of an intellectual asset audit. The effect of KS can be seen to either grow or shrivel a company's stock of knowledge.
The following generic knowledge taxonomy shows the common types of knowledge and their respective characteristics and attributes. It can be used to categorise knowledge resources prior to devising KS strategies appropriate to each type.

A knowledge taxonomy

Observable and non-observable knowledge. Unlike other physical resources, knowledge is invisible as it does not have tangible artefacts (Leonard & Rayport, 1997; Mata et al., 1995; Takeuchi & Nonaka, 2000) nor does it usually figure in today’s corporate balance sheets (Edvinsson, 1997). Observable knowledge is knowledge that can be easily embedded in actions allowing its effects and benefits to be discovered (Teece, 1998). A disadvantage of this is that when products embedding observable knowledge (e.g. hardware technology) are sold to customers the knowledge behind the design may be reverse engineered and discovered by competitors. On the other hand, observable knowledge makes it easier for an identification process to locate valuable knowledge. Non-observable knowledge (e.g. process technology) is more effectively protected from imitation since its disclosure is not necessary in delivering value to customers (Teece, 1998). However, non-observable knowledge is more difficult to locate and thus makes the knowledge audit process harder.

Positive and negative knowledge. Positive knowledge is knowledge about success cases (i.e. knowledge on the causal connection between actions and outcomes together with associated success criteria and performance levels), whilst negative knowledge is lessons learnt from past failures (Teece, 1998). Positive knowledge, such as know-how gleaned from past cases of successful projects, reinforces decisions that previously experienced success to help focus the organisation’s actions and resources for further success. Negative knowledge is just as valuable in that it helps the organisation to stay clear of repeating past mistakes and direct its resources towards mending knowledge deficiencies rather than futile pursuits. The accumulation of positive knowledge helps to guide the exploratory search for new knowledge and new business opportunities (upside risk), whereas the accumulation of negative knowledge is useful for preventing losses from repeated mistakes (downside risk).

Autonomous and systemic knowledge. Autonomous knowledge yields value independently from other knowledge, whilst the benefits of systematic knowledge can be realised only in conjunction with related, complementary knowledge (Chesbrough & Teece, 1996; Teece, 1998). Autonomous knowledge (e.g. the knowledge needed to improve retail operations or accounting processes) is loosely coupled. This means that it can be applied independently with minimal inter-dependence on or disruption to other parts of the organisation. Systemic knowledge is more complex (Brush et al., 2001) because compatibility and inter-dependence are major concerns (Donoghue et al., 1999). Systematic knowledge involves collaboration, interaction and co-ordination amongst actors; hence KS is crucial to the application of systemic knowledge (e.g. the identification of new market opportunities as a result of synthesising knowledge about products, customers, competitors and technology). More importantly, systemic knowledge entails casual ambiguity on knowledge valuation (Sanchez, 1997). This is because systemic knowledge derives its value in conjunction with an integrated system of complementary knowledge, looked at discretely, the true value of systemic knowledge may be obscured (ibid.). It is not only difficult to assign any meaningful value to systemic knowledge out of its organisational context, but effective KS is more problematic because all the inter-related intellectual capabilities must be transferred simultaneously.

Knowledge Content. There are many ways to categorise knowledge according to its content. Knowledge may be categorised in the light of its specific purpose, such as process knowledge that captures best practices documenting the optimised way of structuring business processes; factual knowledge that synthesises basic knowledge on products and customers, or catalogue knowledge that draws up directories of expertise in an organisation (Ruggles, 1997b). The classical dichotomy between practical knowledge gained from empirical experience, and theoretical knowledge derived from abstract, rational and intellectual study, is another categorisation (Nahapiet & Ghoshal, 1998; Polanyi, 1966). Knowledge can also be categorised broadly as know-what, know-how and know-why (Quinn et al., 1996; Sanchez, 1997; Zack, 1999a). Know-what is cognitive theoretical knowledge which understands the purposes and uses to which organisational knowledge can be put to add business value. Know-what is declarative in nature in that it provides one with ability to describe something, to outline novel products or to imagine new markets, but without the detailed knowledge
on execution. *Know-how* is an advanced skill, the detailed practical understanding of how to perform certain tasks and the ability to recognise complex situations in applying learned rules appropriately. *Know-how* is procedural in nature because it provides one with the ability to refine procedures or to execute orders from management. *Know-why* is expert understanding of the causal relationships among the components of complex business systems, their subtle interactions and principles governing organisational actions and responses. Someone who has know-why knowledge is in possession of highly trained intuition or has the insight of a seasoned expert about why things occur. He is able to adapt his existing expertise in response to changes in environment or extend the boundaries of his knowledge by creating new methods to solve complex problems. *Know-what* is learned through formal training and education; *know-how* is learned through repetitive practice and learning-by-doing, whilst *know-why* is learned through mentoring and ‘on-the-job’ experience.

The above taxonomy categorising knowledge resources is analogous to classifying a manufacturer’s ‘raw materials’. The taxonomy helps researchers and managers to map organisational knowledge resources. The various ways in which knowledge assets can be categorised is summarised below. The table divides the different kinds of assets into those that are derived from internal knowledge resources and those developed in conjunction with external parties. Internal-based knowledge assets can be *diffusible* (i.e. easily spread to outside organisations) or *non-diffusible* (i.e. difficult for outsiders to imitate). Externally-related knowledge assets can be protectable, where there are legal regulations or industrial practices protecting the organisation’s rights, or unprotected, where there is no established system protecting such rights.

<table>
<thead>
<tr>
<th>Internal</th>
<th>Diffusible</th>
<th>Non-diffusible</th>
<th>Protectable</th>
<th>Unprotectable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intangible Assets</td>
<td>Cultural assets (e.g. not-invented here culture, KS friendly ethos &amp; openness to share climate).</td>
<td>Functional assets (e.g. staff, distributor, supplier know-how &amp; industry best practice).</td>
<td>Regulatory assets (e.g. intellectual property, patents, trademarks, copyrights &amp; licences).</td>
<td>Positional assets (e.g. distribution networks, customer knowledge, supplier relationships &amp; reputation).</td>
</tr>
<tr>
<td>Intellectual Capital</td>
<td>Organisational process capital (e.g. management practices, structure, systems, procedures &amp; infrastructure).</td>
<td>Human capital (e.g. staff experience, know-how and competence).</td>
<td>Organisational innovation capital (e.g. intellectual property, patents &amp; technology).</td>
<td>Customer capital (e.g. customer knowledge &amp; customer relations).</td>
</tr>
<tr>
<td>Resource Pyramid</td>
<td>Organisational resource (e.g. knowledge teams).</td>
<td>Human resources (e.g. staff knowledge &amp; experience).</td>
<td>Technical resources (e.g. patents &amp; technology).</td>
<td>Social resources (e.g. industry contacts).</td>
</tr>
</tbody>
</table>

### 3.1.3 The Dynamic Knowledge Development Lifecycle

This section discusses the third aspect of KS: the effect of KS on the development of organisational knowledge over time.

People often believe that KS is limited to the access, use and transfer of organisational knowledge. These are important processes, but equally important is the development, growth and renewal of a firm’s accumulated stock of knowledge. If this accumulated stock of knowledge is to be the organisation’s key intellectual asset, it needs to be kept up-to-date and relevant to the changing needs of the organisation. The very same KS mechanisms used to counter the inertness or stickiness associated with mobilising organisational knowledge is valuable in preventing knowledge obsolescence too.

First let us explore the fundamental relationship between time and knowledge. Organisational KS lets the knowledge seeker knowing about historical, current or future events. Historical events, and the generally accepted explanations of why they occurred, are frozen in experiential knowledge (Gavetti & Levinthal, 2000; Kogut & Zander, 1993). Organisations often expend considerable effort in capturing experiential knowledge originating from studies, past projects or lessons learnt from enquiries or post-mortem analyses. This pool of experiential knowledge forms an
organisation's core memory about its history and development trajectory (Decker & Maurer, 1999; Dieng et al., 1999; Kuhn & Abecker, 1997; Walsh & Ungson, 1991). When experiential knowledge is captured in the organisational memory, the knowledge outlasts the knowledge provider (Ruggles, 1997b). The value of experiential knowledge stays with the organisation, so long as its members are able to access the memory when needed, the organisation maintains its capabilities in making effective use of it (being able to understand the content and discern the context) and the knowledge concerned remains relevant to the organisation's changing needs.

On the other hand, there are historical time barriers associated with organisational memory. The meaning of lessons learnt from past actions and the causality between actions and consequences were fixed at the moment experiential knowledge was captured in the organisational memory. Although the knowledge seeker who retrieves lessons from the organisational memory (Walsh & Ungson, 1991) may draw different conclusions from the knowledge provider's as a result of different paradigms or frames of reference used in interpreting that experiential knowledge (Levitt & March, 1988), the filters used by the knowledge provider to discard conjectures or marginalize spurious details nonetheless influence seekers' subsequent understanding of historical events. The changes in actions and behaviours effected by organisational memory may be varied among seekers, but the content of the experiential knowledge captured within the memory remains permanently fixed.

Organisational KS about current events is about sharing current best practices and optimal solutions to solve common problems. Current event knowledge is fluid. It is gained and developed as a result of social interaction among stakeholders who have common interests. Mechanisms that connect knowledge providers and knowledge seekers to allow them to exchange ideas and solutions, either face-to-face or remotely, are critical in ensuring current event knowledge is timely and relevant, since it relates to a rapidly moving target that shifts in synchronisation with an ever-changing business environment. On the other hand, although nobody can be certain what it is going to happen in the future, in the same way that organisations became what they are today because of decisions made in the past, today's decisions will have an impact upon the range of choices available tomorrow. The current event knowledge an organisation acquires today, the innovative ideas, the relationships established with customers and suppliers, the detailed understanding of technological trends, and the comprehensive analysis of competitors, provide a platform of knowledge upon which to prepare for tomorrow. Experiential and current event knowledge both provide the expertise and cognitive capabilities for an organisation to search effectively for opportunities and to select strategic options to plan for the future intelligently.

![Figure 3-2 Relationship between knowledge and time](image)

In order to understand the growth and shrivelling of knowledge assets over time, it is worth examining a typical knowledge lifecycle. Knowledge has a lifecycle of accretion, maturity, propagation and obsolescence (Siemensle & Sinclair, 1999). The knowledge lifecycle begins when organisational actors create fresh know-how as they face new challenges. The organisation rides the learning curve (Levitt & March, 1988) when freshly created knowledge is repeatedly put to the test to solve problem after problem. When cumulative experience and prolonged learning results in better understanding of the knowledge and increased proficiency in using it (Levitt & March, 1988; Teece, 1977), knowledge can be said to be “mature”. As knowledge matures, it becomes more reliable and stable (Teece, 1977). Mature knowledge is then propagated across the organisation and shared among various stakeholders to solve similar problems with increased efficiency and effectiveness. When depleted organisational capabilities and changing business environment degrade the usefulness, timeliness and relevance of knowledge, its value depreciates and it enters the obsolescence stage. Most organisational knowledge suffers from knowledge attrition and decay in the long run. Knowledge attrition (Reichheld & Teal, 1996) is the loss of the intellectual capability to understand and utilise knowledge as a result of staff...
Knowledge decay is a result of the natural aging process by which intellectual capabilities are degraded (Sorensen & Stuart, 2000), skills become irrelevant, and organisational knowledge is not renewed rapidly enough and becomes inconsistent (Day & Wendler, 1998) and obsolete to the changing demands of the company (Zack, 1999b). Due to the lack of relevant and useful knowledge, existing obsolete knowledge may be reorganised, recombined or generalised to induce or deduce new knowledge (Kogut & Zander, 1992; Kogut & Zander, 1993; Zack, 1999b), or failing that, new knowledge disjoint from past know-how may be created. This new piece of knowledge enters the lifecycle and goes through the same stages.

As well as being a useful way of visualising conceptually the longitudinal dynamic development of knowledge, the knowledge lifecycle also provides us with a tool to examine the cost of knowledge transfer incurred at various stages of development. Based on three main groups of contributing costs: (1) pre-transfer knowledge location costs, (2) communication costs, and (3) training and learning costs, knowledge transfer costs over time are found to follow a U-shape graph (Teece, 1977). Knowledge transfer costs are high initially when few actors in the organisation are knowledgeable about the subject matter. Transfer costs fall as the knowledge ages and more actors within the organisation acquire tacit understanding and become more competent. Costs rise again when knowledge captured in the organisational memory outlasts the length of stay of the original knowledge providers, as knowledge attrition and decay deplete the organisation’s capabilities in using its accumulated knowledge effectively.

This analysis shows that resources allocation for any KS program should take into account the status of development of the knowledge resources concerned. Newly created or near-obsolete knowledge is more difficult to share than mature and current knowledge.

3.1.4 Summary

KS is a multifaceted problem. It is argued that the problem can be analysed under three headings. (1) The exchange of knowledge between stakeholders can be analysed at different levels of collectivity. (2) The current stock of knowledge accumulated in an organisation can be revealed by an audit exercise. The knowledge and intangible assets taxonomies may help the audit by identifying the attributes used to categorise intellectual assets. (3) The dynamic knowledge development lifecycle can be used to visualise the growth and shrivelling of knowledge assets longitudinally. KS is useful to the extent that it helps the organisation to utilise its accumulated stock of knowledge more effectively.
3.2 The Framework

The Knowledge Sharing Management Framework (KSMF) is designed to provide a theoretical foundation for guiding the development of the KSMM. Three components constitute the framework: (1) The business context providing the strategic rationale for undertaking any KS initiative (2) the generic Knowledge Sharing Process Model (KSPM) describing the progressive lifecycle a knowledge stakeholder goes through in KS, and (3) the four generic KS strategies with their associated sets of actionable factors that are critical to the success of KS in organisations.

The KSMF is characterised by its holistic focus on the multi-dimensional nature of KS. As the nature of the problem is multifaceted, it is imperative for the KSMF to adopt a pluralistic approach to its epistemological basis. Firstly, the dynamism of KS, i.e. the gaining of knowledge by the knowledge seeker and the unselfish sharing of knowledge by the motivated knowledge provider, implicitly includes a learning process. This learning process, together with a dissemination process that distributes knowledge, is crucial for understanding KS. The KSPM is designed as a comprehensive model to represent such a process. Secondly, the stock of knowledge accumulated in an organisation reflects the knowledge resources an organisation can bring to bear to solve its business problems. Taking stock of a company’s knowledge resources provides a means of evaluating an organisation’s intellectual capabilities.

While the business context provides the strategic justifications for KS and the KSPM represents conceptually the KS activities on the ground, the four KS strategies represent four specific approaches that executives can take to manage KS in their organisations. The KSMF is shown below, with the business context and drivers in the centre part, the five progressive stages of the KSPM at the circumference and the four KS strategies in the middle. The following three sections describe each component of the KSMF in turn.

3.3 Business Context and Business Drivers

The centre portion of the KSMF provides the strategic framework for managers to develop a business case while clarifying the rationale for any KS initiative. The framework articulates the business value of KS by juxtaposing operational risk, knowledge-based core competencies and competitive advantages to bring to light the relationship between KS activities and the potential outcome on business performance (figure below).

The effect of knowledge stakeholder activities on the sharing of knowledge assets

If knowledge is conveyed through conversations (Allee, 2000), then increased interactions, and hence increased conversations, will enhance the probability that
knowledge flows across the interface of knowledge stakeholders. If the knowledge accumulated as a result of learning is embedded in memory constructs of organisational routines (Keen & Morton, 1978; Nelson & Winter, 1982), then increased KS activities making use of the organisational routines will further strengthen the reliability and relevance of the pool of programs and standard operating procedures comprising the routines. KS reinforces the ability of the stakeholders involved to develop their intellectual capabilities further since the more they share, the bigger the pool of knowledge at their disposal and the more they can leverage.

The sharing of knowledge assets to achieve competitive advantage

Though an increase in interactions amongst the knowledge stakeholders and a corresponding increase in the sharing of knowledge assets can be easily observed, the relationship between KS and organisational performance needs to be reliably established. Research has shown that by communicating the causal relationships between a firm’s intellectual capability and its superior performance to the key stakeholders, they will be more motivated to share the knowledge that is fundamental to establishing the firm’s intellectual capability (McEvily et al., 2000).

The performance improvement that a company may benefit from KS can be explained through the concept of competitive advantage. Resource-based theory states that firms can derive competitive advantages from more effective and co-ordinated utilisation of their “unique, valuable and inimitable resources and capabilities” (Grant, 1991). Distinctive intellectual capabilities based on unique knowledge are difficult for competitors to comprehend and imitate. Having superior capability to co-ordinate the use of unique organisational knowledge is therefore crucial in building and maintaining competitive advantages (Zack, 1999a). As a successful KS process is central to the co-ordinated use of unique organisational knowledge, KS contributes enormously to a firm’s ability in achieving competitive advantages in the marketplace.

Competitive advantage through operational risk reduction and knowledge competence enhancement

Next we need to understand the linkage between KS and competitive advantage. The KSMF specifies the key links. Specifically, competitive advantages can be achieved through (1) the reduction of operational risk and (2) the enhancement of knowledge-based competence.

On the whole, the profitability of a business is determined by the difference between the revenues received by the company in selling its products and services, and the fixed and variable operational costs incurred in producing its products and services. The following simple equation represents the concept of profit before tax:

\[ \text{Profit} = \text{Revenue} - \text{Cost} \quad \ldots \text{Eq. 1} \]

According to Sveiby (1997), organisational wealth should encompass the value of both tangible and intangible business assets. Organisational wealth can thus be expressed as follows:

\[ \text{Organisational Wealth} = \text{Intangible Business Assets} + \frac{\text{Tangible Business Asset}}{\theta} \quad \text{Eq. 2} \]

Conceptually the value of knowledge to a company can be determined by the revenues generated by its knowledge assets and the cost of applying those assets to create value for the company. In this way, the KSMF provides a framework that allows us to think of the value of knowledge as consisting of two elements: (1) the utility of the knowledge assets and (2) the costs of KS activities.

\[ \text{Value of KS} = \text{Utility Generated By Knowledge Asset} - \frac{\text{Cost Of Knowledge Activities}}{\text{Cost Of Knowledge Activities}} \quad \text{Eq. 3} \]

1 The equations that follow are used in qualitative sense. Strictly speaking, they should not be read as mathematical equations.
Substituting equation 3 into equation 2 obtains the following equation 4. The intangible business asset in equation 2 should indeed consist of two sub-components: those intangible assets that are knowledge-based and those that are not.

\[
\text{Organisational Wealth} = (\text{Utility Generated By Knowledge Assets} - \text{Cost Of Knowledge Activities}) + \text{Other Non-Knowledge-Based Intangible Assets} + \text{Tangible Business Assets} \quad \ldots \text{Eq. 4}
\]

The concepts of knowledge asset utility and the cost of knowledge activities can be operationalised as follows. The generation of knowledge utility is reflected in the company’s ability to use its knowledge assets (Sveiby, 1997). The cost of knowledge activities is reflected in the company’s operational risk management capability. This operationalisation is well supported by precedence. Superior knowledge can be used to increase revenues and reduce business risks (Preston & Donaldson, 1999). To leverage upon each other’s knowledge competence is often the main reason for the formation of alliance networks and inter-firm collaboration (Dyer & Nobeoka, 1998). KS is also used to share risks and reduce cost (Ruggles, 1997a). Toyota’s strong network of suppliers and sub-contractors is an example where relational knowledge assets are used to increase utility and reduce risks (Dyer & Nobeoka, 2000). Numerous high-profile cases of operational risk management failures in the financial sectors, including Barings Securities and Metallgesellschaft MGRM, are attributable to the ineffective management of organisational knowledge activities (Marshall et al., 1996).

Finally, tacit KS is crucial to the effective communication of risk and hazards (Smallman, 1999).

Therefore, the knowledge-based competencies of an organisation reflect the utility of its knowledge assets. Knowledge-based competencies of an organisation may in turn comprise of its knowledge-creating and its KS capabilities. If utility function is denoted by \( \mu \), then:

\[
\text{Let} \quad KBC \text{ denotes Knowledge-Based Competence,} \]

\[
\text{KCC denotes Knowledge-Creating Capability,} \quad \ldots \text{Eq. 7}
\]

KSC denotes Knowledge-Sharing Capability, and KA denotes Knowledge Assets then since \( \mu(KBC) \) is made up of \( \mu(KCC, KSC) \) and \( \mu(KA) \) may be approximated by the utility value of \( \mu(KBC) \)

\[
\text{hence, } \mu(KA) = \mu(KCC, KSC) \quad \ldots \text{Eq. 5}
\]

On the other hand, if the cost function of an activity is denoted by \( v \), then:

\[
\text{Let} \quad C_i \text{ denotes Communication activities,} \]

\[
C_2 \text{ denotes Co-ordination activities,} \]

\[
T_1 \text{ denotes activities engaged in Technology Provision,} \]

\[
T_2 \text{ denotes Staff Training activities and Time spent on KS,} \]

and \( CKA \) denotes Cost of Knowledge Activities

\[
\text{then } v(CKA) = v(C_1, C_2, T_1, T_2) \quad \ldots \text{Eq. 6}
\]

Furthermore, the operational risk of a business reflects the potential cost/value of KS (See §3.3.1 for detailed discussion on the knowledge-risk relationship). Operational risk arises as a result of inadequate control or failure in one or more of the following four key areas: internal processes (IP), people (P), systems (S) or external events (EE). Of these four areas, failures in internal processes, people and systems can be attributable to inadequacy in organisational KS\(^2\). Therefore,

\[
\text{If } v_\text{rel}(OR) \text{ denotes the part of operational risk that is knowledge related,} \]

\[
v_\text{nonrel}(OR) \text{ denotes the rest of operational risk that is not knowledge related.} \quad \text{then } \quad v(OR) = v_\text{rel}(OR) + v_\text{nonrel}(OR)
\]

Since \( v(OR) \) is comprised of \( v(IP, P, S, EE) \)

and \( v(OR) = v_\text{rel}(OR) + v_\text{nonrel}(OR) \)

\[
\text{then } v_\text{rel}(OR) \rightarrow v(IP, P, S, Sk) \quad \text{and } v_\text{nonrel}(OR) \rightarrow v_\text{nonrel}(IP\text{, others, } P\text{, others, } Sk\text{ other, EE})
\]

\[
\text{hence } v(OR) \rightarrow v(IP\text{, others, } P\text{, others, } Sk\text{, other, EE}) \quad \ldots \text{Eq. 7}
\]

\(^2\) In the process and financial sectors, on average about one-third of operational risk is knowledge related and hence may be resolved by an improvement in KS capability.
We can then use $v_k(OR)$ as a proxy to approximate the potential value to the business should the organisation fail in KS. In other words,

\[
\text{If } v(KCA) > v_k(OR), \text{ then the cost of KS activities is greater than the return in mitigation of knowledge-related operational risk; the organisation has over-invested in KS. ... Predicate 1}
\]

\[
\text{If } v(KCA) = v_k(OR), \text{ then KS investment is in equilibrium with the return in mitigation of knowledge-related operational risk; the KS investment is fully justifiable. ... Predicate 2}
\]

\[
\text{If } v(KCA) < v_k(OR), \text{ then the cost of KS activities is less than the return in mitigation of knowledge-related operational risk; KS investment has delivered true value to the company. ... Predicate 3}
\]

Assuming an organisation is in an equilibrium state (that is, predicate 2 holds, and that the KS investment made is just sufficient to offset the potential downside of knowledge-related operational risk, without over-spending on KS and KS does not deliver above average return on investment). In this case, $v_k(OR)$ can be used as a proxy to approximate the potential value of organisational KS. The corollary is that $v_k(OR)$ is a useful indicator to benchmark an organisation's state of KS investment.

Following on from above, equation 4 may be rewritten as follows.

\[
\mu(KA) = \mu(KCC, KSC) \quad \text{... Eq. 5}
\]

\[
v(KCA) = v_k(OR) \quad \text{... Predicate 2}
\]

Organisational Wealth = $(\mu(KCC, KSC) - v_k(OR)) + \text{Other Non-knowledge-based Intangible Assets + Tangible Business Assets}$

Organisational Wealth = $(\text{Knowledge-Based Competence} - \text{Knowledge-Related Operational Risk}) + \text{Other Non-knowledge-based Intangible Assets + Tangible Business Assets} \quad \text{... Eq. 8}$

The following diagram shows that conceptually KS provides value either by enabling the organisation to be more able to utilise its core intellectual capabilities, or by mitigating the business’s knowledge-related operational risks.

**Figure 3-7 Value of KS**

The business context and the business drivers for KS

The attainment of competitive advantages through enhancement of intellectual capability and mitigation of operational risks provide the business rationale for KS. However, the KSMF is not designed to audit the value of knowledge assets by calculating its quantified monetary asset value in the accounting sense. Instead, the KSMF serves to visualise the 'soft' intangible nature of KS by providing a linkage between KS, its potential value and its upside and downside effects on business. Through this linkage, the relationship between competitive advantages potentially realisable in the marketplace and the effective utilisation of an organisation's knowledge assets can be made clear. By clarifying this relationship, the KSMF provides a well-grounded justification for cost-benefit analysis of KS programs. In the process of defining the linkage, a business can articulate the business drivers for KS and present the business case in terms of operational risks, core competence and competitive advantages.

Implicit in equation five above is that either the reduction of operational risks or the enhancement of knowledge-based competencies can provide business value to the organisation. Both are antecedent conditions that lead to competitive advantages being attained. On the one hand, a business problem that needs to be solved can be
expressed in term of operational risk. From this perspective, the mitigation of risks defines the nature of the problem and also becomes the motivation driving the development of solutions. Assuming the operational risk problem is knowledge related and KS is a plausible solution, the development of knowledge-based competencies is then a means of alleviating the problem and mitigating the associated operational risks.

On the other hand, a business may want to establish certain competitive advantages in the marketplace, leading the firm to develop or gain access to aspects of KS capabilities that were not available to it previously. From this perspective the development of new KS capabilities becomes the business motivation to drive the initiative.

The business drivers for KS thus come from two quarters, as illustrated by the KSMF: the need to reduce operational risk and the goal to create superior business value. The following is the list of common top-level KS business drivers presented from the risk reduction and the value generation perspectives.

Table 3-2 Risk versus competence view on KS

<table>
<thead>
<tr>
<th>Approach</th>
<th>Two Views of Knowledge Sharing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity Focus</td>
<td>Make sure necessary knowledge is made available to the right people at the right time for them to complete their tasks.</td>
</tr>
<tr>
<td>Strategy Orientation</td>
<td>Preventive measure to avoid occurrence of risks that threaten to undermine the very existence of the organisation.</td>
</tr>
<tr>
<td>Market Positioning</td>
<td>Limiting the liabilities of failures in a mature market that is well understood by its players</td>
</tr>
<tr>
<td>Top-Level Business Drivers</td>
<td>• Reuse proven knowledge to reduce the costs of mistakes and losses.</td>
</tr>
<tr>
<td></td>
<td>• Transfer best practices to increase performance and efficiency.</td>
</tr>
<tr>
<td></td>
<td>• Disseminate quality knowledge to decision makers in a timely fashion to enable a faster response rate.</td>
</tr>
<tr>
<td></td>
<td>• Protect intellectual assets from unintended diffusion, to safeguard investment and to reduce the risk of misappropriation.</td>
</tr>
<tr>
<td></td>
<td>• Reduce knowledge attrition by retaining knowledge from key staff and transforming individual knowledge into</td>
</tr>
</tbody>
</table>

Table 3-3 Knowledge demand and supply

<table>
<thead>
<tr>
<th>Demand For Higher Knowledge</th>
<th>Supply Of Intellectual Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advances In Technology</td>
<td>Increases In Technical Capability</td>
</tr>
<tr>
<td>• Invention of new design and production technologies that may involve breakthroughs which are disjoint from the current generation of technologies</td>
<td></td>
</tr>
<tr>
<td>• Application of technologies to new and unexplored areas to let customers do things that were not possible before</td>
<td></td>
</tr>
<tr>
<td>Advances In Governance Practice</td>
<td>Increases In Managerial Capability</td>
</tr>
<tr>
<td>• Adopt industry best practice and acceptable standard of operation</td>
<td></td>
</tr>
<tr>
<td>• Move away from a bureaucratic and hierarchical organisational structure to achieve speed and flexibility to respond quickly to changes</td>
<td></td>
</tr>
<tr>
<td>Advances In Financial &amp; Risk Management</td>
<td>Increases In Financial Capacity</td>
</tr>
<tr>
<td>• Value at Risk (VaR) regular re-assessment of the firm's risk exposure according to current market valuation</td>
<td></td>
</tr>
<tr>
<td>• Profitability discounted proportionally to the risk taken</td>
<td></td>
</tr>
</tbody>
</table>

The risk reduction perspective is inherently a 'demand-pull' approach to developing knowledge-based competencies in order to mitigate known operational risks (Holhoushe, 1998; Scarbrough et al., 1999). On the other hand, the value generation perspective is inherently a 'supply-push' approach (ibid.), a proactive initiative to accrue competitive advantages. The organisation's objective should be to balance the continuous development of internal intellectual capabilities and the increasing knowledge demands to keep abreast of advances in industrial practices to contain operational risks, so that an equilibrium between knowledge demand and knowledge supply may be attained within the organisation (Liew, 1997). Organisational capabilities can be categorised into four groups: managerial, marketing, financial and technical (Prahalad & Hamel, 1990; Stalk et al., 1992). The table below uses the above categorisation to analyse the relationship between the knowledge demand as a result of organisational changes and advances in industrial practices, and the knowledge supply provided through increased organisational capabilities.
### 3.3.1 Knowledge and Risk

Risk management means different things to different people. In the context of environmental safety and the prevention of accidents, risk management entails the mitigation of hazards that may cause bodily harm, damage to property or to the wider environment (Hood & Jones, 1996).

In the context of the financial market, risk management is about managing the likelihood of financial gain or loss (Dowd, 1998). Since financial transactions always carry an element of risk which cannot be eliminated, the primary objective is to manage risks with informed decisions on what the acceptable levels of risks are and hedge against transactions that may result in risks which are above the acceptable threshold. Risk management in general employs one of two strategies. The first emphasises on management control (Simons, 1999) through proper corporate governance structures to delegate accountability (Smallman, 1999) and internal audit systems to report, monitor and control the level of risky activities (Basle, 1998). The second concentrates on the measurement and analysis of quantifiable risks, employing statistical modelling such as the RiskMetrics methodology (JPMorgan, 1995) to evaluate the key risk factors that affect returns to assets invested. Such risk factors taken into consideration may include market volatility, liquidity, interest rates, asset class return or inflation.

In addition to the above distinction between accidental and financial areas, risk management activities may be sub-divided into specific categories dependent upon the nature of the risk factors. The following lists the common types of risks (Dowd, 1998; Froot et al., 1994; JPMorgan, 1995; PwC, 1999; Hood & Jones, 1996):

- **Business risks.** Systematic financial risks specific to the industry or accidental risks specific to the typical environments within which the firm operates.
- **Market risks.** Financial risks of losses arising from the uncertainty of market conditions and adverse movements in market prices (e.g. equity prices) or rates (e.g. interest and exchange rates). The potential total loss due to market risks may be expressed in currency terms (absolute market risk) or set against performance benchmarks (relative market risk).
- **Credit risks.** Financial risks of losses arising from the failure of a counter-party to meet its obligations.
- **Liquidity risks.** Financial risks arising from the costs of unloading assets on disadvantageous terms when buyers are hard to find.
- **Legal risks.** In the financial area, legal risks arise when binding contracts cannot be enforced if a counter-party defaults.
- **Compliance risks.** In both accidental and financial areas this refers to the corporate governance, business ethics and reputation of a firm in relation to compliance with statutory laws, governmental regulations, or accepted industrial or professional standards. A compliance risk is a potential loss due to the costs of damages, litigation, fines or other forms of legal sanction as a result of failing to meet regulations and standards.
- **Strategic risks.** These are financial risks incurred in long-term planning and capital allocation in order to meet the needs of long-term investments and to attain strategic objectives. Inadequate strategic risk management threatens the organisation’s crisis management capability in dealing with unanticipated events. It may even threaten the business’s continuity and survival.
- **Operational risks.** Risks arising from inadequate or failed internal processes, people or systems (PwC, 1999); risks due to shortcomings in internal controls, to human error or to system breakdowns that do not fall into other categories (Basle, 1998; IFCI, 2000). Operational risks may result in losses associated with financial transaction settlement errors (ibid.), business disruptions, human causalities and disastrous accidents (Hood & Jones, 1996), or even bankruptcy (Marshall et al., 1996).
Knowledge sharing and operational risk

KS has useful application to operational risk management in both accidental and financial areas. For instance, KS programs have been undertaken to improve the operational safety of petrochemical plants by increasing active communications amongst duty operators during shift handovers (Liew, 1997). The failure of operational risk management that caused the high profile collapse of several major financial institutions has been attributed to inadequate KS capability that meant that internal control functions were unable to access critical knowledge about risky transactions (Marshall et al., 1996). Human errors and process failures often have a KS dimension where there has been miscommunication, misunderstanding or misjudgement of a situation because of incomplete, inaccurate, unreliable or outdated information. Indeed, knowledge risk (Chong et al., 2000) – the missed opportunities and consequent costs to a business due to inherent knowledge flow impediments in an organisation – is a specialised form of operational risk. It is imperative to explore operational risk management from a knowledge flow perspective. Any risk management system should have KS management as one of its key components.

There are benefits of adopting this approach to integrate KS and operational risk management. Risk monitoring and reporting are key tasks commonly found in many management control systems, providing executives with a balanced view of the current state of the business (Simons, 1999). Approaching KS from a risk management perspective provides an effective tool for managing the invisible and intangible elements of knowledge, which many executives still have difficulty in handling because of the abstract and ‘soft’ concept of knowledge. Explaining KS benefits and costs in terms of mitigating exposed operational risks is a more effective way to gain executive support. Approaching operational risk from a KS perspective tackles many of the misinterpretation and distortion issues inherent in knowledge transfer in complex organisation structures.

Risk-centric versus knowledge-centric approach

Complex organisational problems are often manifested as symptoms which may obscure their true cause and the real issues (Senge, 1994). The symptoms may be manifested as failures of operational risk management such as communication breakdowns or the inaccessibility of critical knowledge. However, the underlying problem that causes the failures in the first place is often hidden behind symptoms. In other words, the operational risk actually measures the potential costs of the shown symptoms of unresolved problems, for example, losses due to human errors. What leads to the high frequency of human errors may nonetheless remain unknown. By nature, symptoms are more easily discovered than problems. Measurement indicators (e.g. error rates) may be designed to monitor the occurrence of symptoms. In addition, an identical problem may cause symptoms of variable magnitude, and therefore result in a varying amount of potential losses, dependent upon such contingent factors as frequency of occurrence, the importance of the organisational functions affected, and how long before the underlying problem is identified and rectified. In this respect, operational risk is different from financial or market risks because the magnitude of gains or losses due to financial or market risks is mathematically a result of fluctuations in interest rates or currency rates (Basle, 1998).

Assuming the human error in question involves a hidden KS problem, the operational risk then reflects the potential costs of symptoms to the organisation. If KS is indeed found to be effective in mitigating the operational risk, then using operational risk (symptom) to approximate the potential value of KS (solution) is the closest we have come yet to attributing the potential realisable value to KS initiatives. As a consequence of employing operational risk as a proxy to value KS, and due to the disparity between the two, the value of KS is highly situated in its organisational application context, that one may not consider the potential value as a definite fixed value, but rather varies according to the ascribed operational risk. The KS value is practically realisable, at that moment when KS solves the problem and symptoms cease to occur or are greatly reduced. Relating knowledge and risk provides us with a tool to go beneath the superficial symptoms to examine the underlying problem, while the magnitude of the operational risk reduced provides clear business rationales as well as a linkage between KS and potential realisable value to shareholders.

There are two approaches to problem-solving: the risk-centred and the knowledge-centred approach. The operational risk-centred view draws management’s attention to the symptoms in order to concentrate organisational resources on identifying and
solving the underlying problem. KS management offers solutions to mitigate operational risk hazards. From a resource-based perspective, the risk-centred view asks what KS capabilities the organisation currently lacks, whilst the knowledge-centred view shows what it actually possesses. In other words, symptoms flaring up due to operational risk management failure are the result of inadequate KS capability. The operational risks identified highlight the knowledge demand in an organisation in order to mitigate the risks. We can call this a demand-pull perspective. Conversely, the KS capabilities possessed by the organisation allow it to utilise and leverage knowledge in exploiting business growth opportunities more effectively. We can call this a supply-push perspective. Management’s task is to balance what KS capability is required and what the organisation already possesses, devising a means to reach a knowledge ‘supply-demand equilibrium’ (Liew, 1997).

Upside and downside risk

The adoption of this twofold KS-operational risk approach means that there are two ways of considering the KS-risk relationship. The risk-centred view is concerned predominantly with the potential costs and losses resulting from operational risk management failures, whereas the knowledge-centred view is concerned primarily with the potential value of the organisation’s KS capability. In other words, one may consider what the organisation does not know and recommend remedial actions to reduce the shortfall in KS capability or one may look at what the organisation does already know and recommend leveraging actions to put that existing knowledge to better use, exploiting the hidden value of latent knowledge. This distinction parallels closely that of the notion of “upside risk” and “downside risk”.

In the financial risk management context, “upside risk” refers to the opportunity cost of the resources, such as financial capital, being allocated. “Downside risk” refers to an undertaking’s loss in value where resources have been committed but the benefits are outweighed by the costs involved. “Upside risk” usually refers to a potential return and “downside risk” to a potential loss. Risk management in the financial context is about seeking upside gains whilst managing downside losses (Puschaver & Eccles, 1997). Seeking the upside is an offensive strategy to exploit the opportunities available for generating higher profits, increasing the probability of success and decreasing the likelihood of losses. Managing the downside is a defensive strategy designed to prevent or reduce potential losses in response to adverse developments that can have a negative impact on organisational performance.

From a KS perspective, seeking upside gains is a matter of exploiting the opportunities offered by an organisation’s existing stock of knowledge and leveraging KS practice to increase performance. Upside risk exists where innovative ideas do not get used or opportunities to share KM best practices are not seized. Organisations effectively under-utilise their intellectual assets if they do not manage upside risk properly. Managers should review what intellectual capabilities their organisations possess, how they are currently being exploited, and which of them may contribute to establishing their organisation’s core competencies to derive competitive advantages in the marketplace.

On the other hand, managing downside losses is a matter of preventing repeated failures and avoiding incurring costly remedies to rectify situations caused by decision makers hindered from having timely access to essential knowledge. Downside risk exists where there are barriers in information systems, communication infrastructures, organisational cultures, corporate policies and work processes, that inhibit knowledge from flowing across social and organisational boundaries. Managers should review KS failure cases, ascertain the real causes of them and learn from past mistakes.

The risk management framework: the director, the effector and the detector

After exploring the twofold KS-operational risk relationship, it is crucial to develop a coherent approach such that both risk-centred and knowledge-centred aspects of the problem may be examined, employing an integrated analysis. The risk management framework of directive, effector and detector (Hood & Jones, 1996) provides the critical linkage. Risk management activities are said to involve three primary kinds of actions: directing, effecting and detecting. This risk management framework closely corresponds to the KS driver, artefact and locator.
The risk directive

Risk management directing activities communicate the message about the importance of diligent risk management and spell out the organisation's risk management policy. They pinpoint the potential hazards the organisation faces and specify the acceptable level of risk determined by management. Communicating risk directive involves imparting senior management's perceptions, beliefs and judgements about risks as well as its objective and subjective evaluation of potential consequences and damages (Smallman, 1999). Communicating risk directives to all levels of the organisation requires raising people's awareness of risk related matters and aligning their perceptions of risky activities. This necessitates an exchange of explicit knowledge on hazardous events that have already happened, tacit knowledge on the interpretation of such hazardous events, and subjective judgement and objective evaluation of the consequences of risk management failures. Communicating risk directive is therefore highly contextual, situational and task-specific. The communicated risk directives are open to (1) misinterpretation, as different paradigms are used to interpret the same hazardous events (Levitt & March, 1988), (2) fragmentation, as risk messages filter up and down the hierarchy (Day & Wendler, 1998), and (3) structural distortion, due to incomplete knowledge (Fransman, 1994), context loss (Quelin, 1997; Sanchez, 1997; Sanchez & Heene, 1997) and imperfect communication in times of crisis (Smallman & Weir, 1999). All these obstacles, often combined with very long communication channels, result in the well-known phenomenon of people lower down in the organisational hierarchy perceiving things very differently from the way things are seen by senior management. These difficulties however can be alleviated by improved KS capabilities to enable communication of risk directives. For this reason, the risk directive should lead the development of top-level business drivers in the KS capability expansion effort. While risk directive should be drawn in a way that aligns with the organisation's strategic objectives in setting corporate-wide risk management policy (Zack, 1999a), it also serves to co-ordinate the strategic development of organisational KS capabilities.

The risk effector

Risk management effecting activities employ organisational levers to avoid hazardous events that may potentially cause organisational crises, incurring risks that are above acceptable thresholds. Organisations often suffer from an 'atrophy of vigilance' (Hood & Jones, 1996) where risk management activities deteriorate over time, especially during prosperous times and periods of rapid expansion (Simons, 1999). When success brings profits and optimism, there is a tendency for management's attention, organisational processes and resource allocation to cut back on risk prevention efforts, with executives often becoming blind to the hidden dangers and latent risks incurred as a result of relaxing or even neglecting their risk management control systems (ibid.). Other reasons that erode risk management vigilance include senior management's oversight in anticipating the resources required for adequate risk policies in a rapidly changing environment. What seemed to be successful in the past may not be sufficient or applicable anymore, an example of 'competence trap'. Another reason is the indifferent or even dismissive attitude of operational level staff who regard risk management policies as unnecessary and burdensome in their daily work, contributing only a heavier workload but otherwise adding nothing to the organisation's performance. Management needs to maintain vigilance to avoid eroding risk management capability over time.

The success of risk effecting activities in maintaining vigilance hinges on the following two KS artefacts. The first artefact is dissident thinking (Nemeth, 1997) that challenges the majority 'herding' mentality and 'groupthink' (Janis, 1982). The herd mentality develops when people blindly follow others' behaviour, either in ignoring risk controls or by disregarding official risk management policy. Even if individuals who follow the 'herd' are aware of contradictory signals which warn of imminent dangers, these signals will be masked unconsciously by various cognitive (Smallman,
1999) and psychosocial filters (Andrews & Delahaye, 2000). The combined effect of these filters results in people discounting negative signals and choosing to hear only affirmative messages, from sources whose opinions are known to be similar to those held by the 'herd', and interpreting such messages solely from that point of view. Groupthink occurs when risk complacency beliefs held by organisation members reinforce a self- affirming culture that thinks the organisation is infallible and perfect. Because members feel comfortable and secured about being in control, risk complacent groupthink can easily lead to "closed-mindedness and pressures towards uniformity" (Leonard & Sensiper, 1998), ignoring external warnings and censoring private doubts. In an extreme case, people will cease to express their views freely if they differ from the group’s adopted viewpoint and stop doing what they think is right in favour of following the direction of the group, due to sheer peer pressure (Nemeth, 1997). Such self-reinforcing groupthink propagates a false sense of security across the organisation that veils the actual risks. Dissident thinking introduces a 'different voice' that challenges unjustifiable majority thinking that the organisation is safe and sound, when that majority view can be far from justified.

The second artefact is risk knowledge framing. Prospect theory (Tversky & Kahneman, 1992; Tversky & Kahneman, 1986; Tversky & Kahneman, 1981) states that different ways of framing an otherwise functionally equivalent risk message influences people’s behavioural intentions and the psychology of risk perception (Ferguson, 2001). Risk messages framed as gains, i.e. hazardous events presented in a positive risk-averse way to assert the certainty of potential gains (rather than the risky consequences of potential loss), are more effective in motivating deterrent behaviours.

The detector

Risk management detecting activities monitor the current level of risk that the organisation sustains and, in the process of gauging risk level, informs risk-effecting activities to ensure that the level of risk falls within acceptable limits. Risk arises out of a cyclic sequence of events characterised by a period of deceptive normality, followed by a period of gradual accentuation of predisposed organisational conditions that incubate latent hazards, then the occurrence of an unexpected triggering event, followed by an escalation of the problem into a crisis; followed, if the organisation survives the crisis, by a period of recovery and learning (Marshall et al., 1996; Smallman, 1999). Organisational conditions, such as a knowledge hoarding culture, that predispose a company to hazards, when considered discretely seldom stand out as critical organisational problems. But when incubated hazards are considered in aggregate and problems accumulate over time, their repercussions can be fatal (e.g. Barings instance (ibid.)). By the time management becomes aware of the problem, it is often already spiralling into a crisis out of control.

There are several reasons why causes of institutional failures that seem blatantly obvious with the value of hindsight remained undetected beforehand. Firstly, where the organisation was ignorant of the imminent risks and the monitoring systems in place were utterly inadequate. Secondly, where management under-estimated the complexity of the interactions between its organisational actors, business processes and risk control systems; executives being unable to distinguish risk signals from noises generated by the conjunction of events that lead to the crisis (Dowd, 1998). Thirdly, where there was blind faith and unjustified reliance on automated systems without the realisation that these systems might contain exploitable loopholes (e.g. Kidder Peabody instance (ibid.)). Fourthly, where there were dysfunctional organisational traits such as incentives to distort information to inflate profits, communication gaps between division heads engaging in factional feuds, or even cover-ups and frauds (Hood & Jones, 1996), that resulted in the withholding of knowledge and other destructive behaviours that undermined the organisation's risk detection capability.

The success of risk detecting activities hinges on organisational capabilities in detecting latent hazards and locating knowledge expertise that can deal with such hazards. Early telltale signs of causes of failures often manifest themselves in daily business operations and are often known to frontline operational staff (Marshall et al., 1996; Hood & Jones, 1996). The key is to have that knowledge shared with management before it is too late. Dialectic thinking (Brown & Duguid, 1998) can promote a healthy scepticism so that people question dubious practices as well as promote alertness in scanning internal and external environments for dormant hazards. People should be encouraged to be willing to challenge common beliefs and ungrounded assumptions, to highlight the weaknesses of past successful strategies in
light of changed circumstances, and to share a sense of urgency about KS and reporting risk management inadequacy in time for remedial action to be taken. Dialectic thinking reduces the risk of the 'competence trap'; it minimises the chances of organisations falling victim to maladapted practices where inferior risk detecting strategies are favoured simply because of the natural tendency to maintain the status quo. Secondly, in the area of risk knowledge framing, expressing risk messages as losses, i.e. hazardous events being framed in a negative risk-seeking way, stressing the risky consequences of potential losses (rather than the certainty of potential gains), results in a higher level of risk perception and is more effective for risk detection behaviours (Ferguson, 2001).

The second challenge is to be able to locate the expertise required to deal with identified risks. Management should generate an environment conducive to direct people-to-people relationships across organisational units and a communication infrastructure that allows knowledge to flow freely up and down the organisational hierarchy. Operational staff on the shop floor should be able to share their local risk knowledge without hindrance by organisational boundary barriers. People should also be able to identify where the stocks of knowledge reside in the organisation and who the key knowledge stakeholders are by referring to a corporate-wide knowledge map. Such a knowledge map will also help to bridge the gap of knowledge that exists between senior management and operational staff, allowing management to delegate responsibilities appropriately to staff who possess the necessary first-hand risk knowledge.

The following table summarises the three core operational risk management activities: directing, effecting and detecting, and outlines their relationship with KS drivers, artefacts and locators.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Risk Directing</th>
<th>Risk Effecting</th>
<th>Risk Detecting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Purpose</td>
<td>Corporate-wide risk management policy and strategy</td>
<td>To effect organisational levers to prevent incurring unacceptable risks</td>
<td>To monitor current levels of latent and overt risks sustained in organisations</td>
</tr>
<tr>
<td>Relationship with Knowledge Activity</td>
<td>Risk directing as business driver to co-ordinate the strategic development of organisational KS capabilities</td>
<td>Risk effecting hinges on three KS artefacts: dissident thinking, knowledge attrition and knowledge risk framing</td>
<td>Risk detecting hinges on dialectic thinking and loss framing to enhance hazard scanning capability, and risk knowledge mapping to locate required expertise</td>
</tr>
<tr>
<td>Challenge</td>
<td>Misinterpretation, fragmentation, distortion, de-contextualisation and miscommunication of risk directive</td>
<td>Over optimism during periods of success, management oversight during rapid expansion, and complacency</td>
<td>Inability to distinguish noises from abnormal signals, blind faith in automated systems and ungrounded assumptions, dysfunctional organisational traits</td>
</tr>
</tbody>
</table>

### 3.4 The Knowledge Sharing Process Model (KSPM)

This section describes in detail the KSPM component of the KSMF. There are two reasons why the KSMF adopts a process-oriented approach to the KSPM. Firstly, KS management is inseparable from the fundamental process that underpins all KS activities (Ruggles, 1998; Sarvary, 1999).

Secondly, while executives have become acutely aware of the importance of knowledge and the potential benefits KM provides to the organisation's performance (KPMG, 2000), the majority of organisations still lack the necessary skills and experience to implement KS projects (KPMG, 1998; KPMG, 2000; Murray & Myers, 1999). To increase the chance of practitioners accepting KM into their organisations, rather than introduce and enforce a completely foreign approach, the use of a widely used and familiar approach reduces the risk of rejection (Davenport & Prusak, 1998; Hipkin & Cock, 1997), provided of course that such an approach is suited to the nature of the KS problem.
Process concepts fit these criteria. Since Frederick Taylor’s use of scientific management methods to analyse work procedures for industrial organisations systematically (Davenport & Beers, 1995), from the continuous improvement efforts in the mid-1940s (Davenport & Stoddard, 1994), to the total quality management (TQM) movement (Hipkin & Cock, 1997; Malhotra, 1998) and the value chain concept (Porter & Millar, 1985; Porter, 1985), and until more recently the introduction of radical business process redesigns to achieve breakthrough improvement in performance heralded by reengineering advocates (Bashein et al., 1994; Caron et al., 1994; Davenport & Beers, 1995; Davenport & Stoddard, 1994; Hammer, 1990), executives have been using process-oriented tools to solve business problems and are therefore generally familiar with process concepts. Executives would be able to describe their business operations from a process point of view, even if they might have difficulty in describing the same operations from a knowledge perspective. The KSPM serves to bring people who are new to the concept of KS management to approach the KS problem from a familiar standpoint, using the process concept as a lever to lead them to the more abstract and intangible concept of knowledge. This bridges the gap that often comes about when there is change of mindset in the process of paradigm shift (Gersick, 1991).

3.4.1 The Role of the KSPM

The process descriptions specified in user manuals and training programs are almost always different from the processes that are currently in practice (Brown & Duguid, 2000). Even if the descriptions were accurate once, organisational changes soon made these codified descriptions obsolete (Nissen et al., 2000). As discussed in the previous chapter, knowledge workers are the ones who possess the knowledge on how best to perform a task, and when and how to execute specific processes. Matching what is known by knowledge workers and what is required by the tasks in hand is a decision situated on the contextual factors here and now. The KSPM is not designed to take this decision away from knowledge workers, nor does it prescribe rigidly how knowledge processes must be. The role of the KSPM is to provide a generic framework so that managers can more easily draw out, from a process-based perspective, their organisation’s current KS practices.

Discussions in the previous chapter provide the theoretical foundations for approaching KS management from a process perspective. From a practical point of view, managers are generally familiar with the process concept. The KSPM thus serves the dual purposes of providing managers with a conceptual tool with which to understand their organisation’s current KS practice, and also with an informative tool that enables them to compare KS practices across disparate operations. The KSPM provides a common analysis framework so that meaningful comparisons of KS practices can be performed. The framework also highlights the differences between KS practices so that one may identify the causes and contextual factors that make a particular practice more effective in enabling knowledge flow than others. In this way, opportunities to improve KS can be identified.

![Figure 3-9 The role of the KSPM](image)

The above diagram shows the reinforcement loop comprising knowledge, the organisational actions made possible by the availability of shared knowledge and the business processes (which the KSPM is to describe) enabled by effective KS. Knowledge accumulated is embedded in processes that in turn reinforce the availability and use of knowledge. From a managerial perspective, knowledge processes are artefacts that actually get managed. This reinforcement loop therefore provides the conceptual model that relates the activities of knowledge stakeholders (i.e. knowledge providers, seekers, and brokers) in sharing knowledge assets, and the linkage between the KSPM and the business context component of the KSMF.

Specifically the KSPM consists of a five-stage model, comprising adoption, adaptation, absorption, integration and dissemination, which describe progressive stages of the KS process. The model extends the adoption and diffusion cycle from
(Lang, 1997), by adding the integration and dissemination stages. It reflects the cognitive processes of receiving, interpreting, internalising and applying knowledge to solve problems. Knowledge is then reframed and represented in such a way that it can be ready for dissemination to others. This process model, however, does not constrain the unit of analysis to individual actors, for the unit can be expanded to analyse the faculties of groups or entire organisations. In addition, the model does not presume linearity for all KS processes. In reality, processes in practice may not permit one-to-one mapping with every stage of the KSPM. Some KS processes may map to more than one of the KSPM stages and others may not map to any of the KSPM stage at all, i.e. an m-to-m relationship.

The next section describes each of the five process stages of the KSPM.

3.4.2 Adoption

The knowledge seeker scans the environment, either through informal socialisation or a systematic search, to identify tacit and explicit knowledge relevant to the tasks in hand. The knowledge seeker’s background knowledge is critical in this identification process, telling him what, where and who to look for. The knowledge he manages to locate may be fuzzy and not situated in his immediate environment.

3.4.3 Adaptation

The logical cognitive processes of the knowledge seeker modify the conceptual models of previously adopted knowledge in order to adapt to the current task-specific context. Through this adaptation process, the knowledge seeker clarifies the relevance of the newly adopted knowledge by forming a conceptual correlation between the newly adopted knowledge and the problem in hand. This may result in more detailed analyses to be carried out to eliminate fuzziness and internal contradictions of the newly adopted knowledge, or subsequent changes in the way new knowledge is interpreted by the knowledge seeker.

3.4.4 Absorption

The knowledge seeker can now start gaining experience and competence in the use of the knowledge adapted. An internalisation process starts to broaden the seeker’s knowledge base as causality of causes and effects are learned through application of the newly adapted knowledge. The knowledge seeker’s mental model of the world is re-formulated and modified continuously as a result of the interactions between the adapted knowledge and the surrounding context.

3.4.5 Integration

Discrete pieces of absorbed knowledge are combined to form a new whole, giving structure and coherence to shape the integration while reconciling inconsistencies between knowledge from various sources. At this stage, the knowledge seeker possesses the skills of systematic problem solving with the ability to articulate the reasoning model and scientific theories behind. He starts to demonstrate the capability of being able to apply integrated knowledge as a whole entity even in novel circumstances.

3.4.6 Dissemination

Knowledge can be disseminated to other members of the organisation through individualised knowledge transfer mechanisms or multidirectional diffusion. Apprenticeship and face-to-face coaching used to transfer tacit knowledge are examples of individualised knowledge transfer mechanisms. Training workshops and staff conferences are common mechanisms used to diffuse knowledge.

3.5 The Four KS Strategies

While the KSPM is used to describe the organisation’s current KS practice from a process point of view, the four KS strategies are used to describe the approach
adopted. Each of the four KS strategies comprises a set of factors. Assessment of an organisation’s KS practice can then be based on the evaluation of these factors to determine which KS strategy an organisation adopts. These factors can be used in conjunction with the KSPM to identify gaps in various stages of a business process where KS can be improved.

Secondly, media selection theory (Daft et al., 1987; Lengel & Daft, 1988) can be used to explain the relationship between the selection of communication channels and the type of knowledge. The theory emphasises on the choice of media used to communicate the intended messages and how well a particular channel is able to convey verbal and non-verbal cues so that a knowledge stakeholder feels the other party’s presence socially – i.e. “the extent to which an individual psychologically perceives other people’s physical presence when interacting with them” (Carlson & Davis, 1998). Based on this concept of social presence, a communication channel can be described as a rich or lean medium. One should select a channel based on its media richness to suit the type of knowledge to be shared. To explain media richness briefly, it increases when oral media are used instead of written media, and with synchronous communication instead of asynchronous different-place communication.

The following table summarises the relationship between the type of knowledge and selection of KS channel (Ambra & Rice, 1994; Carlson & Davis, 1998; Daft et al., 1987; Jones et al., 1994; Lengel & Daft, 1988; Wijayanayake & Higa, 1999):

<table>
<thead>
<tr>
<th>Table 3-5 Relationship between the type of knowledge and media richness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Explicid Knowledge</strong></td>
</tr>
<tr>
<td>Characteristics</td>
</tr>
<tr>
<td>Routine exchange of unequivocal messages; for example, product specifications.</td>
</tr>
<tr>
<td>Leverage</td>
</tr>
<tr>
<td>Relatively easy to share such knowledge to a large group of people.</td>
</tr>
<tr>
<td>Sources of Knowledge</td>
</tr>
<tr>
<td>A single reliable source of knowledge to avoid confusion and increase efficiency.</td>
</tr>
<tr>
<td>Type of Media Required</td>
</tr>
<tr>
<td>Lean medium with a singular channel is sufficient for simple explicit knowledge flow.</td>
</tr>
</tbody>
</table>
3.5.2 Organisational Infrastructure

The set of factors that comes under the group 'organisational infrastructure' considers the ways in which an organisational form facilitates the flow of knowledge from the knowledge provider to the knowledge seeker. The design of organisational form for KS, rather than being based on traditional segregations according to product, geographic, or functional boundaries, must take into consideration the location of various knowledge stakeholders and the knowledge transfer paths used. The way in which knowledge is distributed across the organisation affects the quality of decision-making. The concept of the co-location of knowledge and decision rights can be used to explain the kinds of organisational forms suitable to KS (Jensen & Meckling, 1995).

By the "co-location of knowledge and decision rights" is meant the delegation of decision-making authority to the knowledge stakeholder who holds the necessary knowledge. The cost of KS can be analysed as agency costs and knowledge transfer costs. Agency costs arise from the amount of management time and resources expended in order to co-ordinate the KS activities of knowledge stakeholders and to align their self-interests with the goals of the organisation. In practical terms, the agency costs are the resources devoted to communicate clearly the corporate vision of KS and the investment management committed to KS activities (such as remuneration packages to reward KS activities or corporate campaigns to promote KS). Knowledge transfer costs arise from the training and staff development resources required to equip the various knowledge stakeholders with the necessary skills and knowledge to play their role in the organisation.

When decision rights are delegated to the knowledge stakeholder who holds the necessary knowledge, knowledge transfer costs fall to a minimum. That is, the agent possessing the required knowledge is also the party who makes the necessary decisions. However, divergent interests between the organisation and the autonomous agent result in inconsistent decisions and increased agency costs as management spends more resources in co-ordination. On the other hand, when decision rights are not delegated but centralised agency costs fall to a minimum. The decisions made are more likely to be consistent with the goals of the organisation as they are in minimal conflict with the interests of individual decision makers. However, this increases knowledge transfer costs, as the communication path is lengthened.

Hence, the role of management is to reduce total KS costs, by balancing the interaction between agency costs and knowledge transfer costs. In practical terms, this means the organisational form should harmonise with the way knowledge is distributed in the company and be compatible with the knowledge transfer paths used by people. Management should ensure appropriate authority is delegated to the right knowledge stakeholders, along with clearly defined roles and responsibilities. Furthermore, the formal hierarchical structure should not become a barrier to KS.

3.5.3 Human Factors

The set of factors that comes under the group 'human factors' considers the 'soft' human issues that bring about the deep convictions and changes in culture, norms, attitudes, and beliefs that are crucial to motivate knowledge workers to engage in KS. Employees need to be convinced that any KS initiative is essential and conducive to them achieving their personal goals. Cultural barriers such as hoarding knowledge to gather political power in organisations or indifferent attitudes towards KS must be changed to nurture a KS-friendly culture where people are motivated, committed and willing to share their knowledge. KS should be included in the staff development programme, where people at all levels of the organisation are made aware of the role they can play in KS.

3.5.4 Technology Provision

The set of factors that comes under the group 'technology provision' considers the way information and telecommunication technologies are deployed to enhance the effectiveness of KS activities. IT and telecommunication tools are designed to provide accurate and relevant information quickly on demand. However, in addition to the
above generic characteristics, IT and telecommunication tools developed specifically to support KS activities must also possess the following attributes:

- **Accessibility.** Explicit knowledge captured in the system must be easily accessible. It should have an effective search engine so that knowledge workers can locate the knowledge they require, no matter where it is stored in the organisation.

- **Selectivity.** The system should provide a context-sensitive ranking mechanism to filter relevant from irrelevant knowledge in order to avoid overloading the seeker.

- **Retentiveness.** Explicit knowledge should be represented by an efficient codification scheme so that the organisation can standardise the knowledge capturing process. To keep knowledge up-to-date, the system should also provide a time-based versioning mechanism to ensure good housekeeping.

- **Collaboration.** The system should provide connectivity to people, regardless of where they are located. In addition to simple connectivity, it should provide ‘knowledge brokering’ facilities, matching suitable knowledge providers with explicit requests from knowledge seekers. This brokerage facility should act as the bridge, bringing people together to share knowledge and collaborating on solving business problems.

- **Organisational Scale.** The system should provide a company with the means of enforcing a single, corporate-wide, standardised taxonomy by which to classify knowledge objects in the system. The data structures used to store the knowledge objects should be consistent with open standards so that the system can interoperate with standard hardware and software platforms. It should also adopt an integrated architecture so that the explicit knowledge captured can be leveraged beyond the single business unit and be made available throughout the organisation.

### 3.6 Knowledge Sharing Strategies

The following diagram shows the relationship between individual’s cognitive evaluation of the marginal cost and marginal utility of KS, determining whether it is in his interest to engage in KS. It then shows how the factors described by the KSMF may effect changes in knowledge workers’ behaviours to participate in KS, and consequently improve organisational performance. Based on the KSMF, there are four generic KS strategies: IT-focused; organisational infrastructure-focused; sharing channel-focused, or actor-focused. This lays the theoretical foundation for the KSPM to aid the development of the KSMM.

![Knowledge Sharing Activities Diagram](image-url)

**Figure 3-12 KS and its results**

### 3.7 Summary

This chapter has described in detail the KSMF. It spells out the conceptual relationship between KS and knowledge-related operational risk, and how an increase in knowledge-based core competence and a mitigation of operational risk may be used as proxies to justify the business case of a KS programme. The Knowledge Sharing Process Model (KSPM) is then presented which shows the five-stage A-A-A-I-D
model of a typical KS process. The four sets of organisational factors that are critical to the success of a KS program are then presented with the four generic KS strategies: IT-focused, organisational infrastructure-focused, sharing channel-focused, or actor-focused KS strategies.

The operationalisation of this holistic framework is to be presented in the next chapter, which describes the development of the KSMM. The KSMF provides the KSMM a theoretical foundation and a generic, easy to understand framework, such that the methodology may be developed in a structured, systematic way.

4. The Knowledge Sharing Management Methodology

This chapter describes the Knowledge Sharing Management Methodology (KSMM) in detail. Based on the foundation established by the Knowledge Sharing Management Framework (KSMF) in the previous chapter, this chapter operationalises the KSMF by laying out clearly the procedure and deliverables of the methodology. The steps forming the procedure serve as a step-by-step ‘how-to’ guide that managers can use as a tool to go about managing KS in their organisations. Below is an overview of the procedure and deliverables of the methodology.

Table 4-1 Procedure and deliverables of the KSMM

<table>
<thead>
<tr>
<th>Phases</th>
<th>Steps</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase 1</strong></td>
<td>Step 1: Identifying KS objectives.</td>
<td>• A definition of the KS program’s strategic objectives and of the organisational units involved.</td>
</tr>
<tr>
<td>Business process analysis</td>
<td>Step 2: Identifying the scope of the investigation.</td>
<td>• The modelling of an existing business process selected for further investigation.</td>
</tr>
<tr>
<td></td>
<td>Step 3: Modelling the business process.</td>
<td></td>
</tr>
<tr>
<td><strong>Phase 2</strong></td>
<td>Step 4: Mapping knowledge stakeholders.</td>
<td>• A table describing the roles played by various knowledge stakeholders.</td>
</tr>
<tr>
<td>KS practice review</td>
<td>Step 5: Auditing KS channels.</td>
<td>• A table containing the key communication channels used.</td>
</tr>
<tr>
<td></td>
<td>Step 6: Constructing a KS network.</td>
<td>• A diagram describing where knowledge resides.</td>
</tr>
<tr>
<td><strong>Phase 3</strong></td>
<td>Step 7: Mapping the business process model onto the Knowledge Sharing Process Model (KSPM).</td>
<td>• KS scores for each stage of the business process selected for investigation.</td>
</tr>
<tr>
<td></td>
<td>Step 9: Calculating KS scores.</td>
<td></td>
</tr>
<tr>
<td><strong>Phase 4</strong></td>
<td>Step 10: Analysing KS gaps.</td>
<td>• Prioritisation of the areas in the business process where KS improvement is needed.</td>
</tr>
<tr>
<td>KS improvement analysis</td>
<td>Step 11: Correlating the KS gaps with KS management levers.</td>
<td>• A list of recommendations for managers.</td>
</tr>
<tr>
<td></td>
<td>Step 12: Carrying out a fill-gap analysis.</td>
<td></td>
</tr>
</tbody>
</table>
Each section that follows corresponds to a phase in the KSMM, and each sub-section therein corresponds to a single step in the KSMM. Each sub-section includes an introduction to the aim of the step, followed by explanation(s) of the term(s) used if it is/they are not self-explanatory. Each sub-section has a list of instructions (formatted inside a box) describing in detail the actions to be taken for that particular step. Some of the steps may refer to templates listed in Appendix A. These templates are designed as generic recording tools to help the manager move forward in the methodology.

4.1 Phase 1: Business Process Analysis

This phase aims to:

- Reach agreement, with the organisational units involved, upon the KS objectives.
- Identify the scope of the investigation and model the existing business process from a KS perspective.

4.1.1 Step 1: Identifying KS Objectives

Aim

The first step is for management to articulate the objectives of the KS initiative. By the end of this step the linkage between KS and the company's strategic objectives should have been clearly demonstrated.

Area of Business

Managers should identify areas of the business operation that involve substantial amount of effort to transfer knowledge across organisational boundaries or between various stakeholders of the company. If it is not obvious in the business context where knowledge flow actually occurs in the organisational unit, a manager may begin by identifying the organisational units that he is familiar with, for example, various functional or strategic business units. Next, for each of the organisational units identified, he makes a list of its key knowledge-based assets. Noting how these knowledge assets are utilised in the operations of each unit, this identification process highlights how these knowledge assets are utilised in the operations of each unit.

Business Operations Performance

The area of business identified should have direct impact on operational performance. Managing the operational risks of the area of business should in turn influence the success or failure of the operations. Ideally managers should select an area where a direct relationship between the business unit's operational performance and the company's financial performance has already been demonstrated. For example, most companies are aware of the linkage between equipping service engineers with relevant product maintenance knowledge and the reduction in the number of maintenance re-works engineers have to perform at client sites, something which in turn affects customer satisfaction. In this example, managers can frame the problem from a knowledge perspective by articulating the relationship between the knowledge the engineers possess and customer satisfaction.

Identifying Strategic Objectives

Having narrowed down the business context to a specific area of business, the manager must specify explicitly the strategic objectives of the company; the operational goals of the selected area of business, and how the firm's operational goals can help achieve its strategic objectives. Next he must explore the relationship between the strategic objectives and operational goals, particularly how operational success could help achieve competitive advantages for the company in the marketplace. Improvement in KS should then be viewed as a means of attaining operational success and eventually increased performance and competitive advantage. The reason for the discussion is threefold. Firstly, it articulates the objectives of the KS initiative. Secondly, it provides the business case, connecting the value of the KS undertaking to competitive advantages attained by the company (or organisational unit). Thirdly, it reveals any hidden assumption with regards to the framing of the problem. This ensures that the manager does not consider KS as the only viable solution to the problem at the outset, without proper consideration of the alternatives.
Instructions

Identifying Business Areas

1. List the main business areas in the Business Area Identification Table (see appendix §A.1 for the template).

2. Identify the company’s key knowledge assets. List them under the heading “Knowledge Assets”.

3. If the business areas chosen include sub-divisions that utilise the above assets in distinct ways, break the business divisions down into smaller units in the second column. If they do not, simply use the first row of the Business Area Identification Table corresponding to each business area.

Screening the Business Areas

4. For each business area/sub-division listed, can the relationship between operational success and performance of the company be established? Yes / No

5. If the relationship cannot be clearly established, then proceed to another business area/sub-division. If it is shown to be key to the company’s performance, then tick the box in the column “Key Performance Unit”.

6. Does knowledge get transferred across organisational boundaries or hierarchical levels from the business area/sub-division? Yes / No

7. In what form is KS being manifested in the business area/sub-division?

Best Practice Transfer / Sharing of Lessons Learnt / Reusing Knowledge / Coaching of New Staff / Ensuring Availability of Knowledge / Others (Please Specify)

KS is not being manifested

8. Is KS one of the key activities of the business area/sub-division? Yes / No

9. If all the answers to Q. 6 – 8 are ‘no’ with respect to KS, then proceed to the next business area/sub-division. Tick the box in the column “Involve Knowledge Sharing” for the business area/sub-division with the most positive answers.

Identifying Strategic Objectives & Operational Goals

10. Identify the company’s three key strategic objectives. List them under the heading “Strategic Objectives” in the Business Area Identification Table. (Determine what these are by asking questions such as what the company wants most to achieve in the medium and long-term.)

11. Identify the key competitive advantages possessed by the company. List them under the heading “Competitive Advantages” in the Business Area Identification Table.

12. Every strategic objective should be translated into an operational goal that the business area/sub-division needs to fulfil in order to contribute to the attainment of competitive advantages for the company in the marketplace. List the set of operational goals in the Business Area Identification Table.

13. Does improvement in KS contribute to achieving the operational goal? Yes / No

14. Is KS the only available solution? Yes / No

If not, what are the other possible solutions? 

How does a knowledge-oriented solution compare to the others? Clearly More Suitable / Clearly Less Suitable / Unsure
15. Repeat Q. 13 – 14 for each of the operational goals. If the answers to Q. 13 – 14 are both positive, then tick the box in the column “Knowledge Sharing Contribution” that corresponds to each operational goal for which KS is identified as useful.

**Relating KS Objectives To Competitive Advantages**

16. Include only those business areas/sub-divisions with both “Key Performance Unit” and “Involve Knowledge Sharing” boxes ticked. Similarly include only those operational goals / strategic objectives / competitive advantages with the “Knowledge Sharing Contribution” box ticked.

17. Select the area of business that contributes to the most number of operational goals.

18. The fulfilment of the associated strategic objectives in order to attain the competitive advantages becomes the KS objective of the program.

The following should be clear on completing this step:

- The objectives of the KS initiative.
- The linkage between the company’s strategic objectives and the KS objectives.
- The ways an improvement in KS would help the company realise its strategic goals.
- The potential competitive advantages to be attained by an improvement in KS.

**4.1.2 Step 2: Identifying the Scope of the Investigation**

**Prerequisites:**

The methodology views KS from a process perspective. It is therefore useful that the manager has a clear idea of the organisation’s business processes. Diagrams or descriptions of business processes from previous undertakings in mapping the organisation’s business processes can be reused so long as they indicate where knowledge resides in the organisation and the way knowledge flows between various stakeholders.

It would be helpful if the manager knows the operational costs of each process, so that business processes can be ranked in order of their cost burden to the company.

**Aim**

The second step is to define clearly the scope of the investigation by selecting a business process within the business area identified above. Using a business process to describe the situation from a KS perspective, demonstrating where knowledge resides and showing the paths of knowledge transfer from one organisational unit to another, is an effective way of communicating the purpose of the investigation to all those involved.

**Identifying Business Processes**

Business processes can be identified in one of three ways: by analysing the cross-organisational-boundary workflows (Malhotra, 1998); by scrutinising the interfaces between the organisational units (Davenport & Short, 1990), and by identifying the beginning and end points of activities (Davenport et al., 1996). A complete description of a business process should include a picture of its constitute entities (i.e. the organisational units and the stakeholders involved); an account of a structured sequence of activities (logically grouped into stages), and a precise audit of knowledge inputs and outputs. What differentiates the business processes examined in this study from others is that their primary inputs and outputs are various forms of knowledge.

**Business Process Selection Criteria**

While the process’s stages of activities and the participating stakeholders delineate the scope of the investigation, the constituting organisational units serve to define the unit of analysis. An organisational unit can have a formally defined boundary, such as a
business unit, a functional department, a project team, a workgroup or a taskforce. Stakeholders in such organisational units can be formally assigned a role in the knowledge value chain, with clearly defined responsibilities. However, in practice, the organisational unit is often less clearly defined, with a combination of formal units and informal communities of people engaging in KS within a complex network.

**Prioritisation of Candidate Business Processes**

Which process merits most attention can be determined by three factors: the importance of the process under consideration; the potential impact any KS improvement will have on the process, and the operational cost burdens of the process.

- **Importance:** The importance score will be higher if the business process is a core (as opposed to supportive or secondary) process that plays a key role in contributing to the overall objectives of the company (or organisational unit). Rank the business process in order of relative importance with '1' being the most important business process.

- **Extent of impact:** The score for the extent of impact on the organisation will be higher if the business process's knowledge flow spans multiple organisational units and involves many stakeholders. Rank the business processes according to the relative span of knowledge flow, with '1' being the process that will benefit the largest number of business units.

- **Cost burden:** The cost burden score is an indicator of the process's contribution to the overall operational cost of the area of business. Since the value of any improvement in KS will be relative to the cost burden of the process under consideration, ranking the business process in order of cost burden allows the manager to pay attention to the most significant cost centres. Give a score of '1' to the business process that incurs the highest cost in proportion to others in the business area concerned.

**Instructions**

Use the Business Process Selection Table as a guide to filter the candidate business processes. The template of the table adapts Michael Porters' value chain model (Porter & Millar, 1985; Porter, 1985). The generic names of the template (inbound logistics, operations, outbound logistics, etc.) should be replaced by the appropriate names of the business units involved.

**Identifying Business Processes & Organisational Units**

1. Identify a short list of candidate business processes (not more than eight) in the business area selected from step one. List them under the heading "Business Process" in the Business Process Selection Table (see appendix §A.2 for the template). If it is not clear which business processes to include, start by thinking about the key daily routines and significant activities that transform knowledge input into knowledge output. (See the business process and selection criteria sections above.)

2. Identify the key organisational units participating in the business processes. Both internal and external as well as formal and informal units should be included. Replace the generic names in the Business Process Selection Table headings with the appropriate unit names.

**Identifying Paths of Knowledge Transfer**

3. Ask of each of the candidate business processes whether it involves significant knowledge transfer between organisational units and/or stakeholders? Yes / No

4. If it does not, proceed to the next candidate. If it does, put a tick against each organisational unit involved. Where the organisational unit is both a knowledge provider and a knowledge seeker, tick the box twice.
Selecting a Business Process

5. Assign prioritisation scores for importance, extent of impact and cost burdens to every candidate process. (See the prioritisation criteria section above.)

6. Add up the prioritisation scores and record the total for each candidate process.

7. Select the business process with the highest priority (the one with the lowest total score) for further investigation.

8. The selected business process defines the scope and unit of analysis for the investigation.

The following should be clear on completing this step:

- The focus and scope of the investigation and the unit of analysis.
- All the stakeholders and organisational units involved in the business process selected for investigation.
- Why the business process has been chosen and the criteria used for its prioritisation.

4.1.3 Step 3: Modelling the Business Process

Aim

This step conceptualises the selected business process by modelling diagrammatically its key activities and knowledge flows. The model should schematise the paths of knowledge transfer among organisational units as the reader progresses along stages of the business process.

Identifying the Key Stages of the Business Process

As mentioned in the previous step, a complete description of a business process should include a picture of its constituting entities, an account of a structured sequence of activities and a precise audit of knowledge inputs and outputs.

The previous step of the methodology identified the high-level knowledge transfer paths as well as the key organisational units and stakeholders involved in the business process. This step analyses the selected process in more detail, by breaking down the process into logical stages of activities. A business process normally consists of a logical sequence of activities that can be grouped into stages where major transformations of knowledge inputs into knowledge outputs occur. The primary inputs into and outputs from the process should be various forms of knowledge. Managers must consider where knowledge is provided, consumed and transferred, and how the business process depends upon the availability and transfer of knowledge in order to function properly.

The process’s stages may consist of even smaller sub-division of activities and inputs and outputs that groups of stakeholders are jointly responsible for. However, care should be taken not to include too much detail at this stage. It is not necessary to identify every document flow or the myriad communication channels used. Managers should focus on the high-level key stages of activities and major lines of knowledge transfer connecting those stages, keeping the rest simple.

Identifying Events

Identifying key events of the process is associated with a request for or the consumption of knowledge. The gaps in knowledge that existed somewhere among the stages of activities are the reason that trigger the whole business process into action. Furthermore, the final knowledge output of the process should signal the satisfaction of the business needs of the triggering event.
Diagrammatic Conventions for the Business Process Model

An oval is used to represent a stage of the business process (a logical grouping of activities) as well as an event in the process. A directional arrow is used to represent the direction of knowledge flow from the provider unit/stakeholder to the seeker unit/stakeholder. A dotted directional arrow is used to represent the request for knowledge (i.e., a knowledge gap) that causes an event to initiate the business process.

Instructions

Identifying The Key Activities For The Business Process

1. Copy the names of organisational units from the Business Process Selection Table from the last step (§4.1.2) onto the headings of the Business Process Activities Identification Table (see appendix §A.3 for the template).

2. Is there an existing business process map that describes the process's key stages of activities? Yes / No

3. If there is, extract the key stages of activities from the process map. Ensure that the inputs into and outputs from each stage are described from a knowledge flow perspective. (See the section on stages of business process above.)

4. If there is not, identify the key stages of activities by breaking the business process down into logical groups of steps that transform knowledge input into knowledge output. (See the section on stages of business process above.)

5. List the stages of activities under the first column “Process Activities” in the Business Process Activities Identification Table.

Connecting The Stages Of Activities

6. Identify the main paths of knowledge transfer that connect stages of activities.

7. Use the Business Process Selection Table as a guide. Proceed down the table, row by row; write ‘P’ against each organisational unit acting as the knowledge provider. Write ‘S’ against each organisational unit acting as the knowledge seeker.

8. An organisational unit may act as both a provider and seeker.

9. The result of this step is a detailed breakdown of the last step’s results. Hence the two tables should match each other’s knowledge transfer paths.

Identifying Key Event(s)

10. Identify key event(s) by locating the requests for knowledge in the business process. (See the section on event identification above.)

11. Indicate at which stage of the business process that initiating event is triggered.

12. Indicate at which stage of the business process that the business needs have been satisfied.

Drawing The Business Process Model

13. Draw an oval for each activity listed under the column “Process Activities”. (See the section on process model above for diagrammatic conventions.)

14. Proceed down the Business Process Activities Identification Table row by row. For each row, that is for each pair of stages of activities, a knowledge flow connection exists if there is a ‘P’ or ‘S’ marked in any one of the organisational units.

15. Do likewise for the event, using a dotted directional arrow.
16. Review the business process model you have drawn. Discuss in a group whether the model represents the business process schematic knowledge flow in an accurate way.

17. Repeat this step if necessary to clarify the stages of activities, the paths of knowledge flow and the knowledge events.

The following should be clear on completing this step:

- How the business process breaks down into its key stages of activities, significant paths of knowledge flow, and the gaps in knowledge that determine the events to initiate the whole business process.
- How accurately and clearly the diagrammatic model of the business process reflects reality.

4.2 Phase 2: Knowledge Sharing Practice Review

This phase aims to:

- Identify where knowledge resides and map the knowledge stakeholders.
- Audit and rate the KS channels in use.
- Construct a KS network showing the relationships among the knowledge stakeholders and the directions of knowledge flow.

4.2.1 Step 4: Mapping Knowledge Stakeholders

Aim

This step maps the knowledge stakeholders by identifying where knowledge in a company resides and what role each stakeholder plays in enabling knowledge to flow. The results of this step give managers an idea of the current stock of knowledge possessed by the company, what forms it takes and where it is located.

Types of Knowledge Stakeholder

Knowledge stakeholders can be categorised in two ways. Firstly, stakeholders can be categorised into internal or external knowledge agents. **Internal stakeholders** are knowledge agents over whom the management of the organisation has control. **External stakeholders** are knowledge agents over whom the management of the organisation does not have control but who are often important sources of knowledge. Secondly, stakeholders can be categorised into **formal or informal** knowledge agents. Knowledge stakeholders with formally delegated responsibilities act with an organisation mandate to promote and assist in ensuring the smooth flow of knowledge. Knowledge stakeholders participating in an informal capacity are groups of people from different organisational units forming communities to share knowledge among their members. The communities may not have formal organisational boundaries to define the scopes of their activities, nor discrete roles and responsibilities assigned to their members.

Instructions

The Business Process Activities Identification Table (§4.1.3) and the Business Process Model (§4.1.3) should be made available for reference.

<table>
<thead>
<tr>
<th>Identifying Knowledge Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. For each stage of the business process, knowledge stakeholders should be identified on the Knowledge Stakeholder Map in the following order: internal (formal and informal) and external (formal and informal) (see appendix §A.4 for the template).</td>
</tr>
<tr>
<td>2. A stakeholder may participate in more than one stage of the business process and may play more than one role in different situations. However, list each unique stakeholder only once in the table.</td>
</tr>
</tbody>
</table>
### Identifying The Roles Of Stakeholder

3. For each of the stakeholders listed, categorise the role played (knowledge provider, broker or seeker) at each stage of the business process. Mark the process label in the column denoting the role of the stakeholder. Go through all stages of the business process for each stakeholder.

4. One stakeholder may play more than one role depending on the stage of the business process and who the counter-party is. Hence the same process label may appear more than once in different columns (stakeholder roles). A particular role may be played by the same stakeholder at different stages of the process (different process labels may appear in the same column).

5. Steps 1 – 4 may be repeated to ensure that all the roles played by each of the stakeholders are clearly identified at every stage of the business process.

The following should be clear on completing this step:

- A knowledge stakeholder map that shows where knowledge currently resides in the organisation.
- Who the key knowledge stakeholders are and the roles each of them plays.

### 4.2.2 Step 5: Auditing Knowledge Sharing Channels

**Aim**

This step audits the existing KS channels used to transfer knowledge between knowledge providers and knowledge seekers. The audit furnishes an accurate picture of the actual usage of the communication infrastructure currently available in the organisation.

### Medium vs. Channel

A KS channel should be differentiated from a communication medium. A communication medium is a physical facility used to transfer messages between a sender and a receiver. A KS channel is a means people employ to transfer knowledge. For example a staff conference may be used as a means of conveying certain knowledge to a large number of staff members. A business intelligence community is another example. Members of such a community can make use of any suitable communication media available: email, the computer network, the telephone or face-to-face contact to share knowledge about competitors.

### Inflow vs. Outflow

Depending upon the seekers, a sharing channel can serve as a knowledge outflow mechanism if the seeker is an external stakeholder (for example, in the case of a joint venture, certain knowledge is shared with an alliance partner). A sharing channel can also serve as a knowledge inflow mechanism if the provider is an external stakeholder (for example, in the transfer of knowledge from industrial specialists).

### Instructions

The Business Process Activities Identification Table (§4.1.3), the Business Process Model (§4.1.3) and the Knowledge Stakeholder Map (§4.2.1) should be made available for reference.

### Constructing The Knowledge Flow Network Table

1. In the first column of the Knowledge Flow Network Table list all the knowledge providers (see appendix §A.6 for the template). The full list of knowledge providers, both internal and external (formal and informal), may be copied from the Knowledge Stakeholder Map (§4.2.1).
2. In the first row of the Knowledge Flow Network Table, list all the knowledge seekers. The full list of knowledge seekers, both internal and external (formal and informal), may be copied from the Knowledge Stakeholder Map (§4.2.1).

3. Proceeding from the first stage of the business process, go through the Knowledge Flow Network Table row by row for each of the knowledge providers in order.

4. Record all the KS channels employed to connect each pair of knowledge providers and knowledge seekers. Use a label with a running sequence number to denote each unique sharing channel employed (e.g. SC1, SC2, etc.).

5. There may be more than one sharing channel used by the same pair of knowledge providers and knowledge seekers in different circumstances depending on work urgency, knowledge complexity and other personal and organisational contingent factors. In this case include all the channels used, giving each different channel a separate entry in the Knowledge Flow Network Table.

6. Record each uniquely identified sharing channel in the Sharing Channels Audit Table (see appendix §A.5 for the template).

7. Repeat steps 3 - 6 for every stage of the business process. The Knowledge Flow Network Table is effectively a detailed breakdown of the aggregate knowledge flow outlined in the Business Process Activities Identification Table (§4.1.3).

Identifying Knowledge Sharing Channels

8. The Sharing Channels Audit Table should by now display all the channels currently being used by people in the organisation.

9. Include brief descriptions on the characteristics of each sharing channel and how it is being used.

Rating The Use of Sharing Channels

10. Rank each channel’s usage rate, with 1 being the relatively most frequently used channel.

The following should be clear on completing this step:

- Which KS channels are currently in use.
- How and how frequently each KS channel is being used.

4.2.3 Step 6: Constructing A Knowledge-Sharing Network Map

Aim

This step constructs a KS network map that depicts the detailed knowledge flow occurring within the Business Process Model (§4.1.3). The network map shows diagrammatically (1) the relationships among the knowledge stakeholders, (2) the directions of knowledge flow, and (3) the sharing channels used to connect the stakeholders.

Diagrammatic Conventions for The KS Network Map

A KS network map may consist of the following entities: the individual stakeholder, the group stakeholder, the community stakeholder, the organisational stakeholder, knowledge repositories and KS channels.

Individual stakeholders are agents who normally engage in KS exercises individually with their associates. Group stakeholders are formally assigned groups of agents who share knowledge collectively as a unit. Community stakeholders are informal groups of agents who engage in KS exercises organically as a group but without a formal mandate. Organisational stakeholders are organisational units with clear boundaries (departments, divisions, subsidiaries or professional institutions) whose KS activities should best be viewed as those of a whole unit. Knowledge repositories are stores of
knowledge represented in electronic or paper-based records. KS channels are the means identified in (§4.2.2) for transferring knowledge.

The network structure should reflect/represent the 'connectedness' of the KS channels linking knowledge providers to knowledge seekers. The network map therefore provides a quick way of communicating to its reader the current practice of KS practice adopted by the organisation. Below are legends of the entities used to compose the KS network map.

![Legends](image)

Figure 4-1 Diagrammatic conventions for the KS network map

**Instructions**

The Knowledge Stakeholder Map (§4.2.1), the Knowledge Flow Network Table (§4.2.2) and the Sharing Channels Audit Table (§4.2.2) should be made available for reference while constructing the map.

**Mapping The Knowledge Sharing Network**

1. List all the knowledge stakeholders (internal and external, formal and informal) from the Knowledge Stakeholder Map (§4.2.1). Determine whether each stakeholder should best be represented as an individual, as a group, as a community, or as an organisation on the map.

2. On the map, draw symbols representing each of the knowledge stakeholders. Refer to the section “Sharing Network” for the diagrammatic conventions.

3. Use the Knowledge Flow Network Table (§4.2.2) as a guide. For each entry in the table, draw a sharing channel (represented as a directional arrow) connecting the knowledge provider to the knowledge seeker on the map.

4. A directional arrow connecting any two stakeholders on the map indicates that there is a KS relationship between the two parties. The direction of the arrow indicates the direction of the knowledge flow.

5. For each KS channel in the Knowledge Flow Network Table there should be a corresponding directional arrow.

6. In practice organisations often have repositories of various kinds (from electronic databases to paper filing cabinets) that capture explicit knowledge externalised by stakeholders. These repositories tend to act as intermediaries so that the knowledge from providers may reach a larger group of knowledge seekers across geographical and temporal distances. The knowledge broker may often play a role in establishing, promoting or maintaining such repositories. If key repositories exist alongside the sharing channels, include them in the map as well.

**4.3 Phase 3: Critical Assessment of KS Practice**

This phase aims to:

- Map the business process model in (§4.1.3) onto the Knowledge Sharing Process Model (KSPM).
- Use the KS analysis grid to evaluate current KS practice in terms of enablers and blockers.
- Calculate aggregate and normalised KS scores.
4.3.1 Step 7: Mapping The Business Process onto The KSPM

Aim

This step maps the Business Process Model drawn up in (§4.1.3) onto the Knowledge Sharing Process Model (KSPM). The mapping facilitates analyses later on in the methodology so that KS enablers and blockers can be assessed systematically along the business process.

Figure 4-2 The five stages of the KSPM

The Knowledge Sharing Process Model (KSPM)

The KSPM is made up of the five-stage KS process of adoption, adaptation, absorption, integration and dissemination (please refer to §3.4 for a full description). The generic model describes an ideal KS process that may guide business process design from a knowledge-flow perspective. More importantly, the KSPM can be used as a process framework to identify gaps in KS practices between stages of the Business Process Model (§4.1.3), so that actions to improve sharing can ensure effective knowledge flow to all stakeholders concerned. The knowledge gaps due to the presence of KS brokers or the absence of KS enablers will be revealed later in the methodology. The combined effects of blockers and enablers are the factors that cause an organisation to experience the symptoms spelled out in (§4.1.1). Hence, the removal of blockers from and the provision of enablers to the business process are the practical steps that management can take to mitigate KS risks.

Instructions

Mapping The Business Process Onto the KSPM

1. For each stage of the business process model, find the KSPM stage that corresponds most closely to that stage’s activities from the KS point of view.

2. The mapping may not show a one-to-one relationship. Multiple stages of the business process may map onto a single stage of the KSPM, and vice versa. That is, the mapping could exhibit an m-to-m relationship. 'm-to-m' mapping would not affect subsequent analysis so long as the mapping could be clearly traced.

3. Where it is not feasible to map a business process stage onto any of the KSPM stages, that particular stage’s activities may not involve KS. If that is the case, consideration should be given to reviewing the business process model and to whether that particular stage forms part of the coherent description of the way knowledge is transferred and used in the business.

4. Where there is any KSPM stage that no business process stage is mapped onto, consideration should be given to reviewing whether any key KS activities have been omitted from the business process model. For example, if none of the process stages maps onto the dissemination stage of the KSPM, review whether the knowledge dissemination activities have been omitted. If the process model does indeed reflect the reality, then this signals the current practice does not disseminate knowledge gained to other parts of the business.
4.3.2 Step 8: Filling In The Knowledge-Sharing Analysis Grid

Aim

This step carries forward the mapped processes from the last section (§4.3.1) so that managers may use the Knowledge-Sharing Analysis Grid to evaluate current KS practice. The identification of specific KS enablers and blockers will form the basis in later stages of the methodology for furnishing recommendations for specific actions to improve KS.

Enabler and Blocker

The success of KS, that is, whether effective sharing occurs at all in an organisation, is contingent on the presence of a set of actionable factors that serve to facilitate sharing activities. Conversely, the absence of another related set of actionable factors acting as hindrances and barriers impeding sharing activities may also result in successful KS. The former set of actionable factors is termed enablers, and the latter blockers. Formally, an enabler is defined as a mechanism, system, policy, routine, procedure, or enforced standard put in place by management that facilitates the transfer of knowledge so that the knowledge provider and knowledge seeker will both engage in sharing activities with increased probability. Conversely, a blocker, discourages the knowledge provider and knowledge seeker from engaging in KS activities and therefore impedes KS by reducing the probability of that occurring. Management should hence aim to put in place enablers and remove blockers.

The KS Analysis Grid

The Knowledge-Sharing Analysis Grid is a structured analysis tool to evaluate systematically current KS practice. The grid consists of five sections with a table for each section. The first section deals with Knowledge Property. It assesses the fundamental nature of the knowledge concerned and the implications of sharing it. The remaining four sections correspond to the four strategies of the Knowledge Sharing Management Framework (KSMF) – Sharing Channels, the Organisational Infrastructure, Human Factors and the Technology Provision. There are sets of KS factors within each section, and each factor is represented by one row in the table with the name of the factor shown in the second column of the table. Each factor is used to evaluate the effect of current practice on a particular aspect of KS. Dependent on the assessment of the current practice, a factor may be indicated as an enabler, as a blocker or as a neutral factor. If the current practice favours KS in a particular aspect, the corresponding factor should be indicated as an enabler, and vice versa for a blocker. If a particular factor does not apply to the current KS practice, or the current practice does not have any impact on KS (being neither a blocker nor an enabler), it should be indicated as having neutral effect. For example, if the sharing channel does not have sufficient capacity to allow KS work to be carried out effectively, it becomes a blocker. Conversely it becomes an enabler.

The centre part of every analysis grid table consists of columns representing the mapped stages of the business process. Each mapped stage has two columns under its heading. The boxes under the ‘Practice’ column are for indicating whether a particular factor for that mapped stage is an ‘enabler’ (represented by a tick), a ‘blocker’ (represented by a cross) or has a neutral effect (represented by a zero). The ‘Value’ column is for calculating the KS score. The last column of the table is for adding comments useful in the annotation of each KS factor.
Instructions

The Knowledge Stakeholder Map (§4.2.1), Knowledge Sharing Channel Audit (§4.2.2) and Knowledge Sharing Network (§4.2.3) should be made available for reference.

Filling In The Knowledge Sharing Analysis Grid

1. It will be easiest to follow the grid if the generic names of the KSPM are renamed with the corresponding names of the mapped stages of the business process (see appendix §A.7 for the template). The figure above shows the headings having been replaced with the names of the mapped stages.

2. Proceed to fill in the grid section by section. Starting from the first section on Knowledge Property and the first mapped stage of the business process, go through all the factors within the section to evaluate the effect of current practice on KS.

3. If a particular factor is considered to be an enabler, put a tick in the box at the intersection of the row denoting the named factor and the ‘Practice’ column representing the mapped stage of business process. If the factor has a neutral effect, substitute a zero and for a blocker, a cross.

4. Add in useful comments to annotate each KS factor.

5. Repeat steps 2 – 4 for the remaining mapped stages until all the factors have been evaluated for all mapped stages of the business process.

6. Repeat steps 2 – 5 for the remaining sections of the analysis grid: Sharing Channels, the Organisational Infrastructure, Human Factors and the Technology Provision.

7. Note that distinct pairs of knowledge provider and knowledge seeker may have different practices and systems in place. If the business process involves KS between distinctive sub-groups of stakeholders using vastly different practices, then the assessment may be repeated for each distinctive pair of knowledge providers and knowledge seekers.

4.3.3 Step 9: Calculating Knowledge-Sharing Scores

Aim

This step scores the evaluation results of the analysis grid from the previous section (§4.3.2). The KS scores allow a relatively straightforward comparison of one operation’s sharing practice with another’s to be made.

The KS Score

The KS score is an aggregate numeric value that summarises an operation’s current KS practice. The score provides a yardstick for comparing the KS practices of different business processes.

There are two sets of KS scores. The aggregate score based on the arithmetic sum is a straightforward summation of the number of enablers and blockers, with a score for each of the mapped stages of the business process. There are thus as many aggregate
KS scores as there are mapped stages of the business process. These scores summarise all the factors making up the five sections of the grid for their respective mapped stages.

It is also useful to obtain a score breakdown from each of the five sections that make up the aggregate sum to give us an idea of the relative strengths and weaknesses of the current KS practice. Since all the factors are of equal weighting, the sectional sub-total should be normalised according to the percentage contribution of the section concerned, i.e. by scaling the sectional sub-total according to the ratio of the number of factors within each section to the total number of factors within the grid.

**Instructions**

Results from the Knowledge Sharing Analysis Grid (§4.3.2) should be made available to calculate the KS scores.

**Assigning Value To Knowledge-Sharing Factors**

1. Starting from the first section of the Knowledge Sharing Analysis Grid (§4.3.2), work on the first mapped stage of the business process.

2. For all the factors that are evaluated as enablers (marked with ticks in the boxes under the column ‘Practice’), assign a value of ‘1’ in each of the boxes under the column ‘Value’. Similarly assign value ‘0’ for factors evaluated as neutral (marked with zeroes), and ‘-1’ for blockers (marked with crosses).

3. To populate the value for all the factors, repeat step 2 for all the mapped stages of the business process and for all five sections of the analysis grid.

**Calculating The Sectional Knowledge-Sharing Scores**

4. Starting from the first mapped stage of the business process and the first section of the analysis grid, calculate the arithmetical sum by adding up the value of all the factors belonging to that mapped stage and section of the grid.

5. Repeat step 4 for all the mapped stages of the business process and for all five sections of the analysis grid.

6. At the end of step 5, there should be a sectional sum for each mapped stage of the business process.

**Calculating The Aggregate Knowledge Sharing Scores**

7. The aggregate value for the overall score is then the arithmetical sum of all the five sectional sub-totals.

8. There should be an aggregate value for each mapped stage of the business process. These aggregate values are the scores representing the current state of the business process’s KS practice.

**Calculating The Normalised Scores**

9. Starting from the first section of the analysis grid and the first mapped stage of the business process, calculate the normalised score for that mapped stage and section of the grid. This is obtained by multiplying the sectional sum by the percentage contribution of that particular section (see the ‘KS Score’ section above for details).

10. Repeat the above step for all the mapped stages of the business process and for all five sections of the analysis grid.
The following should be clear on completing this step:

- The aggregate KS scores for each mapped stage of the business process.
- The arithmetical sum and normalised score for each of the five sections of the analysis grid and for each mapped stage of the business process.

### 4.4 Phase 4: Knowledge Sharing Improvement Analysis

This phase aims to:

- Analyse KS gaps between the current and target states of knowledge flow.
- Correlate the gaps with the key set of KS barriers that most seriously inhibit knowledge flow.
- Perform a fill-gap analysis to brainstorm for viable solutions to improve KS.

#### 4.4.1 Step 10: Analysing KS Gaps

**Aim**

This step identifies the mapped stage of the business process with the lowest KS score to highlight the gap between the best and the worst sharing practices.

**Low score and high impact**

A low KS score indicates that currently KS is hampered by certain factors. The particular mapped stage of the business process with the lowest score highlights the presence of a bottleneck, throttling the flow of knowledge to other parts of the system. Actions to mitigate knowledge risks should logically focus on the mapped stage with the lowest score, the area in the process that could result in the highest impact on improving the operation’s overall performance in KS.
4.4.2 Step 11: Correlating the KS Gaps with KS Management Levers

Aim

This step correlates the KS gaps with the barriers that impede knowledge flow. This step is designed to highlight the key KS blockers that caused the mapped stage of the business process having low KS score. The manager can then focus resources on those blockers in an effort to improve the company’s KS practice.

Instructions

The sectional sub-totals from KS Scores (§4.3.3) should be made available. This process begins with expanding the radar chart from the previous section (§4.4.1) to include the sectional scores.

Plotting The Detailed Radar Chart

1. Obtain the sectional arithmetical sum for each of the five sections of the Knowledge Sharing Analysis Grid and for each mapped stage of the business process from §4.3.3.

2. Plot the sectional sub-totals onto a radar (or polar) chart, with an axis for each section of the Knowledge Sharing Analysis Grid. Thus, there should be five axes in the radar chart.

3. Each ‘ring’ on the radar chart should correspond to one mapped stage of the business process. Thus, there should be as many ‘rings’ as there are mapped stages.

4.4.3 Step 12: Carrying Out A Fill-Gap Analysis

Aim

This step provides a systemic closure to the methodology by guiding the brainstorming process for viable solutions to improve KS. Each alternative solution should aim to close the gap between the best and the worst KS practices.

Instructions

Having identified the main group of barriers to knowledge flow, it is imperative to identify viable alternatives that can bring about changes in order to achieve the targets set forth in §4.4.1.

Ranking The Knowledge-Sharing Factors

1. KS factors that belong to the section identified in §4.4.2 as the key barriers to knowledge flow should be ranked in descending order of importance.
2. Obtain the sectional normalised scores for each of the five sections of the Knowledge Sharing Analysis Grid and for each mapped stage of the business process from §4.3.3.

3. Plot the normalised scores onto a line graph, showing all the factors with negative normalised scores positioned to the left hand side of the central axis, and all the factors with positive normalised scores to the right hand side of the central axis.

4. The sub-section that consists of more enablers than blockers will be placed towards the right hand side of the graph. Conversely the sub-section that consists of more blockers than enablers will be placed towards the left hand side.

5. The factors belonging to the sub-section positioned on the leftmost of the graph (with lower negative normalised scores) are considered more important in terms of mitigating knowledge risks. The factors belonging to the sub-section positioned on the rightmost of the graph (with higher positive normalised scores) are considered best practice that others can learn from.

Fill-Gap Analysis

6. List the top five KS factors selected in step 5 in descending order of importance in the first column 'Knowledge Barriers' of the Fill-Gap Analysis Table (see appendix §A.8 for the template).

7. For each of the KS factor sub-sections, identify the alternative courses of actions that may improve the current KS practice.

8. Tabulate the alternative recommendations against the benefits and risks.

4.5 Summary

This chapter has laid out in detail the Knowledge Sharing Management Methodology (KSMM). This methodology operationalises the holistic Knowledge Sharing Management Framework (KSMF) presented in Chapter 3. The procedure and deliverables of the methodology serve as a structured, step-by-step 'how-to' guide that provides managers with a tool to go about managing KS. The next two chapters (5 and 6) illustrate the use of the KSMM by applying the methodology in two case studies with two market-leading industrial partners, PowerSys and PrintCo. These two case studies allow rigorous testing of the methodology in real-world situations.
5. The PowerSys Case Study

5.1 Introduction

This chapter presents the case study carried out with PowerSys to illustrate the application of the KSMM. The methodology was used to evaluate the effectiveness of PowerSys's KS practice in their business intelligence community in support of its corporate strategic planning unit. This chapter forms the first of the two case studies that serves to test the KSMM in a real-world situation.

In this case study, the current KS practice at PowerSys was systematically examined to investigate the enablers and blockers influencing KS between organisational units, in order to identify areas of improvement. If one uses the dichotomy of structured and unstructured knowledge, then this case study provides empirical evidence on KS for the unstructured end of the spectrum, since business intelligence comprises of a substantial amount of incomplete, inaccurate and even contradicting signals. The dependence on human networking to make KS work in the business intelligence community also illustrates how robust the methodology is in a situation where a human-focused KS practice is adopted.

Company Background

PowerSys is a power systems manufacturer of propulsion and gas turbine products. It is an established technology leader in the global aerospace, marine and energy markets. In order to secure its future growth and generate long-term sustainable revenues for the company, PowerSys is expanding and becoming a more broadly-based company providing total solutions. PowerSys has begun to exploit its aftermarket opportunities by providing customers with a comprehensive range of after-sales repair and overhaul services and lifetime support for its various products, to complement its core R&D and production capabilities. During this period of transformation, it is crucial for PowerSys to identify its growth markets clearly and invest selectively in new products and services to meet the demands of these newly defined markets. PowerSys has succeeded in increasing its market share in recent
years by having the right portfolio of products and by exploiting the aftermarket opportunities of its established products.

5.2 Phase 1: Business Process Analysis

5.2.1 Step 1: Identifying KS Objectives

1. Identifying the company’s areas of business

KS is crucial to the following three areas of business activities involving PowerSys’s strategic planning unit:

a. The business intelligence (BI) program involves the informal network of business analysts and marketing and corporate planning executives who gather, analyse and share intelligence about market trends, customers, competitors and product technologies. The BI program is a “systematic and ethical way of gathering and analysing information about competitors’ capabilities, vulnerabilities and business intentions as well as general industrial trends” (Groom & David, 2001; Kolb, 1999). BI is not about industrial espionage (Wall, 1974) or theft of company secrets, but about the legal gathering of intelligence about external opportunities and threats so that the company is warned of potential threats and is better positioned to exploit emerging opportunities. BI involves more than a company’s traditional customer or market research functions as it is dedicated to informing management decision-making by providing essential input to the formulation of tactics and strategies. For example, senior executives making strategic decisions about mergers and acquisitions rely on reliable intelligence on potential candidates. And if the customers’ needs are more accurately understood, key investment can be planned more precisely, so that the company is able to bring the right portfolio of products and services to market more quickly than its competitors can.

b. M&A and JV planning are concerned with the preparation of corporate strategic plans on potential mergers and acquisitions or joint venture targets. This planning process is commonly known as the ‘smell test’ at PowerSys since only a small proportion of the plans prepared will be accepted by the board of directors and acted upon. It is important that the business analysts who prepare the M&A / JV plan share their knowledge effectively about external market conditions and what attractive opportunities exist.

c. The corporate strategic planning project debrief is concerned with capturing the experience of the business analysts involved in drafting corporate plans. At the moment knowledge gained during the course of a strategic planning project is not leveraged in any way.

2. Business sub-divisions

PowerSys has a front-back organisational structure. The back-end operational business units (OBUs) are responsible for the design, engineering and manufacturing of power system products. Products manufactured by these back-end OBUs are then marketed by the front-end, customer-facing business units (CFBUs). CFBUs also project manage the delivery of total solutions to customers by packaging the manufactured products with a comprehensive range of systems integration and support services. The CFBUs are organised around the four key market areas: civil aerospace, defence, energy, and marine. The OBUs and CFBUs are supported by corporate functional departments. The functional department investigated in this case study is the Corporate Development Department.

3. Key knowledge assets

Five key domains of knowledge were identified:

a. Market knowledge about current market conditions and medium- and long-term industrial trends.

b. Competitor knowledge about key competitors’ strategic moves and their product offerings. Intelligence on the performance of the competitors’
products can be used as a benchmark against which to measure the performance of PowerSys's own products.

c. **Supplier knowledge** about the relationships between PowerSys, its suppliers and its partners, including knowledge about partners' technical capabilities, reputations and work practices.

d. **Customer knowledge**: detailed understanding of customers' needs as well as knowledge acquired from long-term relationships with certain key customers.

e. **Technical knowledge** about the latest emerging technology likely to have a major impact upon market conditions and the competitive landscape.

**Identifying Strategic Objectives and Operational Goals**

4. **Strategic objectives**

PowerSys concentrates on the following three key strategic objectives:

a. **Identifying new markets and growth opportunities** ahead of the competition so that PowerSys can invest selectively in the development of new products and services to meet anticipated demand.

b. **Capturing the services and support market** by identifying the appropriate, balanced portfolio of products and services so that PowerSys can exploit aftermarket opportunities of its established products in PowerSys's transformation into a total solution provider.

c. **Leveraging competence** in R&D and process engineering by identifying key technologies that are applicable across the four key market areas of civil aerospace, defence, energy and marine.

5. **Competitive advantages**

PowerSys possesses the following three competitive advantages:

a. **Detailed understanding of customers' needs** and the particular industries they operate in so that PowerSys can provide a broad range of products and aftermarket services to fulfil those needs.

b. **Provision of lifetime total care packages** with comprehensive operational support services throughout the whole life of the product, providing everything from spare parts to repairs and product overhauls.

c. **Technology leadership**. PowerSys is trusted to deliver technical excellence in its products and services.

6. **Operational goals**

PowerSys translates the strategic objectives described above into the following operational goals:

a. **Enhancing decision-making capability**. The BI can provide an input to decision-making at any stage of the process. There are typically more alternatives available to decision-makers in the early stages of the process (at point A). As alternatives are eliminated and choices narrowed, the process converges to the final decision (point B). The availability of timely intelligence at point A can prevent costly mistakes as a result of the wrong decision being made, or a sub-optimal decision being reached because attractive alternatives were not identified. Intelligence becomes obsolete and loses its value rapidly. Windows of opportunity for the company to respond to external opportunities and threats begin to disappear rapidly at point B. The goal of KS is to make intelligence available at point A rather than point B, before the decision process has gone too far. In practical terms this means BI activities should be as proactive, timely and regular as
possible, anticipating technical and market changes and disseminating knowledge of opportunities and threats.

Figure 5-1 Availability of intelligence and decision making

b. Enhancing the quality of decisions: Intelligence provided for decision makers should be accurate, complete and reliable. However, the intelligence that has been gathered is seldom complete or accurate; commonly it includes rumours and disinformation spread deliberately by competitors. For example, the announcement by competitors of the development of a new product may not be followed by actual production of the product. Intelligence about the imminent launch by a competitor of a new product may not include its price, or reveal the competitor’s long-term product strategy. Discrete items of intelligence taken separately like this are seldom useful to decision-makers. BI gathered should be collated so that intelligence about many competitors or on a whole range of competing products across the industry may reveal crucial shifts in market trends or competitors' product strategies. And incoming intelligence should also be filtered to verify the content is reliable.

c. Remaining relevant to the business needs of decision-makers: Intelligence should cater to the specific business needs of the decision-maker.

d. Keeping intelligence actionable: Intelligence should be actionable from the decision-maker’s perspective. For example, rather than merely providing the launch date of a competitor’s product, it is more useful to accompany such intelligence with a comparison of PowerSys’s own products with those of the competitor.

e. Keeping aware of the 'big picture': The focus of BI should be balanced between the needs of longer-term strategic planning and resolving short-term tactical issues.

7. Selecting the business area

The BI program was chosen because it involved the sharing of all five knowledge assets between CFBUs, OBU's and Corporate Development. Neither M&A / JV planning nor project debrief was chosen for further investigation because KS involved mainly the Corporate Development Department with less emphasis on inter-organisational unit KS.

<table>
<thead>
<tr>
<th>Table 5-1 Business area identification table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of Business</td>
</tr>
<tr>
<td>BI Program</td>
</tr>
<tr>
<td>OBU's</td>
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<tr>
<td>Corporate Development</td>
</tr>
<tr>
<td>M&amp;A / JV Planning</td>
</tr>
<tr>
<td>OBU's</td>
</tr>
<tr>
<td>Corporate Development</td>
</tr>
<tr>
<td>Project Brief</td>
</tr>
<tr>
<td>OBU's</td>
</tr>
<tr>
<td>Corporate Development</td>
</tr>
</tbody>
</table>
5.2.2 Step 2: Identifying the Scope of the Investigation

Identifying Organisational Units

No formal, independent BI unit exists as such at PowerSys. Rather the OBUs, the four CFBUs and the Corporate Development Department each have their own staff members charged with responsibilities for BI.

a. Customer-facing business units (CFBUs). There is one CFBU for each of the four key market areas: civil aerospace, defence, energy and marine. Within each CFBU, there are sub-units organised around product categories (for example, airlines, helicopters, oil and gas, etc.) and geographical areas (for example, in-country and regional representatives for European or American markets, etc.). CFBUs are business-orientated hence their BI activities focus on competitor, market and customer knowledge. At present, there is no one who is formally charged with managing BI work within the CFBUs. Instead individual managers responsible for marketing, business development or business strategy at each of the CFBUs or sub-units within the CFBUs may, in order to perform their main functions, commission BI work independently. The amount of resources available to BI work varies widely across CFBUs. In Civil Aerospace and Defence CFBUs, there are full-time analysts dedicated to BI work. Whereas in other units (for example Energy) BI work is dependent upon marketing or business development staff who work part-time on BI activities.

b. Operational business units (OBUs). There are many OBUs. The OBU included in this study is the Process Engineering and Technology unit. OBUs are technically orientated, hence their BI activities focus on emerging technologies and knowledge about the technical capabilities of suppliers. As with the CFBUs, there is no formal role dedicated to managing BI work.

c. Functional department – corporate development. As the group of staff members involved in BI work spreads over many locations and departments, it forms an informal, loosely coupled ‘BI community’, independent of the formal organisational hierarchy. Cross-organisational boundary knowledge flow is common where the sources and seekers of intelligence reside at different business units. This BI community is informally co-ordinated by the Corporate Development Department.

![Organisational Structure](Figure 5-2 Organisational structure)

Identifying Knowledge Transfer Paths

There are four key knowledge transfer paths:

1. **Upstream knowledge flow** refers to intelligence propagated by the four CFBUs and passed to the Corporate Development Department for the regular corporate strategic planning process. There is consistent upstream knowledge flow.

2. **Downstream knowledge flow** refers to the feedback given to intelligence providers at CFBUs, such as how the intelligence provided might add...
value to analysis, planning and decision-making. At the moment
downstream knowledge flow occurs only occasionally.

3. Peer-to-peer knowledge flow refers to the direct sharing of intelligence
between analysts across CFBUs. Peer-to-peer knowledge flow occurs on a
case-by-case basis very much dependent upon the working relationship
that exists between the people concerned.

4. Front-back knowledge flow refers to the sharing of intelligence between
CFBUs and OBUs. There is limited ground-level interaction between the
CFBUs and OBUs. Intelligence gathered by OBUs tends to flow to the
back-end engineering and design departments rather than forward to the
front-end CFBUs.

5.2.3 Step 3: Modelling the Business Process
Identifying and Drawing The Business Process Model

1. Key KS activities and connections

The BI business process is conceptualised as comprising the following three main
stages of activities:

a. Intelligence Gathering. This stage accumulates intelligence about market
trends, competitors and competing products, new technologies, alternative
suppliers, customer preferences, new routes to customers and opportunities
for market growth. Usually, intelligence is gathered from a variety of
sources. It may be from internal sources, such as staff who have regular
contact with customers or suppliers, or from external sources such as
published literature or personal contacts within the industry. Intelligence
comes in various forms: it may be documented or anecdotal, structured or
unstructured. It varies in accuracy, completeness, verifiability and, hence,
reliability.

b. Analysis & Decisions. BI is linked closely to the tactical and strategic
management processes, with intelligence as one of the most important
inputs into sales, marketing, corporate strategic planning and business
development decision-making. Analyses such as market forecasting; the
identification of patterns in customer demand; looking at industrial trends;
the comparison of the cost structures of different products; the
investigation of competitors' pricing strategies; the profiling of
competitors and customers; and the assessment of the company's
investment in new technologies etc. are all dependent upon reliable
intelligence. Gathered intelligence is then analysed to test the hypotheses
set forth to answer the questions raised by the business issue.
c. **Intelligence Dissemination.** For BI to add value, intelligence must reach key decision makers quickly and reliably. BI must be successfully disseminated throughout the organization with minimal delay and distortion.

2. **Events that trigger BI activities**

The BI program functions on a Q&A basis, with activities normally initiated by a *business issue* in light of a need to answer certain business questions. Implicit in this model is that BI is a demand-driven activity. Rather than collecting information at the outset that may eventually prove to be useless and irrelevant to the problems at hand (the ‘just-in-case’ approach), BI operates in a ‘just-in-time’ approach. The business issue at hand provides a focus for BI activities. Common business issues that trigger intelligence activities include:

- competitor actions, either anticipated or unanticipated;
- shifts in customer demand or industrial trends, either temporary and cyclical or fundamental and permanent;
- forecasts of future market demands for capacity, based on comparisons of the best-case and worst-case scenarios;
- the need to review corporate strategies and to plan for business development and growth;
- ad-hoc requests from senior management for intelligence about the external environment.

**Table 5-2 Business process activities identification table**

<table>
<thead>
<tr>
<th>Process Activities</th>
<th>Organisational Units</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Civil Aerospace</td>
</tr>
<tr>
<td>Intelligence Gathering</td>
<td>P</td>
</tr>
<tr>
<td>Analysis &amp; Decisions</td>
<td>S</td>
</tr>
</tbody>
</table>

P*: denotes a knowledge provider who provides intelligence occasionally rather than in a consistent manner.

5.3 **Phase 2: Knowledge Sharing Practice Review**

5.3.1 **Step 4: Mapping Knowledge Stakeholders**

**Identifying The Internal Knowledge Stakeholders**

The roles and responsibilities of the following internal knowledge stakeholders are identified, accompanied by a brief description of their domains of expertise:

1. **Regional executives / Overseas vice presidents**

Executives at regional offices and overseas vice presidents of subsidiaries collate weekly reports of customer visits. These visit reports are a form of digested customer intelligence gleaned from local sales representatives and customer executives.

2. **Business analysts / BI analysts**

Business analysts are the key agents in digesting and analysing intelligence collected to convert it into useful knowledge for decision-making. Some business analysts also act as brokers, forwarding intelligence they gather onto the larger BI community.
3. Corporate development executives

Although they do not themselves possess much of the intelligence concerned, staff at the Corporate Development Department perform the crucial co-ordination role that nurtures the informal BI community. The department organises staff conferences and meetings where people in the BI community can interact. It is also involved in planning the IT infrastructure so that it is better able to support the activities of the BI community. Corporate development can provide a global view of the company’s needs for BI.

4. Senior executives

Senior executives such as marketing directors and business development directors at the various CFBUs and in the corporate strategic planning department are the primary recipients of intelligence. The ultimate goal of BI is to enable senior executives to make informed and correct decisions.

5. Sales representatives / customer executives

Sales representatives and customer executives who have regular contact with customers are the primary source of intelligence about customers and market demands. They are often more effective than external sources in providing intelligence to BI analysts. Sales representatives and customer executives are generally more aware of the type of intelligence important to the company. However, sometimes they express reservations about providing customer intelligence, as they fear the diffusion of sensitive customer intelligence may compromise their relationships with clients. On the other hand, the intelligence provided by sales representatives and customer executives is usually tactical and specific to a sales campaign. It may have limited strategic value.

6. Service representatives

Occasionally, service representatives may provide intelligence about customer satisfaction with the company’s products to the BI community. However, most service representatives are not aware of the importance of forwarding intelligence or of the kind of intelligence that would be useful to BI work.

7. Design engineers

Design engineers provide intelligence about technologies and manufacturing processes to the OBU. They seldom provide intelligence to the CFBUs or the Corporate Development Department as usually they do not understand the relevance of the knowledge they hold to the business of the CFBUs. Training may be required to educate design engineers about the value of the knowledge they possess. It may also be necessary to observe discretion about disclosing to the public what technologies the company has developed.

8. Procurement staff

Staff in the procurement departments who have close contact with the supplier communities are another key source of intelligence. However, they tend to be relatively unaware of the importance of BI work and the value of the knowledge they possess. Training may be needed to help staff in the procurement department to understand the role that they can play and to see the company’s ‘big picture’.

Identifying The External Knowledge Stakeholders

External sources of intelligence include published materials commonly found on the web, information provider databases, industry analysts’ reports, journal articles, conference reports and the press. Besides these documented sources of intelligence, external knowledge stakeholders who play a role to the provision of intelligence are identified as follows:

9. Universities and research institutes

Technical papers published by university researchers and conferences organised by research institutes are valuable sources of knowledge on the next generation of
technologies. These are key sources for intelligence about manufacturing efficiency, manufacturing processes and production technologies.

10. Professional associations and trade groups

Technical forums and special interest groups (SIG) of professional associations and trade groups are good venues at which to gather knowledge on the power systems industry as a whole and data on performance benchmarking and industrial best practices.

11. Consultants

External consultants are useful a sources of intelligence providing unbiased views about general market and technology trends.

12. Competitors

Trade conventions and product launches are good opportunities for gathering intelligence about competitors. Much of this intelligence is in the public domain.

13. Suppliers / system integrators / business partners

Suppliers, system integrators and business partners are valuable sources of intelligence from whom primary intelligence about technological and market trends and secondary intelligence on competitors and customers can be gleaned. Business partners also provide intelligence about opportunities for new markets and innovative applications of the company’s products.
5.3.2 Step 5: Auditing Knowledge Sharing Channels

Identifying Knowledge Sharing Channels

1. The informal BI community

The informal network established by the BI community is the most commonly used medium for sharing intelligence. The community has matured from merely sharing sources of published reports as it did when it was established several years ago to being an extensive human network with contacts that span almost every business unit. The informal communal structure provides the community with a forum in which to exchange competitor intelligence that is independent of the formal organisational hierarchy. The community provides an essential link between sources of intelligence and BI analysts. Presently there are more than 200 members in the network with about 50 people actively involved in BI work. The BI community is an invaluable knowledge asset to PowerSys.

The BI community has a two-tiered structure. BI analysts from the same business units form the first tier. Volunteers are nominated to be the ‘interface nodes’ representing their own business units. These ‘interface nodes’ then form the second-tier network that co-ordinates inter-business unit knowledge flow across the network. Naturally intra-business unit intelligence flow occurs more readily within the first-tier network than inter-business unit flow across the second-tier network. For instance, for intelligence to flow between the OBUs and the CFBUs, intelligence must be forwarded to the respective interface nodes. It must then propagate through the second-tier network to peer interface nodes in other units. Finally, it can be disseminated downward to the destination business units. There are few direct interactions between BI analysts at different business units, and interface nodes do not normally collect intelligence directly from first-tier contacts outside of their own business units. They depend upon their peer interface nodes to forward the intelligence they require to them. As there is a practical limit to the number of contacts any BI analyst can realistically maintain, the interface nodes perform the knowledge broker function to enlarge the analysts’ access to intelligence.

In addition to being the most prominent contact in the community, the interface nodes also perform a ‘gatekeeper’ function, filtering intelligence flowing into and out of the business units. The interface nodes decide whether to forward intelligence to their peer contacts in other business units, depending on their understanding of the other units’ need for intelligence. Intelligence determined as irrelevant by the interface nodes is normally discarded to minimise information overload.

Intelligence is shared when there are specific questions raised by members of the community. However, due to the informal nature of this community, the reach of intelligence is dependent upon the personal contacts of the members in the network and their working relationships with others in the community. For example, BI analysts in the civil aerospace CFBU are better connected than those in other CFBUs; hence the intelligence network at civil aerospace reaches almost every division at PowerSys as well as most of its customers and suppliers. Some BI analysts are so familiar to their fellow colleagues that they become the ‘default’ BI contact in the community that ‘catches all’ intelligence from external sources. However, this informal mechanism relies on personal contacts, individual working relationships and mutual trust – i.e. the ‘well-connectedness’ of the analyst. There is no guarantee that intelligence will flow through the network when it is needed.

2. BI staff conferences and workshops

The BI staff conferences and workshops are annual events focusing on BI work. Most people who attended the conference welcome the opportunity to meet colleagues in the BI community. The conference provides an ideal opportunity for people from various business units to establish new contacts and ‘rekindle’ old ones, building trust and closer working relationships. For novices, the conferences and related workshops provide an initial training in BI work. For experienced BI analysts, the conferences and workshops provide opportunities for sharing best practices, ideas, and sources of intelligence.
3. The email distribution list

A 'news alert' email distribution list is used to broadcast generic intelligence to people who have indicated their interest in BI. The alert is sent out regularly and is useful for updating people about market developments and trends. However, due to the generic nature of the intelligence provided, it does not always provide the most valuable knowledge. Furthermore, it is a 'push' approach; the relevance of the content depends upon how well the provider understands the seeker's BI needs.

4. Meetings and briefings

Face-to-face meetings are arranged periodically for the discussion of community-wide BI issues. Cross-functional teams with members drawn from different business units are occasionally formed to collaborate on analysing PowerSys's BI capability; the results are then presented to senior executives and the BI community in formal briefings. These formal meetings allow the participating BI community to set and agree on specific targets as well as to maintain a clear focus. They also provide people with the opportunities to work together to build trust and positive working relationships.

5. Formal communication channels

Intelligence flow may be initiated following formal requests from business units for knowledge about specific issues. BI analysts at CFBU's regularly solicit competitor intelligence and customer feedback from sales and marketing staff following sales campaigns and customer visits. However, intelligence gathered in this way usually comes 'in snippets'. Furthermore, sales and marketing staff do not necessarily have the motivation to provide intelligence that is detailed enough to be useful for BI analysis and decision-making.

6. Electronic document management systems

Electronic document management systems are the main vehicle for sharing intelligence within each individual CFBU. Each CFBU has its own document management system, ranging from simple workgroup file servers to electronic filing systems. Due to the fact that systems located at individual CFBU's local area network are inaccessible to people outside of the CFBU, intelligence sharing across CFBU is not sufficiently supported by the IT infrastructure. Much intelligence is currently buried in documents stored at individual CFBU's local systems and remains unknown and inaccessible to people at other CFBU's.

7. The BI bulletin board

An electronic newsletter is published regularly on the corporate Intranet. Due to security concerns, the Intranet carries only intelligence that is in the public domain. Because of this, few people have made much use of the bulletin board. A further drawback is that the corporate Intranet is not accessible to people based in remote offices. There is a degree of overlap between what appears on the bulletin board and what is disseminated through the email distribution list.

8. The BI mailbox

An electronic mailbox is used to capture intelligence from external sources. The mailbox was designed to extend the reach of the BI community by providing a 'default' route along which intelligence flowing inwardly into the company might be captured. The mailbox is currently managed by civil aerospace CFBU and few people have hitherto made use of it.

9. Printed circulars

A hardcopy BI handbook called the Blue Book is circulated to all the business units. However, the Blue Book focuses on civil aerospace CFBU. Other business units have limited use for it. Furthermore, much of the content of the Blue Book is available on the Internet. The content should be reviewed to focus on value-added analysis rather than merely facts about competitors.
10. The electronic discussion forum

A virtual forum has been set up for people to post queries and discuss BI issues. However, so far it has attracted little participation. People consider the topics posted too generic, too theoretical or too obvious. People cannot relate the topics posted on the forum directly to their work. Furthermore, they are unsure about what they will get in return for the time they spend answering questions. People consider it too time consuming to engage in online discussions, especially since their questions do not get timely responses.

11. The corporate portal

The corporate portal is a new IT infrastructure initiative providing one-stop access to corporate information. Within this portal framework, BI documents will be accessible throughout the company via standardised Web-based technologies. The portal will act as a gateway to knowledge, providing a single common point of access to intelligence documented anywhere within the company.

<table>
<thead>
<tr>
<th>Sharing Channels</th>
<th>Description</th>
<th>Status of Use</th>
<th>Usage Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal BI Community</td>
<td>An informal network established by the BI community to share intelligence.</td>
<td>The most flexible and commonly used method of sharing intelligence. Intelligence is shared amongst members of the community based on their personal contacts in the network.</td>
<td>1</td>
</tr>
<tr>
<td>BI Staff Conferences &amp; Workshops</td>
<td>The BI staff conferences and workshops are an annual event focusing on BI work.</td>
<td>Many find it useful for establishing new contacts, maintaining existing relationships and sharing best practices.</td>
<td>2</td>
</tr>
<tr>
<td>Email Distribution List</td>
<td>A ‘news alert’ is used to broadcast generic intelligence to people who have indicated their interest in BI.</td>
<td>The alert is sent out regularly to keep people updated about what is happening in the market.</td>
<td>3</td>
</tr>
<tr>
<td>Meetings &amp; Briefings</td>
<td>Face-to-face meetings to discuss intelligence matters.</td>
<td>These formal meetings and briefings are organised on a monthly and quarterly basis.</td>
<td>3</td>
</tr>
<tr>
<td>Formal Communication Channels</td>
<td>Formal requests from business units for intelligence.</td>
<td>Intelligence about competitors and customers are regularly solicited from sales and marketing staff.</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sharing Channels</th>
<th>Description</th>
<th>Status of Use</th>
<th>Usage Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic Document Management Systems</td>
<td>Document management systems set up locally at individual CFBUs.</td>
<td>These systems are the main vehicle for sharing intelligence within individual CFBUs, but not across business units.</td>
<td>3</td>
</tr>
<tr>
<td>BI Bulletin Board</td>
<td>An electronic newsletter publishing public domain intelligence on the corporate Intranet.</td>
<td>A passive means of disseminating intelligence with limited use.</td>
<td>4</td>
</tr>
<tr>
<td>BI Mailbox</td>
<td>An electronic mailbox is used to capture intelligence from external sources.</td>
<td>The mailbox is currently managed by civil aerospace CFBUs but experiences limited use.</td>
<td>4</td>
</tr>
<tr>
<td>Printed Circulars</td>
<td>A hardcopy BI handbook called the Blue Book.</td>
<td>It is circulated to all business units but has limited use, as much of the content is available on the Internet.</td>
<td>4</td>
</tr>
<tr>
<td>The Electronic Discussion Forum</td>
<td>A virtual forum for people to post queries and discuss BI issues.</td>
<td>Limited success because of limited participation.</td>
<td>5</td>
</tr>
<tr>
<td>Corporate Portal</td>
<td>A gateway to BI.</td>
<td>To be deployed soon.</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Table 5-5 Knowledge flow network table

<table>
<thead>
<tr>
<th>Provider</th>
<th>Seeker</th>
<th>Senior Executives</th>
<th>Corporate Development Executives</th>
<th>BI Analysts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regional Executives</td>
<td>P1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BI Analysts</td>
<td>P2</td>
<td>P3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corporate Development Executives</td>
<td>P3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sales Reps</td>
<td>P1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Reps</td>
<td>P1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Engineers</td>
<td>P1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procurement Staff</td>
<td>P1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Researchers</td>
<td>P1</td>
<td></td>
<td>P1</td>
<td></td>
</tr>
<tr>
<td>Professional Associations</td>
<td>P1</td>
<td></td>
<td>P1</td>
<td></td>
</tr>
<tr>
<td>Consultants</td>
<td></td>
<td>P1, P2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Competitors</td>
<td></td>
<td></td>
<td>P1</td>
<td></td>
</tr>
<tr>
<td>Suppliers &amp; Partners</td>
<td></td>
<td></td>
<td>P1</td>
<td></td>
</tr>
</tbody>
</table>

5.3.3 Step 6: Constructing A Knowledge-Sharing Network Map

Here is a map of the KS network:
5.4.2 Step 8: Filling In The Knowledge-Sharing Analysis Grid

Filled templates of the KS analysis grid are shown in the following pages.

<table>
<thead>
<tr>
<th>Knowledge Property</th>
<th>Intelligence Gathering</th>
<th>Analysis &amp; Decisions</th>
<th>Intelligence Dissemination</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Practice Value</td>
<td>Practice Value</td>
<td>Practice Value</td>
<td></td>
</tr>
<tr>
<td>1. Knowledge Content</td>
<td>0</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1.1 Reliability</td>
<td>0</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1.2 Currency</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1.3 Background Knowledge</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1.4 Form &amp; Presentation</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1.5 Language &amp; Jargons</td>
<td>×</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>1.6 Completeness</td>
<td>×</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>1.7 Secrecy &amp; Confidentiality</td>
<td>×</td>
<td>-1</td>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>2. Knowledge Context</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Domain Specificity</td>
<td>×</td>
<td>-1</td>
<td>-1</td>
<td></td>
</tr>
<tr>
<td>2.2 Inter-Dependence</td>
<td>×</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>2.3 Context Sensitivity</td>
<td>×</td>
<td>-1</td>
<td>-1</td>
<td></td>
</tr>
</tbody>
</table>

Intelligence reaches the BI community when needed.
Members are all familiar with business intelligence issues.
BI comes in individual items and different forms.
Snippets of information. Hard to see the complete picture.
Confidentiality agreement, legal regulation, sensitive nature of information.
Different units have different interests and focus.
Snippets of information need piecing together.
Intelligence can be very tactical & specific to a project; need to take strategic views and be aware of the 'big picture'.

Figure 5-3: Critical Assessment of KS Practice

5.4.1 Step 7: Mapping The Business Process onto The KSPM

The following diagram shows the mapping from the BI business process model to the KSPM.
### Organisational Infrastructure (1 of 2)

<table>
<thead>
<tr>
<th>Intelligence Gathering</th>
<th>Analysis &amp; Decisions</th>
<th>Intelligence Dissemination</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice</td>
<td>Value</td>
<td>Practice</td>
<td>Value</td>
</tr>
<tr>
<td>1. Formal Structure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Delegation of Roles And Responsibilities</td>
<td>x</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>1.2 Empowerment</td>
<td>x</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>1.3 Team Structure</td>
<td>x</td>
<td>-1</td>
<td>x</td>
</tr>
<tr>
<td>(-3)</td>
<td>(-1)</td>
<td>(-1)</td>
<td>(-3)</td>
</tr>
<tr>
<td>2. Political &amp; Power Structure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Knowledge Power</td>
<td>x</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>2.2 Sharing Champion</td>
<td>✓</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>(0)</td>
<td>(0)</td>
<td>(0)</td>
<td>(-2)</td>
</tr>
<tr>
<td>3. Knowledge Sharing Network</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Scope</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
</tr>
<tr>
<td>3.2 Network Connection Strength</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
</tr>
<tr>
<td>3.3 Network Fragmentation</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
</tr>
<tr>
<td>3.4 Integrative Synergy</td>
<td>x</td>
<td>-1</td>
<td>x</td>
</tr>
<tr>
<td>3.5 Network Identity</td>
<td>x</td>
<td>-1</td>
<td>x</td>
</tr>
<tr>
<td>3.6 Trigger Mechanism</td>
<td>✓</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>(2)</td>
<td>(1)</td>
<td>(0)</td>
<td></td>
</tr>
</tbody>
</table>

### Sharing Channels

<table>
<thead>
<tr>
<th>Intelligence Gathering</th>
<th>Analysis &amp; Decisions</th>
<th>Intelligence Dissemination</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice</td>
<td>Value</td>
<td>Practice</td>
<td>Value</td>
</tr>
<tr>
<td>1. Communication Channel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Capacity</td>
<td>x</td>
<td>-1</td>
<td>✓</td>
</tr>
<tr>
<td>1.2 Cost</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1.3 Consistent Delivery</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
</tr>
<tr>
<td>1.4 Complex Knowledge Flow</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
</tr>
<tr>
<td>1.5 Channel Accessibility</td>
<td>x</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>1.6 Experience of Use</td>
<td>-</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>(0)</td>
<td>(3)</td>
<td>(3)</td>
<td></td>
</tr>
<tr>
<td>2. Channel Connection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Reciprocal Knowledge Flow</td>
<td>x</td>
<td>-1</td>
<td>x</td>
</tr>
<tr>
<td>2.2 Mediating Agents</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
</tr>
<tr>
<td>2.3 Co-Ordination Process</td>
<td>x</td>
<td>-1</td>
<td>x</td>
</tr>
<tr>
<td>2.4 Choice of Sources of Knowledge</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
</tr>
<tr>
<td>2.5 Personal Focus</td>
<td>0</td>
<td>0</td>
<td>x</td>
</tr>
<tr>
<td>2.6 Multiple Pathways</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
</tr>
<tr>
<td>(1)</td>
<td>(0)</td>
<td>(-2)</td>
<td></td>
</tr>
</tbody>
</table>

### Intelligence Analysis

1. Fonnal Structure
   - Delegation of Roles And Responsibilities: Lack of clearly defined roles and responsibility; no formal role assigned to be accountable for BI work within business units.
   - Empowerment: Mandate is required for cross-unit co-operative intelligence work.
   - Team Structure: Current structure causes erection of boundaries at business sectors.

2. Political & Power Structure
   - Knowledge Power: 'Knowledge-is-power' thinking; some expressed frustration in getting information from other business sectors.
   - Sharing Champion: Stable staffing; but lack of a champion who promotes sharing.

3. Knowledge Sharing Network
   - Scope: The network reaches almost all divisions.
   - Network Connection Strength: Close contacts; the intelligence network is kept warm.
   - Network Fragmentation: Intelligence contacts are well known within individual units only. 1st-tier network is well connected; 2nd-tier is not.
   - Integrative Synergy: Individual units have their own objectives; does not have synergy or global view.
   - Network Identity: People identify with their close circles, not necessarily with the BI community.
   - Trigger Mechanism: Discussion forum, newsletter, conference.

4. Communication Channel
   - Capacity: Limited resources.
   - Cost: Direct interaction & discussion possible.
   - Consistent Delivery: Direct interaction & discussion possible.
   - Complex Knowledge Flow: Direct interaction & discussion possible.
   - Channel Accessibility: Informal tiered network of personal contacts; people in the network are not always available due to other work commitments.
   - Experience of Use: Direct interaction & discussion possible.

5. Channel Connection
   - Reciprocal Knowledge Flow: Lack of feedback & visibility to available intelligence.
   - Mediating Agents: Gatekeeper role performed by 'interface node'. Network contacts are not shared.
   - Co-Ordination Process: Ad-hoc and informal process.
   - Choice of Sources of Knowledge: Multiple public & private sources of intelligence.
   - Personal Focus: Geographical dispersion & remote units inhibit intelligence analysis & dissemination activities.
   - Multiple Pathways: Well-connected network.
### Intelligence Analysis & Intelligence Human Factors Gathering Decisions Dissemination Comments

<table>
<thead>
<tr>
<th>Practice</th>
<th>Value</th>
<th>Practice</th>
<th>Value</th>
<th>Practice</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Motivation &amp; Rewards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Motivation of Knowledge Provider</td>
<td>×</td>
<td>-1</td>
<td>✓</td>
<td>1</td>
<td>×</td>
</tr>
<tr>
<td>“What is it in for me?” People do not seem interested in the selfless act of sharing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 Motivation of Knowledge Seeker</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
</tr>
<tr>
<td>People like to learn about best practice; welcome help and support from Corporate Development.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Incentives</td>
<td>×</td>
<td>-1</td>
<td>×</td>
<td>-1</td>
<td>×</td>
</tr>
<tr>
<td>No reward or compensation linked to intelligence sharing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Morale</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Satisfaction with the status quo.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 Satisfaction</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>×</td>
</tr>
<tr>
<td>People are unsure about the return for their time spent in sharing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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### Training And Cognitive Issues

<table>
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<th>Value</th>
<th>Practice</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Provision of Training</td>
<td>×</td>
<td>-1</td>
<td>×</td>
<td>-1</td>
<td>×</td>
</tr>
<tr>
<td>No formal training provided.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 Awareness</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
<td>1</td>
<td>×</td>
</tr>
<tr>
<td>People are more aware of the importance of gathering intelligence than sharing it.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 Absorptive Capability</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Different units have different capability / tools.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4 Retentive Capability</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Different units have different capability / tools.</td>
<td></td>
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</table>

<table>
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</table>

### Relationships

<table>
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<tr>
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<th>Practice</th>
<th>Value</th>
<th>Practice</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Trust</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
</tr>
<tr>
<td>Personal contacts are well established.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
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<th>(1)</th>
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</table>

### Organisational Infrastructure

<table>
<thead>
<tr>
<th>Practice</th>
<th>Value</th>
<th>Practice</th>
<th>Value</th>
<th>Practice</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Management Commitment &amp; Alignment of Objectives</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 Management Leadership</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
<td>1</td>
<td>×</td>
</tr>
<tr>
<td>Need to secure commitment from each organisation.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2 Shared Guiding Vision</td>
<td>×</td>
<td>-1</td>
<td>×</td>
<td>-1</td>
<td>×</td>
</tr>
<tr>
<td>No clear strategy; separation between units.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3 Alignment of Objectives</td>
<td>×</td>
<td>-1</td>
<td>×</td>
<td>-1</td>
<td>×</td>
</tr>
<tr>
<td>Different units have their own agendas.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4 Business Environment</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
<td>1</td>
<td>×</td>
</tr>
<tr>
<td>Some support intelligence sharing; some don’t find the need.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5 Investment</td>
<td>×</td>
<td>-1</td>
<td>×</td>
<td>-1</td>
<td>×</td>
</tr>
<tr>
<td>Insufficient time &amp; limited resources allocated. Varying IT systems inhibit seamless inter-connection of networking facilities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<table>
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<tr>
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### Technology Provision (1 of 2)

<table>
<thead>
<tr>
<th></th>
<th>Intelligence Gathering</th>
<th>Analysis &amp; Decisions</th>
<th>Intelligence Dissemination</th>
<th>Comments</th>
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<tr>
<td></td>
<td>Practice</td>
<td>Value</td>
<td>Practice</td>
<td>Value</td>
</tr>
<tr>
<td>1. Accessibility</td>
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</tr>
<tr>
<td>1.1 Efficiency</td>
<td></td>
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<tr>
<td>1.2 One-Stop Portal For Knowledge</td>
<td></td>
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</tr>
<tr>
<td>1.3 Knowledge Flow Time Lag</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>(0)</td>
<td></td>
<td>(3)</td>
<td></td>
</tr>
<tr>
<td>2. Selectivity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Relevance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 Precision</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 Contextual Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4 Ranking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(3)</td>
<td></td>
<td>(1)</td>
<td></td>
</tr>
<tr>
<td>3. Retentiveness</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Knowledge Capture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2 Accuracy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3 Obsolescence</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>(1)</td>
<td></td>
<td>(1)</td>
<td></td>
</tr>
</tbody>
</table>

### Human Factors (2 of 2)

<table>
<thead>
<tr>
<th></th>
<th>Intelligence Gathering</th>
<th>Analysis &amp; Decisions</th>
<th>Intelligence Dissemination</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Practice</td>
<td>Value</td>
<td>Practice</td>
<td>Value</td>
</tr>
<tr>
<td>4. Culture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.1 Professional Praxis &amp; Community Norms</td>
<td>✓</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.2 Knowledge Ownership</td>
<td>✓</td>
<td>1</td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td>4.3 Mindsets &amp; Attitudes</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.4 Organisational Culture</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.5 Peer Pressure</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.6 Knowledge Divisiveness</td>
<td>x</td>
<td>-1</td>
<td>x</td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td></td>
<td>(0)</td>
<td></td>
</tr>
</tbody>
</table>
### 5.4.3 Step 9: Calculating Knowledge-Sharing Scores

The KS scores are tabulated below:

<table>
<thead>
<tr>
<th>Knowledge Property</th>
<th>Intelligence Gathering</th>
<th>Analysis and Decisions</th>
<th>Intelligence Dissemination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Content (1)</td>
<td>-1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Knowledge Content (1)</td>
<td>-3</td>
<td>-2</td>
<td>0</td>
</tr>
<tr>
<td>Sharing Channels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Communication Channel (2)</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Channel Connection (2)</td>
<td>1</td>
<td>0</td>
<td>-2</td>
</tr>
<tr>
<td>Organisational Infrastructure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formal Structure (3)</td>
<td>-3</td>
<td>-1</td>
<td>-3</td>
</tr>
<tr>
<td>Political &amp; Power Structure (3)</td>
<td>0</td>
<td>0</td>
<td>-2</td>
</tr>
<tr>
<td>Knowledge Sharing Network (3)</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Management Commitment (3)</td>
<td>-1</td>
<td>-1</td>
<td>-5</td>
</tr>
<tr>
<td>Human Factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivation &amp; Rewards (4)</td>
<td>-1</td>
<td>1</td>
<td>-2</td>
</tr>
<tr>
<td>Training And Cognitive Issues (4)</td>
<td>0</td>
<td>0</td>
<td>-2</td>
</tr>
<tr>
<td>Relationships (4)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Culture (4)</td>
<td>1</td>
<td>0</td>
<td>-5</td>
</tr>
<tr>
<td>Technology Provision</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessibility (5)</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Selectivity (5)</td>
<td>-3</td>
<td>0</td>
<td>-3</td>
</tr>
<tr>
<td>Retentiveness (5)</td>
<td>-1</td>
<td>1</td>
<td>-1</td>
</tr>
<tr>
<td>Collaboration (5)</td>
<td>-2</td>
<td>-2</td>
<td>-2</td>
</tr>
<tr>
<td>Organisational Scale (5)</td>
<td>-2</td>
<td>-2</td>
<td>-2</td>
</tr>
</tbody>
</table>

**Sectional sub-total**:  
Knowledge Property: -4 (-0.36)  2 (0.18)  4 (0.36)  
Sharing Channels: 1 (0.08)  3 (0.25)  1 (0.08)  
Organisational Infrastructure: -2 (-0.13)  -1 (-0.06)  -10 (-0.63)  
Human Factors: -1 (-0.06)  2 (0.13)  -8 (-0.50)  
Technology Provision: -8 (-0.50)  0 (0.00)  -8 (-0.50)  

**Knowledge Sharing Score**: -12 (-0.17)  6 (0.08)  -21 (-0.30)

*Note: The sectional sub-total and KS scores are shown with aggregate values followed by normalised scores in parentheses.*
5.5 Phase 4: Knowledge Sharing Improvement Analysis

5.5.1 Step 10: Analysing KS Gaps

The following radar diagram shows the normalised KS score of the BI business process. Analysis and decisions has the best practice, whilst intelligence dissemination achieved the lowest score.

![Business Intelligence Sharing Score (Normalised)](image)

**Figure 5-7 KS score**

**Intelligence gathering**

All four of the CFBUs and the OBU investigated have high intelligence gathering capabilities. Although the intelligence gathering process is ad-hoc and reactive to business issues and senior management requests, intelligence can be gathered quickly when it is needed. BI analysts are confident that it is unlikely that important issues escape the BI community's notice.

The majority of the customer-facing staff (for example sales reps and customer executives) are aware of the kinds of intelligence relevant and useful to BI work. The BI community at PowerSys has a well-connected network with established internal and external sources for gathering intelligence. The network enables knowledge flow independent of the formal organisational hierarchy. The community's contacts are also well known to staff within their own business units. Some BI analysts act as 'catch-all' contacts in the network to whom intelligence will be forwarded 'by default'.

However, the informal nature of the BI community and the lack of a systematic process in gathering intelligence result in:

- BI analysts not necessarily being aware of the existence of useful intelligence in another business unit. Knowledge is not shared and efforts are duplicated between business units.
- The lack of a standardised structure for capturing and categorising intelligence making intelligence sharing more difficult for the person who tries to locate the required intelligence.
- The community not having an consistent focus or reach among the four CFBUs. The flow of intelligence across the informal network is dependent upon the personal contacts of the individuals concerned. The network has a tiered structure, so that not every member of the BI community is aware of his peer contacts in other business units.
- People outside the immediate BI community are not necessarily being aware of the value of the intelligence they possess.

In summary, PowerSys has an effective, consistent upstream knowledge flow from the CFBUs and the OBU to the Corporate Development Department, but peer-to-peer knowledge flow between CFBUs relies upon how well connected the persons involved are with colleagues in other CFBUs.

**Analysis and decisions**

Not all business units have access to the same set of analytical tools or possess the same level of analytical capability. Some business units have stronger analytical capability than others, and some units have fewer resources available for analysing the intelligence they have gathered, especially about predicting competition actions and market trends. This uneven distribution of resources hinders the sharing of
intelligence because if it does not possess the same set of tools, one unit cannot simply adopt the analysis method used successfully at another.

**Intelligence dissemination**

The informal BI community is a very flexible mechanism for disseminating intelligence across the organisation. It is adaptable to ad-hoc and unforeseen requests for intelligence. The network interface ‘nodes’ of the BI community plays a key gatekeeper role by filtering intelligence disseminated throughout the community. This filtering helps avoid overloading BI analysts in other business units with intelligence irrelevant to their needs. As well as enabling intelligence flow that is more focused on specific needs, the gatekeeper may also translate intelligence to present it from a perspective meaningful to the seeker.

On the other hand, intelligence dissemination via the informal community relies upon the knowledge provider to know what intelligence to pass and to whom. Hence, intelligence flow depends upon the trust and the working relationship established between the parties involved, as well as how well the provider understands the seeker’s needs for BI. Certain staff may not have sufficient understanding of the ‘big picture’. They may not forward intelligence potentially crucial to another business unit deeming it unimportant or unrelated. Valuable intelligence may be discarded or not acted upon. Secondly, the information-overloading problem can simply shift to the gatekeeper, creating a bottleneck in the knowledge flow path. Thirdly, the gatekeeper creates an additional layer of communication between the knowledge provider and the knowledge seeker. Intelligence received by the seeker is therefore more likely to become distorted and fragmented.

PowerSys has many channels for intelligence dissemination in place. The key barrier to intelligence dissemination is not the lack of communication channels but the lack of staff participation and the lack of a formal system. Intelligence dissemination receives the least amount of attention among the three stages of BI activities from the staff on the ground. BI analysts do not perceive the need for co-operation and intelligence sharing across business units. When such a need is identified, people feel it is the other person’s job to ensure effective intelligence flow, as no one is formally accountable for KS. The challenge is to get people involved, to change the organisational culture and people’s attitudes, to make them aware of the importance of KS, and to put in place a formal system in support of the intelligence dissemination activities currently done through the informal BI community.

**5.5.2 Step 11: Correlating the KS Gaps with KS Management Levers**

The KS scores for each of the five sections of the analysis grid are plotted on the diagram below. All three stages of the BI business process score well on the sharing channels area, reflecting the many formal and informal communication channels available and the well-connected network of the BI community. The results also reflect the fact that the BI community’s current practice is rather better at intelligence gathering, analysis and decision-making than intelligence dissemination. Intelligence dissemination is particularly weak in the organisational infrastructure and the human factors areas.

![Sharing Score - By Factor Diagram](image)
The organisational infrastructure

1. Management commitment

The two main issues here are the availability of resources and the need to communicate clearly defined management objectives with respect to intelligence sharing.

- People genuinely do not have the time to engage in intelligence sharing activities, even if they very much want to. Due to time pressure and resource constraints, BI analysts tend to concentrate on solving the problem in hand. Intelligence sharing becomes an ‘after-thought’, which more often than not results in intelligence being gathered and analysed to answer one particular question. Intelligence is then left unused afterwards, because other people are not aware of its existence. The lack of intelligence ‘re-use’ in turn results in a duplication of effort that perpetuates the vicious cycle.

- On the whole, the BI community is aware of the importance of intelligence, but people are not aware of the pressing need for intelligence sharing. There is no clear vision communicated to the BI community about the benefits and the opportunities created by the synergy of the BI network. The lack of a shared understanding of management objectives contributes to the low priority given to intelligence work, which is often superseded by other, ‘higher priority’ tasks especially for those who are asked to ‘double-up’ in BI work part-time.

2. Formal structure

The roles and responsibilities for BI work are not clearly defined. There is no single point of ownership accountable for BI work, and no one is charged with disseminating intelligence. At the moment intelligence flow follows the formal organisational hierarchy, which causes boundaries to be erected at the business units’ borders, segregating the discrete areas of intelligence into ‘isolated islands of knowledge’ situated mostly in individual CFBUs. There could also be a potential conflict of interests between knowledge providers and knowledge seekers (for example analysts wanting more detailed intelligence from sales representatives, but sales representatives wanting to spend more time meeting clients). On the other hand, individual CFBUs do not have the mandate to initiate formal cross-business-unit intelligence sharing initiatives. Cross-organisational boundary intelligence flow depends entirely on the personal contacts of the people involved.

3. The company’s political and power structure

Some people still think knowledge is power. Although the word “intelligence” may suggest secrecy, in fact 80% – 90% of the intelligence involved is in the public domain. One of PowerSys’s directors felt people often overplayed the issue of secrecy in BI: “Confidentiality is not the most important barrier to sharing intelligence. In fact, it is very unlikely that a piece of intelligence acquired by PowerSys will not become public knowledge for long periods of time”.

However, this does not prevent people from viewing knowledge as power and associating the possession of knowledge with a privileged position. Some analysts expressed frustration about the difficulty of obtaining intelligence from other business units. The BI community needs a champion to promote sharing and openness.

The human factors

1. The organisational culture

There are several organisational cultural attitudes that hinder intelligence sharing: (1) the scepticism of some about the merits of sharing (2) intelligence sharing is not regarded by most as part of their jobs (3) knowledge is power and people want control over the use of intelligence they provide, and (4) intelligence and the sharing of intelligence have bad connotations. The following contribute to such cultural attitudes:

- The ‘need-to-know’ culture which obtains in some parts of the organisation makes the nature of intelligence unnecessarily too sensitive. Concerns about ‘intelligence leaks’ cause BI analysts to throw a security net over the intelligence they possess. But although certain intelligence is confidential and
unwarranted disclosure is undesirable, most of the intelligence concerned is in
the public domain. This 'need-to-know' culture discourages sharing with others
in the company.

- Analysts at different business units have different areas of focus and interests
  in intelligence. If intelligence does not help the bottom line performance of
  someone's own unit, then he will not make the effort to share it proactively.
- In relation to the above point, as the company has many offices located around
  the world; there are few opportunities for interaction between colleagues in
  different business units when they could compare notes to understand each
  other's intelligence needs.
- There is a cultural division between staff located at corporate headquarters and
  those in the branch offices. The newly acquired business units also have a very
different culture that is taking time to integrate seamlessly with the rest of
the company.
- The culture of feeling 'self-sufficient' encourages complacency with the status
quo. It discourages people from coming forward to share their know-how.
- The legalistic ethos attaches bad connotations to intelligence sharing. There
  are two related issues here. Firstly, certain intelligence may be protected by
  confidentiality agreements signed with joint-venture partners. Non-disclosure
  conditions of the confidentiality agreement dictate what can be shared outside
  of the joint venture. Secondly, the US Antitrust Laws and the Economic
  Espionage Act have huge implication for intelligence work. These regulations
  create a climate in which people fear the legal consequences, regarding
  intelligence sharing as invariably an unlawful act. This legalistic ethos hinders
  people from sharing useful intelligence with each other, even when such
  sharing is perfectly legitimate.

2. Motivation and rewards

There are no rewards for sharing intelligence. People like to learn about best practice,
welcome support and knowledge from others, but are not usually motivated to share
proactively their know-how without incentives. Intelligence may get shared if specific
questions are asked, but people are unlikely to volunteer knowledge. When analysts
are unsure about a return for their time spent in sharing, they question why they
should engage in such an altruistic act. This is a clear example of the 'What is it in for
me?' symptom.

The technology provision

1. Collaboration

Although the basic collaborative tools are already available at some business units
(for example the corporate Intranet, the document management system, electronic
bulletin boards, discussion forums, etc.), the corporate computer network lacks
seamless inter-connection across business units and geographical locations.
Documents stored in individual business units are not accessible by people outside
them. PowerSys needs a tool to locate intelligence residing in various locations.

The following line graph shows the detailed factors of the analysis grid.

![Normalised Sharing Score - By Factor](image-url)

Figure 5-9 KS score – detailed
5.5.3 Step 12: Carrying Out A Fill-Gap Analysis

Recommendations for improving the BI business process are tabulated below.

Table 5-6 Fill-gap analysis table

<table>
<thead>
<tr>
<th>Knowledge Barriers</th>
<th>Recommendation</th>
<th>Benefits</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Commitment</td>
<td>• Rather than carrying out thorough research and analysis on all incoming</td>
<td>• This approach focuses on key intelligence areas.</td>
<td>• The possibility of overlooking important areas until it is too late.</td>
</tr>
<tr>
<td>(Allocation of Time and Resources)</td>
<td>intelligence, concentrate on selected market areas and/or competitors.</td>
<td>Resources are concentrated on areas where they matter most.</td>
<td>• Capacity planning needs to cater for the escalation system and ad-hoc requests, in order to respond to unanticipated competitor movements or new market entrants.</td>
</tr>
<tr>
<td></td>
<td>• BI work can be categorised into (1) consistent monitoring, (2) periodic</td>
<td>• Intelligence work can become more proactive to signal opportunities and threats on consistently monitored areas, without requiring substantial additional resources.</td>
<td>• The risk of neglecting periodic monitoring activities as they may be perceived as less important, weakening the &quot;intelligence radar&quot; in its scanning for the unexpected.</td>
</tr>
<tr>
<td></td>
<td>monitoring, or (3) response to ad-hoc special requests from senior management.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• For example, 'good enough' analyses are carried out on periodically</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>monitored competitors.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• More detailed analyses may be initiated via an escalation system, if</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>serious threats are found based on initial analysis.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management Commitment</td>
<td>• Clarify the relationship between BI and business objectives.</td>
<td>• A sound vision is fundamental in creating the environment and to focus the BI community on the benefits of intelligence sharing.</td>
<td>• To make people outside the immediate BI community identify with the objectives of intelligence sharing, and contribute their time as a result, is a challenge.</td>
</tr>
<tr>
<td>(Alignment of Objectives)</td>
<td>• Provide a vision for intelligence sharing by articulating the link</td>
<td>• With a clearly communicated vision of ‘owners’ the awareness issue can be addressed directly.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>between intelligence flow and bottom-line performance.</td>
<td>• When people share the objectives of the vision, they will find KS relevant and agree with the pressing need to engage in KS.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Publishing case studies of successful BI examples is a very effective</td>
<td>• Addressing ‘live’ KS issues is effective on-the-job training in sharing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>means of achieving a shared understanding of the objectives of intelligence</td>
<td>intelligence.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sharing.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Have a ‘live’ KS project to demonstrate the value of</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>intelligence sharing.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5.6 Summary

This case study demonstrates the application of the KSMM to evaluate the effectiveness of PowerSys's KS practice in their business intelligence community. This case study provides empirical evidence on KS mechanisms employed for unstructured, volatile business intelligence with the use of human networking. The following table summarises findings of PowerSys's business intelligence sharing practice using the KSMM:

<table>
<thead>
<tr>
<th>Knowledge Property</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Context</td>
<td>Aid strategic decision making in order to enhance PowerSys's capability to identify new markets and growth opportunities</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Intelligence covered a wide range of subject matters and was typically gathered from many different internal and external sources.</td>
</tr>
<tr>
<td>Property</td>
<td>Intelligence was conveyed in many forms – documented or anecdotal; structured or unstructured – that varied in completeness and reliability.</td>
</tr>
</tbody>
</table>

Table 5-7 Findings of the PowerSys case study
Intelligence gathered must be analysed which might involve analysts' judgement, opinions and tacit understanding of the market conditions in addition to 'hard' verifiable facts.

**Sharing Channels.** Many KS channels were available, but the informal community, i.e. human networking, was the key channel to sharing intelligence.

In applying the KSMF and the KSMM, the following lessons have been learnt basing on feedback from managers and the researcher's own observations:

- **The Business Context of the KSMF.** Managers viewed KS management as a value-enhancing endeavour. The framework's linking of the value of KS management to competitive advantages derived from cost reduction and value enhancement as a result of mitigated knowledge-related operational risk and increased knowledge-based core competence was a novel concept.

- **The Knowledge Sharing Process Model (KSPM) of the KSMF.** The KSPM provided a structured approach to investigate the BI sharing practice adopted by PowerSys. The structured approach allowed managers to discover issues that previously had been hidden from them. In particular, the business intelligence work process is divided into intelligence gathering, analysis and decisions, and intelligence dissemination as part of a feedback loop. Since analysts at the business intelligence community had been familiar with the former two stages, the addition of intelligence disseminated highlighted the importance of sharing.

- **The sharing-channel component of the KSMF.** The choice of sharing channels was in agreement with media selection theory. Human networking, face-to-face dialogues or telephone conversations was the preferred KS channel. Analysts' judgement, opinions, anecdotes and snippets gleaned from knowledge providers were unlikely to be documented. Analysts often quoted insufficient time as the primary reason for not capturing intelligence into the system.

- **The organisational infrastructure component of the KSMF.** The case study provided KS evidence involving informal communities of business analysts, within the larger organisational context of traditional hierarchical structure with business units divided into front-end and back-end divisions.

- **The KSMM.** The methodology was useful to pinpoint the strengths and weaknesses in the KS practice currently adopted at PowerSys. The methodology was more useful as a conceptual tool to locate areas for improvement than to provide prescriptive recommendations.
6. The PrintCo Case Study

6.1 Introduction

This chapter presents the case study carried out with PrintCo to illustrate the application of the KSMM. The methodology was used to examine the state of knowledge flow between PrintCo’s sales and R&D business units in their effort to achieve ‘right-first-time’ product implementation. This chapter forms the second of the two case studies that serves to rigorously test the KSMM in a real-world situation.

This case study provides a good comparison with the PowerSys case study in that it presents empirical evidence on mechanisms applicable to effective KS involving precise and structured knowledge. The use of a web-based bulletin board system as a centrepiece of PrintCo’s KS practice also provides the background to test the methodology in a situation where a technology-focused KS practice is adopted.

Company Background

PrintCo is a specialist printer manufacturer, producing advanced industrial printing and marking equipment. Since its inception in the early 1980’s, it has quickly established itself as a world leader in manufacturing printing, product coding and identification equipment, employing inkjet and laser technologies. PrintCo does its own product research and development, printing equipment and consumables manufacturing, sales, marketing and customer support. The company’s sophisticated solutions are being used by its industrial and commercial customers to print and code a wide variety of information onto their products. PrintCo has customers in some 130 countries operating in a wide spectrum of sectors from automotive to beverages, from pharmaceuticals to publishing. The company is of medium size but has been enjoying healthy double-digit sales growth in recent years. It is in the process of planning further expansion to increase its geographical reach and market sector coverage.
6.2 Phase 1: Business Process Analysis

6.2.1 Step 1: Identifying KS Objectives

1. Identifying the company's areas of business

KS is crucial to the following four areas of business that involve the sales and R&D units.

a. Sales configuration. This is concerned with the problem of sharing technical knowledge and product implementation experience between engineering and sales units in order to support the sales process of recommending and delivering 'right-first-time' printing solutions to customers as effectively as possible. PrintCo's printing equipment is routinely used either to form key components of their customers' production lines or to be integrated into other OEM (original equipment manufacturers) systems. It is imperative for PrintCo to be able to deliver printing solutions that interface flawlessly with the various kinds of equipment and associated hardware and software configurations at customers' factories. The ability to leverage what has been learnt by service engineers in after-sales implementation so that the knowledge gained can be consolidated into the sales operation is imperative. It is crucial to the sales configuration process's performance in delivering correct workable printing solutions to customers. This 'right-first-time' approach helps to reduce PrintCo's costs and the time it takes them to sell and deliver their products and also increases the satisfaction of their customers. Armed with the latest product interoperability knowledge, sales teams can recommend product specifications specifically tailored to their customers' needs.

b. Product updating. This involves the R&D and manufacturing departments continuously using knowledge fed back from customers and field service engineers to improve and develop PrintCo's products.

c. Product launching. This uses KS when deciding on development of new products. New product development is driven by market analysis and the anticipation of customers' future product demands.

d. Supply chain KS. This is concerned with examining inter-departmental KS across the company's supply chain from R&D, manufacturing and sales to customer services.

2. Business sub-divisions

PrintCo's organisational structure comprises four product-centred strategic business units (SBUs), corporate functional departments and subsidiaries.

a. SBU: Each of the four SBUs focuses on one of four particular product families: PI (Product Identification); OCC (Outer Case Coding); CP (Commercial Printing), and laser printing. Each SBU is responsible for its product family's R&D, product lifecycle management, technical support, marketing and distribution. Apart from the company's US laser product development centre, all the SBUs are based at its UK headquarters. In terms of opportunity for synergy, PI, OCC and Laser have similar customer bases. From a technical perspective, however, CP employs similar technologies to PI and OCC.

b. Corporate functions and manufacturing: Product manufacturing is overseen by one of the corporate functional departments. Manufacturing activities are concentrated in the UK and are supported by backup production facilities and product assembly plants in four other countries. Other corporate functions include managing human resources, finance, legal and technical quality assurance.

c. Subsidiaries and distributors: Product sales and after-sales customer training and support services are carried out by PrintCo's subsidiaries and distributors. PrintCo is represented in 12 different countries directly via its subsidiaries, and also by a strong global network of 75 distributors.
operating in the rest of the world. The SBUs provide technical support training for subsidiaries and distributors in order to ensure that customers across the world receive a consistent level of quality service in accordance with corporate standards. SBUs draw up customer service directives, sales and marketing guidelines and conduct regular audits to ensure compliance with their service standard directives.

Figure 6-1 Organisational structure

3. Key knowledge assets

Five key domains of knowledge were identified:

a. Market knowledge: knowledge about market conditions and business intelligence about specific competitors and rival products.

b. Customer knowledge: detailed understanding of customers’ requirements and awareness of product customisation demands in particular countries. For example product coding equipment for the food and drink industry has to meet very different requirements in operating on the soft, wet surfaces of cakes, chocolates or soft drink bottles from what’s needed in a product identifier for the automotive industry that has to scribe durable codes on hard rigid metallic surfaces.

c. Technical knowledge: hardware and software know-how about production line machines and technical standards commonly found at customers’ sites.

d. Product expertise: the intimate technical knowledge about the company’s product specifications, physical capabilities and limitations.

e. Implementation experience: first-hand tacit knowledge on product characteristics (in terms of their compatibility, reliability and recorded performance) gained by field service engineers when installing and maintaining the printing machines.

Identifying Strategic Objectives and Operational Goals

4. Strategic objectives

PrintCo concentrates on the following three key strategic objectives:

a. Improving customer service so that customers feel confident about depending upon PrintCo’s printing solutions. There are two key ways of improving dependability: (1) by providing high quality printing solutions that reliably fulfil customers’ needs and add value to customers’ operations, and (2) by providing high quality customer service support and a stable supply of consumables to help maintain customers’ production lines in continued operations.

b. Increasing geographical reach and market sector coverage to secure continued expansion of market share by providing products that more comprehensively fulfil customers’ specific niche requirements.

c. Controlling costs incurred in product sales and delivery.
5. Competitive advantages

PrintCo possesses the following three competitive advantages:

a. **Product dependability:** highly reliable solutions that customers can safely rely upon.

b. **Exceptional aftercare:** consistency in subsidiaries and distributors across the globe. PrintCo has a strong reputation for quality customer service among major users and system integrators of coding equipment OEM.

c. **Value for customer:** delivering quality products at competitive prices.

6. Operational goals

The strategic objectives described above are translated into the following operational goals:

a. **Product compatibility with other equipment.** Typically, PrintCo’s inkjet and laser printers are required to operate in controlled synchronisation with the embedding production processes so that products can be scribed even while they continue to move on the production line. Customer service staff must ensure that the printing equipment integrates seamlessly with the hardware and software configurations installed at clients’ factories. The myriad permutations of interface configurations can result in very complex decisions having to be made to ensure seamless integration, especially when PrintCo’s customers operate in such a wide range of sectors.

b. **Correct product specifications.** By streamlining the product recommendation process of the sales units (at subsidiaries) PrintCo ensures that the right products with correct parameters are specified in the sales orders.

c. **Leveraging knowledge across geographies.** PrintCo should leverage after-sales implementation knowledge gained by subsidiaries and distributors across geographies.

d. **Leveraging knowledge across product lines.** PrintCo should leverage technologies and innovative ideas across SBUs and across product families.

e. **Knowledge provision for front-line units.** PrintCo should provide necessary knowledge and technical support for front-line units (subsidiaries and distributors).

f. **Knowledge integration with back office units.** PrintCo should gather feedback from front-line units (field service engineers implementation experience and customer feedback) and integrate that knowledge with head office SBUs.

g. **Reducing the number of wrong deliveries.** Whether as a result of misspecification of product requirements, product incompatibility discovered on-site or logistical mistakes in the shipment process, PrintCo should avoid making such expensive errors.

h. **Reducing the amount of repair work.** PrintCo should minimise the amount of reworking undertaken to fix problems introduced by earlier poor repair work and should reduce incompatibility problems by taking this into consideration during the product design phase.

7. Selecting the business area

The sales configuration was chosen for investigation because it involved sharing of all five knowledge assets between the SBUs and subsidiaries. Supply chain KS was not chosen because of the pragmatic reason of insufficient resources being available to study KS in the whole organisation. The product updating and product launching
areas were not chosen because they involved the sharing of limited types of knowledge assets.

### Table 6-1 Business area identification table

<table>
<thead>
<tr>
<th>Area of Business</th>
<th>Sub-Area</th>
<th>Knowledge assets</th>
<th>Operational Objectives</th>
<th>Competitive Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales Configuration</td>
<td>4 SBUs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing databases</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Support</td>
<td>4 SBUs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsidiaries and databases</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product Launching</td>
<td>4 SBUs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsidiaries and databases</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Chain</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subsidiaries and databases</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.2.2 Step 2: Identifying the Scope of the Investigation

Identifying Business Processes and Organisational Units

1. Business processes

Sales configuration activities are centred on the following three processes:

a. The sales process. The process has the following steps: (1) pre-sale product requirement specifications, (2) quotation request, (3) technical vetting, (4) order processing, (5) order fulfillment technical check, (6) after-sales installation check, and (7) product feedback.

b. Problem resolution. This is the formal process designed to log customer problem calls and to track product problem reports filed by customer service engineers. Descriptions of problems and resolutions are communicated to product development units at SBUs and technical support units at subsidiaries.

c. Quality workbench. This business process is designed to deal with formal customer complaints on issues related to product quality.

### 2. Organisational units

The organisational units involved in sales configuration belong to either SBUs at corporate headquarters or subsidiaries and distributors.

a. Corporate SBUs. Within each of the PI, OCC, CP and Laser SBUs, there is one product development and one product management group. The development group carries out R&D for the product family the SBU focuses on. The product management group carries out market research and gathers competitor intelligence related to its SBU’s product family.

b. Group Technical Support (GTS). The centralised technical support unit at corporate headquarters provides a secondary helpdesk function, supporting frontline service engineers in subsidiaries and distributors. GTS does not deal directly with customers, but functions as the backend technical knowledge base which pools together resources and know-how from the company’s worldwide support network to provide corporate support on technical issues that local subsidiaries cannot readily resolve.

c. Subsidiaries. Each subsidiary (or third-party distributor) has a technical and a sales team providing local customer support and sales coverage for all the four product families in the respective country represented. The technical team provides technical training for customers as well as functioning as the primary helpdesk giving first-line support for service engineers. The sales team maintains contact with customers and organises
Identifying Knowledge Transfer Paths

There are three key knowledge transfer paths:

a. *Downstream knowledge flow.* This is technical and commercial knowledge propagated by corporate SBUs development and product management groups to subsidiaries technical and sales teams.

b. *Upstream knowledge flow.* This is after-sales implementation experience and product feedback transmitted from frontline customer facing staff members to headquarters SBUs.

c. *Peer-to-peer knowledge flow.* This is the inter-product family cross fertilisation of ideas among SBUs.

Selecting the Business Process

Both the sales and problem resolution processes are key to the sales configuration operation, and both contribute to the bulk of the operational costs. However, the sale process was chosen because it has wider impact on SBUs and subsidiaries.

<table>
<thead>
<tr>
<th>Table 6-2 Business process selection table</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
</tr>
<tr>
<td>Product Rigit (SBU)</td>
</tr>
<tr>
<td>Quotation</td>
</tr>
<tr>
<td>Problem Resolution</td>
</tr>
<tr>
<td>Sales</td>
</tr>
<tr>
<td>Operations</td>
</tr>
</tbody>
</table>

6.2.3 Step 3: Modelling the Business Process

Identifying and Drawing The Business Process Model

1. Key KS activities and connections

The sale process is conceptualised as comprising the following three key stages of KS activities:

a. *Product knowledge dissemination.* The product development groups at corporate SBUs provide technical specifications on product capabilities to SBU product management groups, GTS, and technical and sales teams at subsidiaries. GTS and local technical support at subsidiaries rely on the technical knowledge from SBU product development to perform their helpdesk function. Based on market forecasts, SBU product management groups will analyse the specifications to determine whether the products concerned will be able to meet anticipated customer demand. The market knowledge gathered by SBU product management will be disseminated to sales teams at the subsidiaries, who will combine market knowledge with technical product know-how to provide product recommendation and sales service for customers.

b. *Product recommendation and delivery.* Activities in this stage can be described as comprising pre-sales, sales and after-sales operations. Apart from quotation processing and sales administration, the key knowledge activities in pre-sales operations are dealing with product requirement specifications and undertaking technical vetting. Sales teams follow the prescriptive rules contained within the corporate product database to identify the right products to recommend to their customers. Standard configurations are relatively straightforward as specifications for such configurations are already provided in the database by product development, but the process for dealing with non-standard requirements
is complex. Special requirements for non-standard configurations and tailored customisation must be vetted by technical managers at the subsidiaries. Technical managers will base their decisions on relevant experience from the currently installed base, using it as the benchmark to determine the likelihood of any technical problem that may arise. If no installation with a similar configuration can be found, the technical manager will solicit opinions from service engineers at another subsidiary or from the GTS. The process for providing equipment that has non-standard configuration can involve experiential learning with a substantial element of trial and error. Once customers are satisfied with the recommended solution, they will raise a sales order. The subsidiary (or distributor) will process the order; this involves a technical check to verify that the printing equipment ordered can meet the technical requirements specified at the pre-sale stage. Once the equipment has been installed, the after-sales installation check ensures that any problem can be identified early on before the newly installed machine is put into production. If any problem is discovered at this stage, the customer, the sales team, the service engineers involved and the management from the subsidiary concerned will be brought together to resolve the issue.

c. Gathering product feedback. The after-sales service teams at subsidiaries will call their customers 30 days after product installation to check on the newly installed equipment and gather customer feedback. This feedback may on occasions identify further action required, such as additional user training or product customisation. The product will then be put into after-sales support carried out by local technical helpdesk from subsidiaries. When technical issues cannot be resolved by the local technical helpdesk they are escalated to the technical manager who may decide to raise a problem report and request help from GTS. GTS forwards the problem report to the respective SBU product development group if the issue involves changes in product design. On business-oriented knowledge, SBU product management groups will receive market intelligence about product performance and customer satisfaction from subsidiaries during the three annual budgetary planning meetings. SBU product management may then readjust its market forecasts to provide the SBU development group with new generic or customised product requirements suited to particular geographic or market segments.

2. Events that trigger sales configuration activities
Sales configuration activities are initiated by two types of events: (1) marketing campaigns driven by SBU product management and subsidiary sales teams, and (2) product revisions carried out by SBU development groups in the light of problems discovered.

<table>
<thead>
<tr>
<th>Table 6-3 Business process activities identification table</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Process Activities</strong></td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>Product Knowledge Dissemination</td>
</tr>
<tr>
<td>Product Recommendation &amp; Delivery</td>
</tr>
<tr>
<td>Gathering Product Feedback</td>
</tr>
</tbody>
</table>
6.3 Phase 2: Knowledge Sharing Practice Review

6.3.1 Step 4: Mapping Knowledge Stakeholders

Identifying The Knowledge Stakeholders
The roles and responsibilities of the following knowledge stakeholders are identified, accompanied by a brief description of their domains of expertise.

1. SBU product development

From a knowledge perspective, the purpose of SBU product development is (1) to provide technical know-how to help GTS and local support helpdesks at the subsidiaries in troubleshooting and problem resolution (2) to provide product specifications for the SBU product manager to determine if printing products meet current and anticipated future market demands, and (3) to provide product documentation for sales teams at the subsidiaries. The kind of knowledge SBU development requires is technical and complex. However, the feedback SBU product development receives is usually in the form of problem reports focusing on descriptions of particular problems. What the product developers require is elaboration and explanation of the problem context to draw out sufficient detailed background information for conducting a thorough technical analysis.

2. SBU product management

SBU product managers communicate regularly with the corresponding SBU product development group to determine whether the printing products in the development pipeline are likely to meet market demands, and to allocate resources in view of anticipated product demand. SBU product management may carry out bi-annual customer surveys to provide the SBU development group with some ideas of future market trends and (fairly informally) the general level of customer satisfaction. Market knowledge gathered by SBU product management will then be disseminated to subsidiaries' sales teams.

3. Subsidiaries customer service

In comparison with SBU product developers, field service engineers at the subsidiaries require rapid access to very specific and up-to-date technical knowledge for troubleshooting. Speed and responsiveness is crucial; commonly asked questions must be anticipated and answers prepared. Ideally, the answers should be indexed to allow quick reference to pinpoint the knowledge needed. Product knowledge must be digested and summarised to provide precise, direct answers quickly. Field service engineers are not interested in overly detailed technical background and complicated analyses that do not directly help problem diagnosis. They look for instant answers. These engineers maintain close contact with customers; they possess first-hand knowledge on after-sales implementation and on products’ performance in the field.

4. Technical management & support helpdesks at the subsidiaries

If a service engineer fails to find an answer from the product documentation database to resolve an immediate problem, the subsidiaries’ local technical support helpdesks will provide the first line of backup. Local helpdesks typically hold technical support knowledge on all the (four) product families that the subsidiaries are responsible for. If the problem cannot be resolved locally it will be escalated to the subsidiaries’ technical managers who may decide to request further help from GTS.
5. The GTS support helpdesk

GTS personnel are experienced support engineers who understand intimately the challenges faced by field service engineers. When technical problems are referred to GTS by subsidiaries' technical managers, GTS will leverage corporate-wide knowledge at the global technical support network to resolve the problem. If the problem has been diagnosed as one that requires product design changes, a problem report will be filed, describing the issue that will then be forwarded to the appropriate development group. GTS in this case also acts as a knowledge broker that filters upstream knowledge flow to avoid overloading the SBU development groups.

6. The subsidiary's sales team

Salesmen at subsidiaries, whose situation is similar to that of service engineers, have close contact with customers. They possess first-hand knowledge of customer business requirements and customer satisfaction with PrintCo's printing products. However, the process of sharing knowledge on customer satisfaction with SBUs is infrequent and informal.

7. The corporate librarian

The librarian organises the corporate knowledge base and structures the catalogue, directories and presentation of the technical documentation it contains.

Table 6-4 Knowledge stakeholder map

<table>
<thead>
<tr>
<th>Knowledge Stakeholder</th>
<th>KS Role</th>
<th>Domain of Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>SBU Product Development</td>
<td>P1, P3</td>
<td>Possesses detailed technical know-how on products, but usually receives only discrete feedback in the form of problem reports.</td>
</tr>
<tr>
<td>SBU Product Management</td>
<td>P1, P2</td>
<td>Has knowledge of customer demand and market trends worldwide.</td>
</tr>
<tr>
<td>GTS Support Helpdesk</td>
<td>P3, P1</td>
<td>Corporate-wide leverage of the global technical support network knowledge; filters upstream knowledge flow to SBU product development.</td>
</tr>
</tbody>
</table>

6.3.2 Step 5: Auditing Knowledge Sharing Channels

Identifying The Knowledge Sharing Channels

1. The Bulletin Board System (BBS)

The BBS is the formal mechanism and the main vehicle by which SBU development groups disseminate technical product knowledge to subsidiaries (and distributors). The BBS is a web-based extranet with security measures that allow authorised users from subsidiaries around the world to access detailed product descriptions; technical specifications; briefings on technical updates, and product revision releases. The dissemination of product knowledge is managed by individual SBUs, each of which has its own sections on the BBS (currently the majority of content is P1 focused). Currently, 95% of the content contained on the BBS is technically oriented. PrintCo is planning to expand the BBS to include market knowledge and information about the release and distribution of software. The BBS contains most of the technical product knowledge required by service engineers. Hence in the first instance service engineers search product databases at the BBS before requesting help from local technical support or the GTS. Usually, staff can locate and retrieve required knowledge from the BBS proficiently.
2. Ad-hoc

An ad-hoc approach is commonly used to share knowledge at PrintCo. This involves the use of common communication media such as e-mail, CD-ROM, telephone or fax. While this is true for downstream market knowledge flow where it is not covered by the BBS (see above), this ad-hoc approach is especially conspicuous in peer-to-peer and upstream flows.

a. Downstream. The four SBU development groups initiate formal processes to transmit technical knowledge downstream to subsidiaries, but the knowledge transmitted focuses on the SBU's own product family. Subsidiaries then need to co-ordinate technical KS across the four product divisions themselves in order to ensure the right package of product solutions are recommended to customers. Market knowledge from SBU product management is transferred informally.

b. Peer-to-peer. There is occasional KS between different SBUs during product development or product improvement projects. Market knowledge and competitor intelligence is exchanged only on an ad-hoc basis among subsidiaries through emails or in discussion forums.

c. Upstream. Field experience gained by service engineers is shared informally within respective subsidiaries (amongst service engineers, local technical support workers and subsidiary technical managers) in conversation, via e-mail or telephone. Such knowledge may be translated into staff training materials for future use by subsidiaries. In the case of market knowledge, feedback to SBU product managers is informal and infrequent (except where it concerns compliance with sales and marketing standard practice).

3. The technical issues Intranet site

This is an Intranet site designed (1) to track software faults and software release versions (2) to support call logs and (3) to process problem reports filed by GTs and subsidiary technical support teams. Technical issues encountered by service engineers are collated and filtered to produce the top-ten list of the most critical, urgent and common problems. This issue list is updated weekly and forwarded to SBU product development groups for follow-up action should any of the problems require design changes. Resolutions of the problems and documents detailing any product functionality changes are disseminated to subsidiary technical and sales teams via the BBS. Unresolved issues are e-mailed to the subsidiary technical manager who originated the change request. In general, this approach allows the filtering of information at source, enabling the issue site to act as a moderated knowledge flow channel for subsidiaries to provide technical feedback on product design issues.

4. Service documents

Records of services carried out by subsidiaries in the UK, USA, France and China are forwarded to corporate headquarters for processing. Service documents from these four countries are sampled to deduce the overall quality of service offered by the company's subsidiaries. Besides ensuring the quality of service offered complies with corporate standards, these records serve as a useful way of gathering field experience from the service engineers, as they record the reliability and common servicing problems of various products.

5. The red alert

This is an operation management process to control product quality. When a product fault is discovered the red alert process is activated to stop production of the affected products. A quality manager is given the responsibility of ensuring that product quality conforms to corporate standards.
6. The quality workbench

This is a system designed to deal with formal customer complaints about product quality. Staff members are assigned to follow up each complaint.

7. Chat rooms

Online discussion forums are established to facilitate technical and market knowledge flow. Service engineers, local technical support and GTS make use of a common discussion forum for sharing tips and experience. Development teams at various SBUs that work on projects employing similar technologies are encouraged to form technical discussion groups to exchange ideas on areas of common interest. Peer-to-peer and upstream knowledge flow occurs when there is a specific request for knowledge from product development groups in the chat rooms (for example requesting help on reliability and design experience on inkjet printer performance in a humid and dusty environment). In the case of market knowledge, SBU product managers and subsidiary sales managers make use of the competitor intelligence discussion forum and the email distribution list to exchange knowledge on competitor and market conditions. The chat rooms provide an informal but flexible platform for communication between corporate SBUs and subsidiaries.

8. Conferences and meetings

Conferences and meetings are an important means of establishing working relationships, exchanging ideas and raising the awareness of KS. An annual conference is organised for field service engineers from subsidiaries so that they can meet and share their experiences. Every six months, there are technical meetings for the GTS and the local technical support workers and service engineers from selected countries to discuss common problems and share tips and practical knowledge. Formal meetings are held quarterly for all the subsidiary technical managers to discuss, face-to-face with SBU development groups, about major technical issues that may influence future product R&D. Within subsidiaries, regular monthly meetings are held between service engineers and local helpdesk staff to discuss technical issues. Market knowledge gleaned by subsidiaries through customer contacts, market analyses and customer surveys may be shared informally through budgetary and managerial meetings that involve senior management and representatives from subsidiaries and SBUs. These meetings provide opportunities for managers to provide feedback, share information and review product performance.

<table>
<thead>
<tr>
<th>Sharing Channels</th>
<th>Description</th>
<th>Status of Use</th>
<th>Usage Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBS</td>
<td>A bulletin board system employing web-based extranet technologies.</td>
<td>A formal technical knowledge dissemination channel that connects</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>corporate SBUs and subsidiaries around the world.</td>
<td></td>
</tr>
<tr>
<td>Ad-hoc</td>
<td>Making use of common communication media such as the telephone, e-mail</td>
<td>The most commonly used approach especially for peer-to-peer and</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>or CD-ROM.</td>
<td>upstream knowledge flow. KS is initiated as and when there is a</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>specific request for knowledge.</td>
<td></td>
</tr>
<tr>
<td>Intranet Technical</td>
<td>An Intranet site that logs problem</td>
<td>A formal channel used to gather</td>
<td>3</td>
</tr>
<tr>
<td>Issues Site</td>
<td>reports, support calls and details of software defects.</td>
<td>technical feedback for SBUs. However, the Intranet is directly</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>accessible only to SBUs and GTS at</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>corporate headquarters.</td>
<td></td>
</tr>
<tr>
<td>Service Documents</td>
<td>Sampling of service records at four subsidiaries to glean knowledge from</td>
<td>Useful knowledge can be captured on</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>field service engineers.</td>
<td>various products’ reliability and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>common servicing problems.</td>
<td></td>
</tr>
<tr>
<td>The Red Alert</td>
<td>An operation management process to stop the production of</td>
<td>Records of red alerts can provide</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>faulty products.</td>
<td>useful knowledge on manufacturing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>processes for quality control purposes.</td>
<td></td>
</tr>
<tr>
<td>The Quality Workbench</td>
<td>A formal customer complaint management process.</td>
<td>The quality workbench process provides</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>useful knowledge about</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>customer satisfaction with</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>implemented products.</td>
<td></td>
</tr>
<tr>
<td>Chat Rooms</td>
<td>Online discussion forums established for technical and market KS.</td>
<td>An informal but flexible KS channel</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>between SBUs and subsidiaries.</td>
<td></td>
</tr>
<tr>
<td>Conferences and</td>
<td>Various conferences and meetings organised to exchange</td>
<td>Regular meetings are scheduled, but</td>
<td>5</td>
</tr>
<tr>
<td>Meetings</td>
<td>ideas and share experience.</td>
<td>usually the meetings cater for either</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>technical or sales staff.</td>
<td></td>
</tr>
</tbody>
</table>
Table 6-6 Knowledge flow network table

<table>
<thead>
<tr>
<th>Seeker</th>
<th>SBU Product Development</th>
<th>SBU Product Mgmt</th>
<th>GTS Helpdesk</th>
<th>Local Helpdesk</th>
<th>Technical Manager</th>
<th>Customer Service</th>
<th>Sales Team</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provider</td>
<td>P1</td>
<td>P1</td>
<td>P1</td>
<td>P1</td>
<td>P1</td>
<td>P1</td>
<td>P1</td>
</tr>
</tbody>
</table>

6.3.3 Step 6: Constructing A Knowledge-Sharing Network Map

Here is a map of the KS network:

Figure 6-4 KS network

6.4 Phase 3: Critical Assessment of KS Practice

6.4.1 Step 7: Mapping the Business Process onto The KSPM

The following diagram shows the mapping from the sale configuration business process model to the KSPM:

Figure 6-5 Mapping business process model onto the KSPM

6.4.2 Step 8: Filling In The Knowledge-Sharing Analysis Grid

Filled templates of the KS analysis grid are shown in the following pages.
## Sharing Channels

<table>
<thead>
<tr>
<th>Practice</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communication Channel</strong></td>
<td></td>
</tr>
<tr>
<td>1. Capacity</td>
<td>✓ 1 ✓ 1 ✓ 1</td>
</tr>
<tr>
<td>1.2 Cost</td>
<td>✓ 1 ✓ 1 ✓ 1</td>
</tr>
<tr>
<td>1.3 Consistent Delivery</td>
<td>0 0 0 ✓ 1</td>
</tr>
<tr>
<td>1.4 Complex Knowledge Flow</td>
<td>× -1 × -1 0 0</td>
</tr>
<tr>
<td>1.5 Channel Accessibility</td>
<td>✓ 1 × -1 ✓ 1</td>
</tr>
<tr>
<td>1.6 Experience of Use</td>
<td>✓ 1 ✓ 1 ✓ 1</td>
</tr>
</tbody>
</table>

Comments:
- Formal and informal channels combined.
- An ad-hoc approach may result in inconsistent signals being transmitted.
- Knowledge is primarily shared within individual subsidiaries for the product recommendation and delivery process.

## Channel Connection

<table>
<thead>
<tr>
<th>Practice</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reciprocal Knowledge Flow</strong></td>
<td>× -1 0 0 × -1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Mediating Agents</td>
<td>✓ 1 0 0 0 0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 Co-Ordination Process</td>
<td>✓ 1 × -1 ✓ 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 Choice of Sources of Knowledge</td>
<td>× -1 × -1 ✓ -1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4 Personal Focus</td>
<td>× -1 × -1 × -1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5 Multiple Pathways</td>
<td>× -1 × -1 × -1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(-2) (-4) (-3) 1</td>
<td>-3 2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

No mechanism to provide effective feedback on knowledge shared.
- Subsidiary technical managers and GTS are formally assigned responsibilities to filter knowledge through various channels.
- Certain formal processes present to co-ordinate knowledge dissemination from SBUs and gather problem reports from subsidiaries.
- Sources of knowledge are not always clearly defined.

## Knowledge Property

<table>
<thead>
<tr>
<th>Practice</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reliability</strong></td>
<td>✓ 1 × -1 ✓ 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Currency</td>
<td>✓ 1 ✓ 1 ✓ 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 Background Knowledge</td>
<td>✓ 1 0 0 ✓ 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Form &amp; Presentation</td>
<td>× -1 ✓ 1 ✓ 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Language &amp; Jargons</td>
<td>× -1 × -1 × -1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 Completeness</td>
<td>× -1 0 0 ✓ 1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6 Sufficiency</td>
<td>✓ 1 ✓ 1 ✓ 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.7 Secrecy &amp; Confidentiality</td>
<td>✓ 1 ✓ 1 ✓ 1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<td>1.8</td>
<td>(2) (2) (6)</td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Lack of prior experience of certain product configurations requires a trial and error approach to obtain the knowledge needed.
- Knowledge transferred is up-to-date.
- Product recommendations and delivery processes are not concerned with detailed background knowledge.
- Technical jargon is not understood by business users; language barrier between subsidiaries.
- Problem reports can be too specific to provide the full picture.
- Proper amount of knowledge is transferred with filtering mechanisms in place.
- Staff are free to use and apply any knowledge they deem fit.

<table>
<thead>
<tr>
<th>Practice</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Domain Specificity</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Inter-Dependence</td>
<td>× -1 × -1 ✓ 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 Context Sensitivity</td>
<td>0 0 ✓ 1 ✓ 1</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2.3</td>
<td>(0) (1) (3)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Staff understand the domain of knowledge shared.
- Individual units are generating knowledge for their own use. Knowledge is generated for one single purpose only and any created know-how is not shared.
- The context in which the gathered knowledge may be applied is not always clear.
4. **Management Commitment & Alignment of Objectives**

<table>
<thead>
<tr>
<th>Practice</th>
<th>Value</th>
<th>Practice</th>
<th>Value</th>
<th>Practice</th>
<th>Value</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Management Leadership</td>
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<td>0</td>
<td>×</td>
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<td>✓</td>
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<tr>
<td>4.2 Shared Guiding Vision</td>
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<td>-1</td>
<td>×</td>
<td>-1</td>
<td>×</td>
<td>-1</td>
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<tr>
<td>4.3 Alignment of Objectives</td>
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<td>-1</td>
<td>×</td>
<td>-1</td>
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<td>0</td>
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</table>

| 2 | (-1) | (-3) | (2) | |

---

3. **Gathering & Product Feedback**

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<tr>
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<th>Practice</th>
<th>Value</th>
<th>Practice</th>
<th>Value</th>
<th>Comments</th>
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<td>3.1 Scope</td>
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<td>K</td>
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<tr>
<td>3.2 Network Connection Strength</td>
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<td>✓</td>
<td>1</td>
<td>×</td>
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<td>3.4 Integrative Synergy</td>
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<td>×</td>
<td>-1</td>
<td>0</td>
<td>0</td>
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<tr>
<td>3.5 Network Identity</td>
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<td>1</td>
<td>×</td>
<td>-1</td>
<td>×</td>
<td>-1</td>
</tr>
<tr>
<td>3.6 Trigger Mechanism</td>
<td>✓</td>
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<p>| (4) | (-2) | (1) |</p>
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<tr>
<th>Human Factors</th>
<th>Gathering</th>
<th>Product Recommendation &amp; Delivery</th>
<th>Product Knowledge Dissemination</th>
<th>Comments</th>
</tr>
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<td>Practice Value</td>
<td>Value</td>
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<td>4. Culture</td>
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</tr>
<tr>
<td>4.1 Professional Prac &amp; Community Norms</td>
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<td>0</td>
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<tr>
<td>4.2 Knowledge Ownership</td>
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<td>1</td>
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<tr>
<td>4.3 Mindsets &amp; Attitudes</td>
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<tr>
<td>4.4 Organisational Culture</td>
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<td>✓</td>
<td>1</td>
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<tr>
<td>4.5 Peer Pressure</td>
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<td>4.6 Knowledge Divisiveness</td>
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<td>✓</td>
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<table>
<thead>
<tr>
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<th>Gathering</th>
<th>Product Recommendation &amp; Delivery</th>
<th>Product Knowledge Dissemination</th>
<th>Comments</th>
</tr>
</thead>
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<td>Practice</td>
<td>Value</td>
<td>Practice Value</td>
<td>Value</td>
</tr>
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<td>1. Motivation &amp; Rewards</td>
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</tr>
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<td>1.1 Motivation of Knowledge Provider</td>
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<td>-1</td>
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<tr>
<td>1.2 Motivation of Knowledge Seeker</td>
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<td>✓</td>
<td>-1</td>
</tr>
<tr>
<td>1.3 Incentives</td>
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<td>-1</td>
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<tr>
<td>1.4 Morale</td>
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<td>1</td>
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<tr>
<td>1.5 Satisfaction</td>
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<td>✓</td>
<td>-1</td>
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</tbody>
</table>

| 2. Training And Cognitive Issues |           |                                   |                                |                                                                                            |
| 2.1 Provision of Training | ✓         | -1                                | ✓                               | -1                                                                          | Except the BBS there are limited formal processes for KS, hence the lack of training.                                              |
| 2.2 Awareness        | 0         | 0                                 | ✓                               | -1                                                                          | Some staff members at some units are not aware of the importance of KS.                                                             |
| 2.3 Absorptive Capability | ✓         | 1                                 | 0                               | 0                                                                           | The divide between technical-oriented and business-oriented staff.                                                                  |
| 2.4 Retentive Capability | ✓         | 1                                 | ✓                               | 1                                                                           | Separate databases are used to capture knowledge concerned.                                                                        |

<p>| 3. Relationships     |           |                                   |                                |                                                                                            |
| 3.1 Trust            | ✓         | -1                                | ✓                               | -1                                                                          | Autonomous structure does not help to foster trust among the various organisational units.                                       |</p>
<table>
<thead>
<tr>
<th>Technology Provision (2 of 2)</th>
<th>Gathering Product Feedback</th>
<th>Product Recommendation &amp; Delivery</th>
<th>Product Knowledge Dissemination</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Collaboration</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>4.1 Connectivity</td>
<td>×</td>
<td>×</td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>-1</td>
<td>-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The corporate network is not accessible from subsidiaries. Web-based extranet connection provides the vehicle for knowledge dissemination.</td>
</tr>
<tr>
<td>4.2 People-To-People Bridge</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>1</td>
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<tr>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>Online discussion forums were formed.</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>5. Organisational Scale</td>
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<td>5.1 Standardised Knowledge Structure</td>
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<td>0</td>
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<td>0</td>
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<tr>
<td>5.2 Internal Integration</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>KM tools are integrated with the work procedures of individual units.</td>
</tr>
<tr>
<td>5.3 External Integration</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>5.4 Scalability</td>
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<td>×</td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>-1</td>
<td></td>
<td>Document database in the subsidiaries are not integrated.</td>
</tr>
<tr>
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</tr>
<tr>
<td></td>
<td>(2)</td>
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</table>

<table>
<thead>
<tr>
<th>Technology Provision (1 of 2)</th>
<th>Gathering Product Feedback</th>
<th>Product Recommendation &amp; Delivery</th>
<th>Product Knowledge Dissemination</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Accessibility</td>
<td></td>
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</tr>
<tr>
<td>1.1 Efficiency</td>
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<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Several non-integrated systems must be searched for product feedback.</td>
</tr>
<tr>
<td>1.2 One-Stop Portal For Knowledge</td>
<td>×</td>
<td>-1</td>
<td>×</td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>The BBS centralises the dissemination of product knowledge to GTS and subsidiary technical and sales teams.</td>
</tr>
<tr>
<td>1.3 Knowledge Flow Time Lag</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
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</tr>
<tr>
<td>2. Selectivity</td>
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</tr>
<tr>
<td>2.1 Relevance</td>
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<td>✓</td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 Precision</td>
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<td>-1</td>
<td>×</td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>User cannot control the degree of detail in the knowledge retrieved.</td>
</tr>
<tr>
<td>2.3 Contextual Information</td>
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<td>-1</td>
<td>×</td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>There are no hyperlinks to contextual information except on the BBS.</td>
</tr>
<tr>
<td>2.4 Ranking</td>
<td>✓</td>
<td>×</td>
<td>×</td>
<td>-1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>-1</td>
<td></td>
<td>Feedback from subsidiaries is manually ranked before recording in the system.</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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</tr>
<tr>
<td>3. Retentiveness</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Knowledge Capture</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>Knowledge is captured at all three stages.</td>
</tr>
<tr>
<td>3.2 Accuracy</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>There is quality checking, technical vetting and input verification to ensure that the knowledge captured is correct.</td>
</tr>
<tr>
<td>3.3 Obsolescence</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
<td>There is a housekeeping maintenance process to ensure the knowledge within the BBS and various document databases is up-to-date.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
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</tr>
</tbody>
</table>
6.4.3 Step 9: Calculating Knowledge-Sharing Scores

The KS scores are tabulated below:

<table>
<thead>
<tr>
<th>Knowledge Property</th>
<th>Gathering Product Feedback</th>
<th>Product Recommendation &amp; Delivery</th>
<th>Product Knowledge Dissemination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Content (1)</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Knowledge Context (1)</td>
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<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Communication Channel (2)</td>
<td>3</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Channel Connection (2)</td>
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<td>-4</td>
<td>-3</td>
</tr>
<tr>
<td>Formal Structure (3)</td>
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<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>Political &amp; Power Structure (3)</td>
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<td>0</td>
</tr>
<tr>
<td>Knowledge Sharing Network (3)</td>
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<td>-2</td>
<td>1</td>
</tr>
<tr>
<td>Management Commitment (3)</td>
<td>-1</td>
<td>-3</td>
<td>2</td>
</tr>
<tr>
<td>Motivation &amp; Rewards (4)</td>
<td>0</td>
<td>-3</td>
<td>2</td>
</tr>
<tr>
<td>Training And Cognitive Issues (4)</td>
<td>1</td>
<td>-1</td>
<td>3</td>
</tr>
<tr>
<td>Relationships (4)</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
</tr>
<tr>
<td>Culture (4)</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Accessibility (5)</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Selectivity (5)</td>
<td>0</td>
<td>-2</td>
<td>0</td>
</tr>
<tr>
<td>Retentiveness (5)</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Collaboration (5)</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Organisational Scale (5)</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>Sectional sub-total</strong>*:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge Property</td>
<td>2 (0.18)</td>
<td>3 (0.27)</td>
<td>9 (0.82)</td>
</tr>
<tr>
<td>Sharing Channels</td>
<td>1 (0.08)</td>
<td>-3 (-0.25)</td>
<td>2 (0.37)</td>
</tr>
<tr>
<td>Organisational Infrastructure</td>
<td>2 (0.13)</td>
<td>-6 (-0.38)</td>
<td>4 (0.25)</td>
</tr>
<tr>
<td>Human Factors</td>
<td>4 (0.25)</td>
<td>-2 (-0.13)</td>
<td>8 (0.50)</td>
</tr>
<tr>
<td>Technology Provision</td>
<td>5 (0.31)</td>
<td>1 (0.06)</td>
<td>10 (0.63)</td>
</tr>
<tr>
<td><strong>Knowledge Sharing Score</strong>*:</td>
<td>14 (0.20)</td>
<td>-7 (-0.10)</td>
<td>33 (0.46)</td>
</tr>
</tbody>
</table>

*Note: The sectional sub-total and KS score are shown with aggregate values followed by normalised scores in parentheses.

6.5 Phase 4: Knowledge Sharing Improvement Analysis

6.5.1 Step 10: Analysing KS Gaps

The following radar diagram shows the normalised KS score of the sales configuration business process. Dissemination of product knowledge has the best practice, whilst product recommendation and delivery achieved the lowest score.

![Figure 6-6 KS score](image)

Gathering product feedback

Subsidiaries usually possess field knowledge about all four product families, together with knowledge about product reliability, performance and interoperability. They also know how satisfied customers are with products that have been installed. While high-level sharing of knowledge on technical issues and customer feedback are conducted through managerial meetings, operational KS amongst staff on the ground is less transparent. At present, there is no formal system or reliable channel through which subsidiaries can transmit their wealth of knowledge back to the SBUs, except through problem reports or service records. In reality, the problem reports represent merely the tip of the iceberg as in some countries as few as 1% of the technical problems encountered will be forwarded to GTS and eventually to the SBUs. Secondly, the
SBU’s knowledge needs cannot be satisfied by problem reports. There is a mismatch of knowledge needs between the subsidiaries and the SBUs.

Product recommendation and delivery

Cross-country KS among peer subsidiaries or cross-product-family sharing among SBUs occurs on an ad-hoc basis. At the moment, knowledge is shared only if specific questions are asked or requests for knowledge are explicitly made, i.e. the ‘pull’ approach. This partially explains the current situation where knowledge is often gathered for one unit’s own needs and purposes and not consolidated for sharing. Valuable experience gained in tackling certain combination of hardware and software configurations or knowledge learnt through servicing common issues is not shared amongst subsidiaries. Some of this knowledge may be transferred to colleagues in the SBUs, GTS or subsidiaries through conversations, discussion forums or via email, but the bulk of it is lost in the ad-hoc process. Knowledge in the subsidiaries remains as isolated ‘islands’, difficult to access from outside the geographical organisational boundary. A more proactive approach to institutionalising KS could be beneficial.

Product knowledge dissemination

Downstream dissemination of technical knowledge from the SBUs is structured through a systematic and formal process with the use of the BBS. The system is well understood by and accessible to all the units concerned. However, there is opportunity for improvement in the area of disseminating market knowledge. Online discussion forums are used to share knowledge informally among SBU product management groups. It would be useful to leverage such knowledge as global market trends or printer demand forecasts in various market segments with subsidiaries via the BBS.

6.5.2 Step 11: Correlating the KS Gaps with KS Management Levers

The KS scores for each of the five sections of the analysis grid are plotted on the diagram below. Factors related to organisational infrastructure and human issues contribute the most to product recommendation and delivery’s low score, followed by technology provision, knowledge property and sharing channels. The polar diagram also indicates that the process stage is weak in all areas except knowledge property.

![Sharing Score - By Factor](image)

**Figure 6-7 KS score – by factor**

The organisational infrastructure

1. Roles and responsibilities

There is no clear accountability for KS. Staff in subsidiaries are not aware of the role that they might play in transmitting their valuable field knowledge to SBU product development, or in sharing their experience with subsidiaries in other countries. Similarly, within SBU product management and development groups, people sometimes feel it is not part of their job to facilitate knowledge flow, that somebody else within the organisation will ‘take care’ of it.

2. Organisational structure

PrintCo has a hierarchical organisational structure, comprising product-centric SBUs and subsidiaries divided by geographies. Knowledge flows relatively effectively within each organisational unit following the hierarchical structure, but, except for
downstream knowledge transfer, intra-organisational sharing that cuts across boundaries offers opportunity for improvement. A lot of knowledge of common interest is held by individual units, and used primarily within the local units.

3. Alignment of objectives

The autonomy of subsidiaries has implications for KS across organisational units. As each unit (especially subsidiaries) organises itself in a self-sufficient way, each unit has its own knowledge requirements. Management needs to co-ordinate action at a corporate-wide level to align the objectives of knowledge activities and to provide global knowledge transparency so that duplication of effort can be minimised. An example is the ambiguous apportionment of profit and cost centres along the whole value chain. A product that costs little to produce may seem attractive to the manufacturing unit, but it may not prove profitable to the organisation as a whole if it incurs abnormally high service support costs. Without proper accountability for the product’s profit and loss throughout the whole value chain, the cost centre may simply be pushed downstream to the subsidiary, causing conflicts between units. People may start using their intimate knowledge of the product as a means of negotiating their position in the organisation. Management can impart an integrated global view, the company’s ‘Big Picture’, so that individual units’ knowledge objectives are aligned and people become aware of the part that they can play in sharing knowledge.

The human factors

1. Trust

The level of trust between organisational units is not high. Staff are sceptical about the reliability of knowledge held by certain providers in the company. This is known as the problem of “perceived credibility”. For example, experience gained by a subsidiary in one country may be rejected by others because it is not considered to be based on facts, but on personal opinions and an individual’s judgement. The nurturing of trust amongst staff in different units is not facilitated by the lack of frequent day-to-day interaction or a common language.

2. Motivation

Besides the absence of explicit rewards and incentives, there is no feedback system to motivate the providers to share their knowledge. For instance, subsidiaries feel that the knowledge they have forwarded to corporate SBUs is not appreciated. They do not know how the knowledge has been used, nor what conclusions have been drawn based upon it. Management should make use of a knowledge flow feedback loop to create more opportunities for KS, to establish trust between units and to motivate both knowledge providers and seekers to further engage in knowledge activities.

3. Culture

PrintCo’s culture is open to KS. Staff are very willing when asked to share their experience and knowledge with others. PrintCo does not have a knowledge-hoarding problem. Its open culture is a strong foundation for KS management to build on.

The technology provision

1. Connectivity

At the moment the LAN that the Intranet currently depends upon is accessible only to departments at corporate headquarters. Subsidiaries do not have access to the corporate LAN nor to the Intranet since the computer networks are not interconnected. The corporate IT plan is to provide business units worldwide with secured access to the networking infrastructure in the near future.

2. Integration

Besides the product documentation section on the BBS, other knowledge repositories are not integrated. For example, subsidiaries have their own individually developed databases on installation experience and service problems. Knowledge may be extracted from these databases for reporting common product faults to SBUs for product improvement, or they may be used to improve the pre-sales recommendation processes of individual countries. However, although these databases hold a huge
volume of reliable and field proven experience learnt from the currently installed base, the knowledge they contain is not shared.

The following line graph shows the detailed factors of the analysis grid.

![Normalised Sharing Score - By Factor](image)

**Figure 6-8 KS score – detailed**

### 6.5.3 Step 12: Carrying Out A Fill-Gap Analysis

Recommendations for improving the right-first-time sales configuration process are tabulated below.

#### Table 6-7 Fill-gap analysis table

<table>
<thead>
<tr>
<th>Knowledge Barriers</th>
<th>Recommendation</th>
<th>Benefits</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roles and</td>
<td>Elect a KS champion dedicated to promoting KS</td>
<td>KS management is relatively new to PrintCo; the staff member may drive</td>
<td>The person selected must be relatively senior with a proven track record in the company; otherwise the initiative may be seen as a fad.</td>
</tr>
<tr>
<td>Responsibilities</td>
<td>in the company.</td>
<td>knowledge activities in the company and increase awareness of benefits and</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>opportunities.</td>
<td></td>
</tr>
<tr>
<td>Organisational</td>
<td>Merge product R&amp;D SBUs with GTS to form a technical</td>
<td>Technical competence SBU integrates product development and technical support to improve both</td>
<td>The restructuring can become costly, risky and may harm short-term operational performance.</td>
</tr>
<tr>
<td>Structure</td>
<td>competence SBU.</td>
<td>upstream and downstream knowledge flow.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Establish total solution centres at subsidiaries,</td>
<td>The same team in a subsidiary is responsible for the whole sales process (i.e. one team will follow the</td>
<td>Increased complexity in co-ordination in the subsidiaries.</td>
</tr>
<tr>
<td></td>
<td>merging sales and technical support teams. Total</td>
<td>client from product recommendation, sales, to delivery and after market support, rather than two</td>
<td>Must guard against future bloat in size of corporate SBUs when functions are integrated and further expansion is</td>
</tr>
<tr>
<td></td>
<td>solution teams may focus on customer industries</td>
<td>Total solution teams act as product consultants who are more able to evaluate customer requirements and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(e.g. automotive, beverages, publishing), but have expertise on all (applicable) product families.</td>
<td>vet technical specifications.</td>
<td></td>
</tr>
<tr>
<td>Alignment of</td>
<td>Adopt the value chain approach to apportioning</td>
<td>Decision makers have a global view on new market opportunities and are in a</td>
<td>Could be difficult for divisional heads to agree on strategies and decisions.</td>
</tr>
<tr>
<td>Objectives</td>
<td>profit and cost by products. The company has to</td>
<td>better position to identify areas for improvement.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>recognise opportunities and threats across the whole</td>
<td>A shared vision and an integrated view of KS needs together with clear accountability for profitability according to</td>
<td>Does not help KS across product boundaries.</td>
</tr>
<tr>
<td></td>
<td>value chain from supplier, R&amp;D, manufacturing and</td>
<td>product lines.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>sales to distribution as well as throughout the whole</td>
<td>More proactive approach to provide and utilise knowledge across different</td>
<td>Certain amount of restructuring is required.</td>
</tr>
<tr>
<td></td>
<td>product lifecycle from product conceptualisation,</td>
<td>units supporting the same product family, Better KS across geographies.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>production, after market services and technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>licensing.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.6 Summary

This case study demonstrates the application of the KSMM to examine the state of knowledge flow between PrintCo’s sales and R&D business units in their effort to achieve ‘right-first-time’ product implementation. This chapter provides a good comparison with the PowerSys case study in the previous chapter in that this case presents empirical evidence on KS mechanisms employed for precise, structured knowledge. The use of a web-based bulletin board system as a centrepiece of PrintCo’s KS practice stands in sharp contrast to PowerSys’s human networking approach. The following table summarises findings of this case study:

<table>
<thead>
<tr>
<th>Knowledge Barriers</th>
<th>Recommendation</th>
<th>Benefits</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust &amp; Motivation</td>
<td>• Staff rotation for sales and technical personnel as part of the induction training.</td>
<td>• Provides opportunities for sales and technical staff to appreciate the other party’s job, for them to understand each other’s culture better and to interact more.</td>
<td>• More manpower and resources are needed.</td>
</tr>
<tr>
<td>Connectivity &amp; Integration of Technology</td>
<td>• Develop an integrated knowledge repository that is accessible corporation-wide.</td>
<td>• Captures the company’s experience in printer configuration and installation as part of the organisational memory.</td>
<td>• Maintenance problem in keeping the database up-to-date and relevant.</td>
</tr>
<tr>
<td></td>
<td>• There should be a corporate standard structure to capture knowledge of the whole process from pre-sale, sale to after-sales operations.</td>
<td>• Ability to employ case-based reasoning to identify configurations that may involve higher maintenance costs or technical difficulty.</td>
<td>• Delegation of responsibility to manage the content of the database should be clear. There must be clear rules of mutual benefit governing activities such that all units concerned should contribute content to the database.</td>
</tr>
<tr>
<td></td>
<td>• The sales configuration repository should capture product configuration, installation issues, and (standard or customised) application notes.</td>
<td>• Provides a standardised product recommendation and delivery process to save time and costs.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The sales configuration repository should be supported by a competitor intelligence database.</td>
<td>• Reduces the likelihood of interoperability problems; improves reliability of installed products and company reputation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The two databases should be integrated and linked for cross-referencing.</td>
<td>• Increases competitiveness with enhanced ability to optimally price non-standard configuration or turnkey customisation.</td>
<td></td>
</tr>
</tbody>
</table>

Table 6-8 Findings of the PrintCo case study

<table>
<thead>
<tr>
<th>Company</th>
<th>PrintCo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sector</td>
<td>Manufacturing</td>
</tr>
<tr>
<td>Size</td>
<td>Medium size enterprise</td>
</tr>
<tr>
<td>Status</td>
<td>A dynamic and growing specialist printing equipment manufacturer</td>
</tr>
<tr>
<td>Scope of Investigation</td>
<td>Investigated the sharing of product implementation knowledge in PrintCo’s pre- and after-sale process</td>
</tr>
<tr>
<td>Business Context and Strategic Objectives</td>
<td>• Ability to deliver ‘right-first-time’ printing solutions to customers</td>
</tr>
<tr>
<td>Knowledge Property</td>
<td>• Enhance operational efficiency and control cost</td>
</tr>
<tr>
<td></td>
<td>• Technical product knowledge and implementation experience to be shared were based on a set of ‘hard’ codifiable facts.</td>
</tr>
<tr>
<td></td>
<td>• The subject matters were clearly defined by the families of products sold by PrintCo.</td>
</tr>
<tr>
<td></td>
<td>• Service engineer required quick access to precise, readily available technical knowledge, whereas salesman required product specifications to be presented in layman terms free of technical jargon.</td>
</tr>
<tr>
<td>Sharing Channels</td>
<td>• The web-based extranet Bulletin Board System (BBS) was the main channel for inter-business-unit KS.</td>
</tr>
</tbody>
</table>

In applying the KSMF and the KSMM, the following lessons have been learnt basing on feedback from managers and the researcher’s own observations:

- The Business Context of the KSMF. Similar to the PowerSys case study, managers at PrintCo viewed KS management as a value-enhancing endeavour. They too found the framework’s knowledge-risk conceptual linkage to be novel.

- The Knowledge Sharing Process Model (KSPM) of the KSMF. The KSPM model was too abstract, and the process of mapping from the existing business process model onto the KSPM was not straightforward. The model was hardly useful in helping to resolve the managers’ particular problems in improving upstream knowledge flow from technical support staff at subsidiaries to corporate strategic business units (SBUs), or peer-to-peer knowledge flow across SBUs and/or local subsidiaries.

- The technology provision and human factors components of the KSMF. PrintCo adopted a technology-oriented KS practice focusing on the use of the BBS. Again similar to the PowerSys case study, availability and connectivity of IT tools were
the dominant factors that influenced the adopted KS practice. Managers preferred technology-oriented to human-oriented KS strategy.

- **The sharing-channel component of the KSMF.** There was a system that explicitly codified technical knowledge on printing products. These technical documents were then disseminated via the BBS. The BBS was the primary vehicle used to make this knowledge readily available to enable quick access.

- **The organisational infrastructure component of the KSMF.** The case study provided KS evidence involving formally assigned teams of engineers, salespersons, and technical support staff, within the larger organisational context of traditional hierarchical structure with corporate business units and holding subsidiaries.

- **The KSMM.** The methodology was useful as a conceptual tool in raising managers’ awareness and understanding in KS management. It was less useful as a tool to provide prescriptive recommendations.

### 7. Conclusion

This chapter summarises findings of the PowerSys and the PrintCo case studies and critically evaluates the KSMF and the KSMM in view of the experience gained in applying the two tools. They are followed by a discussion of the lessons learnt from these two case studies and a brief description of future work for KS management researchers.

#### 7.1 Findings

Findings of the PowerSys and PrintCo case studies are summarised in the table below.

<table>
<thead>
<tr>
<th>Table 7-1 Findings of the two case studies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Company</strong></td>
</tr>
<tr>
<td><strong>Sector</strong></td>
</tr>
<tr>
<td><strong>Size</strong></td>
</tr>
<tr>
<td><strong>Status</strong></td>
</tr>
<tr>
<td><strong>Scope of Investigation</strong></td>
</tr>
<tr>
<td><strong>Findings</strong></td>
</tr>
<tr>
<td><strong>Business Context and Strategic Objectives</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Knowledge Property</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Sharing Channels</strong></td>
</tr>
</tbody>
</table>
There was consistent upstream knowledge flow from individual business units to the Corporate Development Department.

But knowledge flow between different customer-facing business units and between front-end customer-facing and back-end operational business units needed improvement.

PowerSys lacked an overall KS strategy; there was no clearly defined role for KS.

The 'need-to-know' culture discouraged KS by throwing a security net over intelligence gathered and made BI work unnecessarily sensitive.

The feeling of being 'self-sufficient' encouraged complacency with status quo.

A lack of standardisation in computer systems for BI: systems and knowledge repositories belonging to different business units were not integrated.

The Intranet and LAN were not accessible from some remote offices.

The corporate portal initiative attempted to provide corporate-wide connectivity to all business units.

Product implementation experience gained by one subsidiary was used within the confines of that particular unit.

Feedback on implementation results was provided by sales and services engineers, but this knowledge was not forwarded back to the SBUs.

No co-ordinated identification of knowledge needs among subsidiaries and SBUs.

PrintCo had an open culture; people were willing to provide knowledge when asked.

Employees were not aware of the pressing need and the benefits of KS.

People were discouraged to share their experience if there was no 'hard' scientific proof substantiating it.

The BBS centralised the dissemination of product knowledge to subsidiaries.

Document database in the subsidiaries were not integrated or accessible from other business units.

The following table summarises the lists of recommendations made to PowerSys and PrintCo.

<table>
<thead>
<tr>
<th>PowerSys</th>
<th>PrintCo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop and communicate an intelligence sharing strategy:</td>
<td>Elect a KS champion to promote knowledge sharing:</td>
</tr>
<tr>
<td>• Communicate the management’s vision for the BI community and develop an intelligence sharing strategy.</td>
<td>• The person will be charged with developing an overall KS strategy for the company.</td>
</tr>
<tr>
<td></td>
<td>• The person will also co-ordinate KS initiatives in the company.</td>
</tr>
<tr>
<td>Implement an escalation system to tackle the limitation in resources and the ‘crunch-time’ problem:</td>
<td>Establish technical competence SBUs and total solution teams:</td>
</tr>
<tr>
<td>• Carry out thorough intelligence analysis only on the most critical areas with the use of an escalation system based on findings of initial analyses.</td>
<td>• Merge product R&amp;D, product management and GTS into technical competence SBUs.</td>
</tr>
<tr>
<td></td>
<td>• Establish total solution teams at the subsidiaries.</td>
</tr>
<tr>
<td>Streamline the BI work process:</td>
<td>Adopt a company-wide perspective to appportionment:</td>
</tr>
<tr>
<td>• Adopt a systematic approach to intelligence work and integrates the work process with a workflow system.</td>
<td>• Recognise the distribution of profit and cost centres across the whole value chain from supplier to after-sale servicing.</td>
</tr>
<tr>
<td>Assign clear roles and responsibilities for BI work:</td>
<td>Improve training and nurture trust among staff:</td>
</tr>
<tr>
<td>• Appoint an ‘agent of excellence’ who is charged with promoting intelligence sharing.</td>
<td>• Rotate newly recruited employees between the sales and technical departments as part of their training programme.</td>
</tr>
<tr>
<td></td>
<td>• Appoint knowledge experts for each crucial area of intelligence.</td>
</tr>
</tbody>
</table>

7.2 Critical Evaluation

First of all, the KSMF (diagram 3-5 on p. 80) is critically evaluated, based on the evidence collected in the two case studies. Next, the KSMM (table 4-1 on p. 109) is assessed to see whether it is a useful tool for managers in their efforts to improve their companies’ KS practice. This evaluation is based on feedback from managers and the researcher’s own observations.

Evidence gathered from the two comparative case studies highlights the following points about the KSMF and the KSMM:

Table 7-3 Lessons learnt about the KSMF and the KSMM


7.2.1 The Business Context

When the framework was first presented to managers, it was discovered that most practitioners viewed KS management exclusively as a value-enhancing endeavour. The KSMF’s linking of the value of KS management to competitive advantages derived from cost reduction and value enhancement as a result of mitigated operational risk and increased knowledge competence was a novel concept to them. This conceptual linkage was found to be useful in both case studies because it suggested a way of conducting the cost-benefit analysis of a KS initiative: that the value of KS can be expressed in terms of its ability to help an organisation realise its strategic objectives. In addition to providing a means of justifying the value of a KS initiative, the concept also helped to secure management commitment.

7.2.2 The Knowledge Sharing Process Model (KSPM)

The process model was useful in changing managers’ paradigm of thinking and orientating them towards viewing their business organisations from a KS perspective. This change in perspective allowed them to discover problems that previously had been hidden from them. In the PowerSys case study the model facilitated the mapping of the key knowledge stakeholders and identifying knowledge flow bottlenecks in the company’s business intelligence practice. The KSPM provided a structured model that helped to make the modelling process systematic.

However, it was also discovered in the PrintCo case study that mapping from existing business processes to the KSPM was not always straightforward. It resulted in a model so abstract that it was hardly useful in helping to resolve the managers’ particular problems. The mapping process had to be repeated several times before the key knowledge flow paths were identified.

7.2.3 The Four KS Strategies

- Technology provision and human factors. Although neither PowerSys nor PrintCo had an explicit KS strategy, the KS work practice adopted by both companies was strong evidence that KS enablers/blockers within the human-oriented and the technology-oriented strategies were the most important factors influencing the success of KS. The impact of these two strategies was as follows. Firstly, most managers preferred a technology-oriented to a human-oriented KS strategy, which they considered the latter a more difficult management problem. Managers were more enthusiastic about technologies than the ‘soft’ cultural and motivational issues that were fundamental to a human-oriented KS strategy’s success. The KS strategy adopted thus tended to be driven by the available telecommunications tools and technological infrastructure. Surprisingly it was to a much lesser extent driven by the characteristics of the knowledge concerned (whether it was highly structured product knowledge or unstructured business intelligence knowledge about a wide range of domains). Operational staff, however, would eventually resort to the practice they deemed most suitable in order to share their knowledge and get the job done, largely independently of the strategy adopted by management. For example, at PowerSys, even though there were many IT tools available for sharing intelligence, analysts still depended upon the informal BI community and human networking. Managers focused on implementing an intranet and an electronic discussion forum system, thinking two systems were the key to entice analysts share their intelligence with one another. It was until after some period of the two systems being under-utilised that managers started to probe further about why they did not deliver the expected results, and started to question the key role played by the human network. Secondly, if the same items of knowledge were to be shared repeatedly with a large group of knowledge seekers, knowledge providers were more likely to adopt a technology-oriented practice. Thirdly, regardless of whether a technology-oriented or human-oriented practice was in place, there was a tendency for people to shy away from advertising their knowledge and experience. KS was impeded at PowerSys because providers’ expertise was not made known effectively to others in the organisation.
• **Sharing channels.** Evidence from the case studies regarding the choice of sharing channels was in agreement with the media selection theory, confirming the relationship between choice of communication channels and knowledge property. People would typically choose a KS channel that cost them the least time and effort, based on knowledge properties such as tacit versus explicit knowledge, structured versus unstructured knowledge, and the degree of complexity perceived by the knowledge workers involved. If the knowledge concerned was perceived as explicit, structured and relatively simple, the knowledge provider would be more likely to make use of IT tools to enhance the efficiency of the KS process. If the knowledge concerned were perceived as tacit, unstructured and volatile, the knowledge provider would be less likely to document his knowledge. Instead, the knowledge provider would supplement KS with face-to-face dialogues or telephone conversations.

• **Organisational infrastructure.** PowerSys has a front-back organisational structure divided into back-end operational business units and front-end customer-facing business units, whilst PrintCo has a hierarchical structure comprising corporate business units and holding subsidiaries. In the case of PrintCo, core KS activities took place in formally assigned teams of engineers and salespersons, whereas in the case of PowerSys, KS activities involved informal communities of business analysts. However, more evidence is required to understand more fully the set of variables within the organisational infrastructure strategy before definite conclusions can be drawn about the relationship between organisational form and KS. Since both cases involved variations in the traditional hierarchical structure, further work is needed to understand the impact organisational forms have on the alignment of objectives amongst principals, agents and KS.

### 7.2.4 The Knowledge Sharing Management Methodology (KSMM)

With regard to the Knowledge Sharing Management Methodology (KSMM), the methodology was able to help managers identify which business processes merited close scrutiny. The systematic procedure gave the investigation process a clear structure, helped in achieving consensus among the participants and made the prioritising of activities more transparent. The KS score was useful because it helped people to visualise intangible concepts such as current KS practice, which managers could use to pinpoint where there were KS strengths and weaknesses in their operations. However, it was discovered that there was a conceptual gap between the descriptive and the prescriptive portions of the methodology. The KSMM consists of an idealised sequence that can be useful in guiding an investigation into an organisation’s KS practice, but there is not a sufficiently prescriptive element within the methodology to generate useful recommendations in view of the descriptive findings. The KSMM still relies on the creativity of a knowledgeable and skilful researcher in recommending appropriate solutions. This could be because the qualitative research approach adopted resulted in a lack of predictive capability in the methodology. However, the methodology is useful as a conceptual tool in raising managers’ awareness and understanding in KS so that they can more effectively probe their organisations for the means to improve current practice.

### 7.2.5 Changes Made to the KSMM

An operational risk component was removed from the original design of the KSMM in the course of conducting the two case studies. The component was removed due to the lack of evidence from the two cases to substantiate the operationalisation of the hypothesis of using operational risk as a proxy to measure the *potentially* realisable value of organisational KS. Managers found that the KSMF’s knowledge-risk conceptual linkage was novel. But PowerSys and PrintCo’s risk management and reporting systems did not capture any operational risk data.

Although this study did not manage to gather empirical data on operational risk, this does not mean that operational risk is not an important element to organisational KS management. In other studies of the process (petrochemical plants) and the financial (banks) industries, quantitative figures are actually assigned to operational risk. In those studies, about one-third of the operational risk was found to be knowledge-related.
7.3 Discussion and Conclusion

This section provides a closure to the thesis by discussing to what extent the objectives and the research questions set forth in Chapter 1 have been met, as well as the lessons learnt and the conclusions drawn from this research.

7.3.1 Meeting The Objectives

This section critically examines to what extent the objectives set forth in §1.4 have been met, in relation to the original motivations discussed in §1.2.

1. Identifying a common set of KS practices observable in modern knowledge-intensive companies. This objective has been met with the identification of the human- and technology-oriented KS practices. The business intelligence community at the PowerSys case study revealed how an informal community and human networking was used to share unstructured, often incomplete, inaccurate and even contradicting knowledge. The web-based Bulletin Board System (BBS) was key to the KS practice at PrintCo that shared precise, structured product knowledge and implementation experience. These two cases illustrate the two ends of the KS spectrum. On the one hand, unstructured knowledge must flow to fulfil ad-hoc, unpredictable demands of senior management in the context of a rapidly changing volatile environment. On the other hand, precise knowledge must be made readily available that allowed quick access to reliable know-how. Managers should take into account this distinction of KS practices and the intrinsic ‘stickiness’ of KS. They should not consider KS as simply an IT or systems problem, but make investment in IT only when it fits with the underlying KS practice exercised by the company.

2. Clarifying the relationship between KS, operational risk, intellectual capability and competitive advantage. This objective has been met by the development of the KSMF. Chapter 3 (specifically §3.3 and §3.3.1) deals which the conceptual linkage between the four ideas. It was argued that the potential value of KS might be realised from a reduction in knowledge-related operational risk. As a result of a reduction in exposure to operational risk, a company may derive from its enhanced intellectual capability an increased competitive edge in the marketplace.

3. Developing a practical KS management methodology that includes a procedure to identify and compare an organisation’s current state of KS. These two objectives have been partially met. The KSMM is a useful conceptual ‘how-to’ tool to support the identification of an organisation’s current KS practice. The Knowledge-Sharing Analysis Grid (§4.3.2) allows managers to compare the KS practices of different units effectively by juxtapositioning the strengths and weaknesses of respective units. This methodology also bridges the gulf between the theory and the practice. This holistic methodology is not only theoretically grounded, but also provides practitioners with a tool to put their KS strategies into practice. The Knowledge-Sharing Analysis Grid integrates the diverse yet inter-related theories of organisational learning and cognition, communication and media selection, culture and motivation, organisational structure, information management technology and knowledge networks. However, as mentioned earlier, the KSMF is too abstract and further work is required to operationalise the knowledge-operational risk relationship in order to employ the concept to value KS.

4. Having a structured procedure to reveal the gap between existing and targeted KS practices. This objective has been partially met. Phase 3 (Critical Assessment of KS Practice) and Phase 4 (Knowledge Sharing Improvement Analysis) of the KSMF provide a procedure to assess an organisation’s current KS practice. Based on the assessment, the procedure includes a set of steps to analyse the gap between the existing and the targeted KS practices. However, as described in the last section, the strategy formulated as a final deliverable of the methodology is still very much dependent upon the skills and knowledge of the researcher.

7.3.2 Answering the Research Questions

This section explains to what extent the framework KSMF and the PowerSys and PrintCo case studies answer the research questions set forth in §1.5.

1. What is the conceptual relationship between operational risk and KS management? The Knowledge Sharing Management Framework (KSMF) has
suggested one conceptual relationship between the two. It is that effective KS management leads to a reduction in knowledge-related operational risk and an enhancement of knowledge-based core competence, and as a result, accrues competitive advantage to the company concerned.

2. *What are the observable KS strategies? What are the key enablers and blockers to effective KS?* Although neither PowerSys nor PrintCo has an explicit KS strategy, the two practices adopted by their staff (as opposed to managers’ deliberate decisions) are human-oriented and technology-oriented practices respectively. The sharing of business intelligence at PowerSys is dependent upon its community members’ human network, while the web-based bulletin board system is the centrepiece of disseminating technical knowledge across business units at PrintCo.

3. *How does an organisation assess its current KS practice?* The Knowledge Sharing Management Methodology (KSMM) provides a step-by-step ‘how-to’ guide for managers to assess their organisations’ KS practices. Specifically, Phase 1 of the methodology presents a structured method to effectively identify the scope of an investigation. As knowledge is omnipresent and KS is so ubiquitous, the methodology helps to prevent managers from losing sight of their primary objectives. Phase 2 of the methodology presents a method to systematically review the KS practice adopted by an organisation. Phase 3 of the methodology presents a self-assessment procedure (the KSPM and the KS Analysis Grid) for an organisation to review its KS practice. The resulting scores and the radar diagrams from the KS Analysis Grid are effective means to focus managers’ attention on the most critical parts of their organisation’s business processes for further improvement.

4. *How does an organisation improve its current KS practice?* The KSMM provides a partial solution in helping managers to move forward their organisation’s KS practice. Specifically, Phase 4 of the methodology provides a guide to analysing the gaps between an organisation’s current practice and its strategic objectives. However, as discussed above, there is insufficient prescriptive help in providing recommendations such that an action plan can be drawn up.

### 7.3.3 Novelty of This Research

The novelties of this research are twofold. Firstly, a new holistic management framework – the Knowledge Sharing Management Framework (KSMF) – has been developed to integrate the diverse set of theories relevant to KS. This new holistic framework establishes the relationship between KS, knowledge-related operational risk, knowledge-based core competence and competitive advantage as the conceptual foundation for justifying the value of a KS initiative. The Knowledge Sharing Process Model (KSPM) it contains as a component is a newly developed generic KS model that extends on Lang’s (1997) adoption and diffusion cycle (the KSPM adds the integration and dissemination stages to Lang’s original work). The KSPM is then supported by four sets of organisational factors that are critical to successful KS. These factors are grouped into four generic KS strategies (sharing channels, organisational infrastructure, human factors and technology provision).

Secondly, this research has developed a new management tool – the Knowledge Sharing Management Methodology (KSMM). This methodology contributes to the next phase of KM development by helping to move forward the state of KM research from investigating ‘what’ knowledge is to investigating ‘how’ it should be shared. This novel methodology establishes the crucial link between strategic and operational level decision-making by examining an organisation’s current KS practice from a business process perspective.

### 7.3.4 Summary and Discussion of Key KS Issues

This section summarises the key KS issues laid out in §2.5 and discusses how they have been addressed by the two case studies. The table below provides a cross-reference between the key KS issues highlighted in §2.5 and the sub-headings of lessons learnt under which the key issues are discussed.

<table>
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<th>Item</th>
<th>Key KS Issues Discussed in §2.5</th>
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<td>Sufficient time and utility value</td>
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<td>#2</td>
<td>Feedback mechanism – mechanism that underpins KS</td>
<td>Knowledge sharing reciprocity and ‘trading’ relationship</td>
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<td>#3</td>
<td>Knowledge worker at the centre of attention</td>
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#1 – Issue: Relationship Between Time and KS; Lesson: Sufficient Time and Utility Value

How much time was invested in KS crucially influenced the success of such initiatives. Modern business organisations are typically lean structures with little slack in manning. In the drive to cut costs and increase efficiency, hierarchies have been flattened to eliminate redundant layers of management so there is little slack in the system. While the staff numbers have fallen steadily, staff workload has not decreased proportionately. Employees are expected to be highly productive and to work to tight project deadlines. For example, due to time pressure and resources constraints, analysts at PowerSys tend to concentrate on solving the problem in hand. Intelligence sharing becomes an ‘after-thought’, which more often than not results in intelligence being gathered and analysed to answer one particular question. The lack of intelligence ‘re-use’ in turn results in a duplication of effort that perpetuates the vicious cycle.

If KS is not included in a job description, the staff member does not think it can be important to the organisation. Indeed, some people even regard it as a distraction. As another example, analysts at PowerSys want more detailed intelligence from sales representatives, but sales representatives want to spend more time meeting clients. Similarly at PrintCo, service engineers do not have time after they have returned from customers’ sites to record problems they encountered to a level detailed enough to be useful for the R&D units.

This is an example of ‘single-loop’ learning, staying with the current way of working but doing it more often and doing it more quickly. KS involves a change of mindset and a different paradigm of thinking on the part of management. Managers need to engage the whole organisation in ‘double-loop’ learning, highlighting the importance and benefits of KS both to the individual knowledge worker and to the organisation as a whole. Managers should include KS activities as part of the job descriptions not only of knowledge workers but also of every employee who may provide or receive valuable knowledge from the organisation. Managers should also recognise when employees are engaged in KS and dedicate sufficient time for them to participate in KS activities.

But even we do allocate sufficient time for KS activities, time remains a scarce resource¹; both the knowledge provider and the knowledge seeker need to feel their time is well spent and that KS contributes to their getting their work done. The knowledge seeker will feel KS is a worthwhile undertaking if he regards the marginal utility of the knowledge he acquires is higher than the marginal cost of the time he spent acquiring it (or the marginal cost of the time that he would otherwise have had to expend in order to develop that knowledge on his own accord). The knowledge provider will feel KS is a worthwhile undertaking if the marginal utility of gain he benefits from sharing his knowledge is higher than the marginal cost of his time spent in coaching the seeker (or any loss of opportunity utility value he suffers had he not shared his knowledge is greater than the marginal cost of sharing). For example, business development executives at PowerSys found that it was too time consuming to engage in online discussions, especially since their questions did not get timely responses. Eventually people lost their interest and the electronic discussion forum remained under-utilised. Whereas in the case of PrintCo, service engineers, local and corporate technical support were making heavy use of their ‘chat room’ for sharing tips and experience. People participated because they found that they gained something out of their time spent on these discussion forums. They often ask: ‘what is it in for me?’ When they are unsure about what they will get in return for their time spent answering questions, they will be reluctant to participate in KS. Satisfying this condition of ‘utility’ is key to successful KS, which is also closely related to the principle of reciprocal sharing discussed below.

¹ Time as a scarce resource can be extended to effort expended or any other commodity or resource dear to the party involved.
#2 – Issue: Feedback Mechanism; Lesson: Knowledge Sharing Reciprocity and ‘Trading’ Relationship

Sustainable KS is reciprocal, i.e. a ‘trading relationship’ is established between the knowledge provider and the knowledge seeker with participation in KS providing mutual benefits to both stakeholders. If one party shared his knowledge, it is implicitly understood that the seeker would return the favour by exchanging his knowledge with the provider in the future. Knowledge gets ‘traded’ in this informal market because mutual benefits accrue in the transaction as both parties gain access to useful knowledge with less effort than it would otherwise cost them. For example, at PowerSys, ‘trading intelligence’ was commonly practiced. In fact, reciprocal sharing is one of the two underlying mechanisms used to keep the business intelligence network ‘warm’ and maintain contact between analysts (the other mechanism is having an ongoing ‘live’ project).

The advantage of the ‘trading’ approach is that it is highly motivating and develops trust and understanding amongst those involved in a virtuous cyclical manner. At PrintCo, product development units often use highly technical jargon that salespeople find difficult to understand. For example, salespeople had difficulty with the meaning of the phrase ‘depleted reservoir’ used on product documentation distributed by product development, when product development engineers ‘expected’ sales to understand it. ‘Trading knowledge’ is an effective way to cement understanding, trust, and relationship between provider and seeker. Once these have been cemented, the provider is more motivated to share his knowledge if the expected value of the knowledge he anticipates receiving in return is high enough (i.e. the ‘utility’ condition is satisfied).

Often the provider who expends resources in sharing his knowledge may not be the one who benefits from a knowledge exchange exercise. The reciprocity condition is thus important in maintaining the interest of the knowledge provider (given the seeker is already motivated to search for the provider’s knowledge in order to resolve his problems). For example, at PowerSys ‘interface nodes’ who perform the brokerage role at the business intelligence network does not always benefit from every KS transaction. However, reciprocal sharing provides a two-way feedback mechanism that encourages both the knowledge provider and the knowledge seeker to sustain their relationship and continue their sharing activities. This also helps to eliminate the ‘free-riding’ problem where someone benefits from KS by ‘milking’ knowledge from the provider without sharing his knowledge in return. All parties involved must contribute their knowledge; those who do not will be excluded from further access to knowledge. Thus reciprocal sharing results in the mutual exchange and KS rather than a one-way transfer as knowledge flows in one direction only.

The potential disadvantage of this ‘reciprocal trading’ approach is the hoarding of knowledge by people who anticipate that ‘higher value’ knowledge can be bargained for (assuming that the knowledge provider has already concluded that the ‘utility’ condition is met). This drawback was reported in studies of knowledge networks (Dyer & Nobeoka, 2000) and could be deduced from the proposed knowledge market (Cohen, 1998; Davenport & Prusak, 1998) which employs a similar concept of reciprocity, having knowledge sellers and buyers conducting transactions in a knowledge exchange to trade their know-how.

Those who champion communities of practice commonly believe that KS relies on openness and the willingness of the parties involved to share their knowledge and experience generously (Allee, 2000; Brown & Duguid, 1998; Brown & Duguid, 1991; Wenger & Snyder, 2000; Wenger, 1998; Wenger, 2000), a communal concept based purely on goodwill and doing what is good in the interests of the community. However, the empirical evidence gathered in this study gives a stronger support for the ‘reciprocal trading’ approach than the communal mechanism based on goodwill and altruism.

#3 – Issue: Knowledge Worker at the Centre of Attention; Lesson: Human Knowledge and Organisational Culture

KS cannot be forced, and managers cannot micro-manage people’s KS activities. Managers may impose certain behaviours in their organisations for a short period of time, but people’s normal behaviours are much more difficult to change. Although several attempts had been made at introducing an electronic discussion forum at PowerSys, after some initial enthusiasm, people’s interest waned. The system fell into disuse once the initial ‘push’ by management was over. People reverted to their human networking approach. Business analysts at PowerSys wanted to operate on a
‘need-to-know’ basis, where they could have control over the intelligence they possessed, something which the electronic discussion forum was unable to support. On the other hand, the bulletin board and discussion forums at PrintCo were heavily depended upon by both the product delivery team and the helpdesk staff when they needed to resolve implementation issues. Service engineers and sales representatives were well aware that the knowledge they were after would almost certainly be held somewhere on the organisation’s intranet. They knew that more often than not they could re-use the experience captured by the system, and it was in their own interests to share their experience.

The above discussion highlights the critical importance of creating a knowledge-friendly culture if organisations are to succeed in enabling KS. Even if the best technological tools are made available and the work procedures are meticulously specified, knowledge may still not get shared on the ground if people cannot identify with the purposes of KS and if KS runs counter to their belief and norms. Technology alone cannot solve the staff participation issue. Managers cannot expect people that will start sharing their knowledge automatically if technology tools are installed, and strict policies and rigid procedures may not enforce participation either. It is far better to have an employee whose objectives are aligned with sharing, who volunteers to share his knowledge with others in the organisation. The difficulty is that it can take much longer to change organisational culture and employees’ mindsets.

#4 - Issue: Holistic Factors Influencing KS; Lesson: Motivation and Knowledge as Power; Trust and Relationship

As discussed in §7.2.3, although managers preferred technology- to human-oriented KS strategy, operational staff would eventually adopt the most appropriate practice to fit the task in hand, be it technology- or human-oriented. Against the backdrop of holistic KS as introduced in §1.1 that KS is inseparable from human knower, this section discusses motivational and relational factors that underpin human KS.

‘Knowledge is power’ and ‘knowledge hoarding’ are often postulated as the primary barriers to KS (Marshall et al., 1996). Knowledge as a means of gaining political influence in an organisation as well as a means of protecting one’s own turf was cited in two interviews in this study, but otherwise the researcher found this to be a less significant impediment to KS than lack of time; the failure to recognise KS’s utility; the ambiguity in assignment of roles and responsibilities, and the absence of a knowledge friendly culture. On the whole, people do not hoard their knowledge in order to shore up power, but are willing to share it if they have the time and if they think the benefits they may recoup are worthwhile.

Having said that, however, people are generally reactive rather than proactive when it comes to sharing their knowledge. People normally welcome support and want to learn from others, but are not usually motivated to share proactively their know-how without incentives. At both PowerSys and PrintCo case studies, it was observed that knowledge seekers needed to take the initiative to search for available knowledge, and that once the appropriate knowledge was found, they had to engage with providers in a process of KS. It was seldom the case that the provider would volunteer his knowledge if there was no specific request from the seeker. These findings confirm the fact that KS is a function of human nature, that we are keen to share our own experience and know-how with others if the conditions are right (Ives et al., 2000).

The reactive nature of KS, that it is initiated upon requests or events also agrees with discussions under various headings such as ‘knowledge pull’ (rather than ‘knowledge push’) (Dieng et al., 1999; Holtshouse, 1998; O’Dell & Grayson, 1998; Zack, 1999) and ‘just-in-time’ demand-driven approach (rather than ‘just-in-case’ supply-driven) (Metayer, 1999; Waite & Company, 1997).

Even if KS is something people do naturally, it is still imperative to understand what creates the right conditions, in addition to having sufficient time available, the condition of utility, and a knowledge-friendly culture. A knowledge provider will be more inclined to share his knowledge if the following two conditions are satisfied (1) he can expect recognition and is aware of incentives, and (2) he has a good working relationship with the knowledge seeker that he can trust with the seeker’s handling of the provided knowledge. Discussions of recognition and incentives are often limited to financial compensations. Although monetary rewards can encourage KS behaviours, they are difficult to be put into practice consistently throughout an organisation due to the lack of an objective performance measurement system. KS activities often happen in the shadow of other formally assigned tasks (for example knowledge about a new competitor may be gained through a market research project
reviewing the company’s current position) and it can be impossible to separate performance appraisal criteria for knowledge activities from others. Feedback, letting the knowledge provider know how and what the provided knowledge has been used for, is a useful motivational mechanism to complement financial rewards. People like to know how their experience helps others solve their problems and what value it adds to others’ work. Besides its being courteous to give feedback, providing constructive feedback signals the seeker’s recognition of the effort spent by the provider in sharing his knowledge, and more importantly, strengthens the learning loop between the provider and the seeker such that they better understand each other’s knowledge needs. Furthermore, constructive feedback also helps establish trust between provider and seeker. The knowledge provider will feel more comfortable when he knows how his knowledge will be used, and to whom it might eventually be transferred. Established trust cements closer working relationships, and closer working relationship establishes trust and understanding of knowledge needs – the working of a mutually reinforcing loop.

#5 – Issue: Different Types of Knowledge Requires ‘Richness’ of Communication; Lesson: Knowledge Sharing Channels

Informal KS channels could be as effective as formal ones. PrintCo’s use of the bulletin board and discussion forums supported by an intranet and an extranet established an organisation-wide communication backbone that enabled access to technical product knowledge. Equally effective, the informal business intelligence community at PowerSys was a very flexible self-adapting and self-organising mechanism that enabled KS across organisational boundaries. The PrintCo’s formal communication channels based on telecommunication technologies allowed the high bandwidth transfer of explicit, relatively structured and stable knowledge on specific subject domains. The PowerSys’s informal channel based on human networking provided a rich communication medium that allowed the effective sharing of tacit, relatively unstructured and volatile knowledge on diverse subject areas. A technology-based KS channel may increase efficiency, but human networking is ever flexible, constantly adapting to the changing environment.

#6 – Issue: ‘Measurability Difficulty’ and ‘Valuation Problem’; Lesson: KS and Operational Risk

As briefly discussed in §7.2.5, §7.3.1 and §7.3.2, there was insufficient empirical evidence to operationalise the knowledge-operational risk concept. Further work is required to select appropriate operational risk measurement indicators that can be reliably used as proxy to measure the utility value of KS.

7.3.5 Guidelines

Drawing from the results of this study, the following principles are generic guidelines that may be useful for any KS initiative.

- People will find KS a heavy burden if it requires a substantial amount of extra effort. If KS consumes too much time that might otherwise have been spent on people’s primary tasks, they will regard KS as a nuisance, distracting their attention from their proper tasks and preventing them from delivering results. As far as possible, any KS initiative should be embedded in people ‘normal’ work processes, becoming part of daily routine rather than require additional effort.

- Identifying and making use of both formal and informal sharing channels is essential. Building and improving upon existing established channels that people find useful and are already familiar with is more effective than trying to create new ones. The key to facilitating ground-level interactions among staff is providing the KS channel needed for day-to-day work (for example, nurturing a knowledge network of human experts, or making available suitable IT tools, or both).

- For managerial staff, the most important consideration is understanding the relationship between KS and the organisation’s strategic objectives. The relationship between the value of KS and competitive advantages derived should be made clear to every one in the organisation. Managers should become aware of the key factors influencing sharing behaviours, understanding what are the organisational levers that they can use to effect sharing activities.

- A firm must not depend solely on a technologically oriented approach to KS. Technology decisions should depend on the type of knowledge concerned and
how well the organisational culture may fit with the introduction of a new tool. The limitations of computerised knowledge repositories should be recognised. Technology should be used to increase people’s KS capabilities, but not to replace human beings. Should the use of IT be necessary, it needs to be able to support the multifaceted characteristics of KS in a variety of media, not only the highly structured directories of documents but also the unstructured chaos of anecdotal knowledge and stories.

- It is important to provide the space and time for ground-level interactions and for people to participate in KS activities. Management should facilitate KS by providing space in the office as well as time for staff meetings, team gatherings, project debriefs and company conferences to keep the KS culture warm. Changing people’s mindsets and the organisational culture is a long process; there are no quick fixes.

- In additional to offering financial rewards, management should also recognise selected members of the organisation for their contribution to KS. People should also be encouraged to provide constructive feedback to one another. In addition to asking “what knowledge have you shared with your colleagues?”, managers should also ask “what feedback and appreciation have you shown your colleagues who shared their knowledge with you?” The reward system should support both ways of the knowledge transfer and feedback loop.

7.4 Further Work

This section points to further work that may increase our understanding of KS behaviours and improve the quality of the KSMM. In particular, it is important to gain a deeper understanding of the pervasive KS mechanism. Many interesting issues remain to be explored, such as if there is any other mechanism besides reciprocity (or community of practice) that may be used to mediate KS transactions between a knowledge provider and a knowledge seeker. What is the relationship between utility value, availability of resources and KS reciprocity? How does the structure of a KS network influence knowledge flow among knowledge stakeholders, further than that theorised by social network ties? Is there any difference in the mechanism (KS reciprocity or otherwise) that people employ to share knowledge in different geographical areas, culture or professional practices? For example, to what extent is KS reciprocity related to the ‘guanxi’ custom practised by many Chinese companies?

The methodology may be improved by enhancing the quality in the following five areas: generalisability, scalability, scope of application, prescriptive capability and linkage to intellectual capital management.

Although the research results are empirically valid and should be replicable across companies of different sizes and at different stages of development in the manufacturing engineering sectors, further work is required to generalise the findings for companies in other sectors. The KSMM is a generic design and it does not rely on any internal specifics peculiar to manufacturing companies. There is no design reason why it should not be equally applicable to companies in the service sector, for example.

The two case studies investigated core KS processes in the strategic planning and sales and product implementation functions. The findings reflected typical knowledge flow involving a modest number of organisational units within a company, focusing on specific functions. It would be useful to examine whether the methodology would be equally effective if a larger number of organisational units were involved, performing a wider range of functions within the company. For example, it would be useful to evaluate how the methodology performs in improving KS practice across an organisation’s supply chain, from supplier and partner following downstream all the way to distributors and customers.

In order to be able to apply the methodology across an organisation’s supply chain, it needs to be tested in an inter-organisational KS setting. Evidence for this research was gathered by examining intra-organisation KS. It would be interesting to test whether the methodology is equally effective in an inter-organisational setting. Such examples include KS among partners in alliance networks or virtual organisations. It is

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2 Guanxi is a Chinese custom characterised by a network of relationships and connections that seek to secure favours in social and business settings (Park & Luo, 2001).
anticipated that inter-organisational KS will increase complexity by bringing in another dimension: the problem of knowledge protection. Inter-organisational KS incurs a higher chance of illegitimate imitation and knowledge leak, thereby forcing the knowledge holding organisations to employ legal systems to protect their interests against knowledge misappropriation.

As discussed in §7.2 critical evaluation of the KSMM, the methodology requires further work in order to improve its prescriptive element such that it is more able to generate useful recommendations independent of the skills and expertise of the researcher. It is envisaged that a new phase (Phase 5) is to be appended to the methodology, with the option that the output from Phase 5 provides Phase 3 with feedback for iteration. That is, the methodology iterates between Phase 3 and 5, rather than following the linear progression in the current version. Step 12 shall be integrated with the newly added steps in Phase 5 such that the methodology may provide the manager with more prescriptive help about what can be done in view of the descriptive findings. This addition gives the manager a structured guide to come up with a list of alternative solutions so that one may be presented with a list of viable (recommended) options for evaluation and decision. This prescriptive phase should ideally be integrated with an action-planning tool that the methodology is packaged as a comprehensive tool to deal with not just the identification and analysis parts of the problem, but also the implementation aspects. The aim is for the methodology to generate concrete, actionable recommendations that the manager can select to move forward KS practice in their organisations.

The last point about the link to the field of intellectual capital management refers to the quantification of the value accrued as a result of improved KS practice. At the moment, the value derived from KS is analysed through competitive advantages resulting from the reduction of operational risk and the increase in knowledge competence. The relationship between the two is qualitative. Building a quantitative model to examine the relationship between KS and operational risk is a good step towards using risk (not only operational risk but other kinds of risk as well) as a proxy to measure intangibles. Certainly this area needs substantial further work to deepen our understanding.
### A.3 Business Process Activities Identification Table

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### Technology Provision

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### Human Factors

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### A.8 Fill-Gap Analysis Table

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**Technology Provision (2 of 2)**

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Appendix B. Definition of Terms

This appendix provides a definition of the terms used in the Knowledge Sharing Analysis Grid (refer to §4.3.2 and §A.7). The following list of terms are organised according to the structure of the Knowledge Sharing Analysis Grid. Each section below corresponds to one part of the analysis grid.

B.1 Knowledge Property

1. Knowledge Content:
   1.1 Reliability
   1.2 Currency
   1.3 Background Knowledge
   1.4 Form & Presentation
   1.5 Language & Jargons
   1.6 Completeness
   1.7 Sufficiency
   1.8 Secrecy & Confidentiality

2. Knowledge Context:
   2.1 Domain Specificity
   2.2 Inter-Dependence
   2.3 Context Sensitivity

B.2 Sharing Channels

1. Communication Channel:
   1.1 Capacity
   1.2 Cost
   1.3 Consistent Delivery
   1.4 Complex Knowledge Flow
   1.5 Channel Accessibility
   1.6 Experience of Use

2. Channel Connection:
   2.1 Reciprocal Knowledge Flow
   2.2 Mediating Agents
   2.3 Co-Ordination Process
   2.4 Choice of Sources of Knowledge
   2.5 Personal Focus
   2.6 Multiple Pathways

B.3 Organisational Infrastructure

1. Formal Structure:
   1.1 Delegation of Roles And Responsibilities
   1.2 Empowerment
   1.3 Team Structure

2. Political & Power Structure:
   2.1 Knowledge Power
   2.2 Sharing Champion

3. Knowledge Sharing Network:
   3.1 Scope
   3.2 Network Connection Strength
   3.3 Network Fragmentation
   3.4 Integrative Synergy
   3.5 Network Identity
   3.6 Trigger Mechanism

4. Management Commitment & Alignment of Objectives:
   4.1 Management Leadership
   4.2 Shared Guiding Vision
   4.3 Alignment of Objectives
   4.4 Business Environment
4.5 Investment Have sufficient time and resources been allocated for KS activities?

B.4 Human Factors

1. Motivation & Rewards:
   1.1 Motivation of Knowledge Provider Are knowledge providers motivated to actively share both their positive (success stories) and negative (experience of failure) knowledge?
   1.2 Motivation of Knowledge Seeker Are knowledge seekers motivated to actively look for opportunities to re-use knowledge and learn from best practice?
   1.3 Incentives Is there incentive for people to share their knowledge? Is KS included as one of the performance appraisal criteria?
   1.4 Morale Are employees worried about job security or are they in fear of losing their value in the organisation if their knowledge becomes known to everybody?
   1.5 Satisfaction Are employees satisfied with the benefits they gained from KS? Do they find their time well spent?

2. Training And Cognitive Issues:
   2.1 Provision of Training Is sufficient training provided for on KS?
   2.2 Awareness Are employees aware of the opportunities and the pressing need for KS?
   2.3 Absorptive Capability Is there difficulty on the part of the knowledge seeker to understand and internalise the knowledge received from the provider?
   2.4 Retentive Capability Is significant amount of knowledge lost through attrition as a result of high staff turnover?

3. Relationships:
   3.1 Trust Is the necessary level of trust established between the knowledge provider and the knowledge seeker?

4. Culture:
   4.1 Professional Praxis & Community Norm Are socio-organisational milieu conducive to KS? Is KS an accepted practice of the community concerned?
   4.2 Knowledge Ownership Are employees willing to openly share their knowledge? Is knowledge considered a ‘proprietary’ asset used to exploit individual gains, or a communal property used to promote co-operation for the collective good?
   4.3 Mindsets & Attitudes Do employees believe in KS? Do they have a positive attitude towards KS initiative?
   4.4 Organisational Culture Is the organisational culture friendly to KS?
   4.5 Peer Pressure Is there peer pressure that encourages KS or sanctions knowledge hoarding?
   4.6 Knowledge Divisiveness Is there segregation in the organisation as a result of sub-culture adopted by certain groups of employees, which may impede KS? (For example, engineers versus managers versus administrative staff.)

B.5 Technology Provision

1. Accessibility:
   1.1 Efficiency Is the search function provided by a KMS efficient in retrieving the most relevant pieces of knowledge?
   1.2 One-Stop Portal For Knowledge Does a KMS provide an integrated access to multiple sources of knowledge, such as that provided by a portal?
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