



Provided by the author(s) and University of Galway in accordance with publisher policies. Please cite the published version when available.

Title	A scorecard for supporting enterprise knowledge management
Author(s)	Cormican, Kathryn; O'Sullivan, David
Publication Date	2003
Publication Information	Cormican, K. and O'Sullivan, D. (2003) 'A scorecard for supporting enterprise knowledge management'. <i>Journal of Information and Knowledge Management</i> , 2 (3):191-201.
Item record	http://hdl.handle.net/10379/3674

Downloaded 2024-04-25T16:18:40Z

Some rights reserved. For more information, please see the item record link above.



Cormican, K and O'Sullivan, D. (2003) A scorecard for supporting enterprise knowledge management. *Journal of Information and Knowledge Management*, 2, 3, pp 191-201.

A Scorecard for Supporting Enterprise Knowledge Management

Kathryn Cormican¹ and David O'Sullivan

CIMRU, Department of Industrial Engineering,

National University of Ireland, Galway, Ireland.

Tel: + 353 91 512292

Fax: + 353 91 562894

Email: Kathryn.Cormican@nuigalway.ie

Abstract

Enterprise knowledge management is becoming a critical component of competitive success. Managers must ensure that they can successfully generate, leverage and reuse knowledge assets in their organisations. In this view, they must seek to develop an environment that promotes effective knowledge management initiatives. Self-assessment scorecards can help managers and decision makers ascertain whether they are incorporating best practices in terms of knowledge management initiatives. This paper presents findings from an exploratory case study analysis. Specifically, it presents a knowledge management scorecard expressly designed to help managers to measure their performance in terms of knowledge management against best practice. It helps to provide an overview of a company's strengths and areas for improvement with regard to knowledge management, highlighting those areas that

¹ Corresponding Author

require attention. In this view, it serves as a checklist for effective knowledge management.

Keywords

Knowledge Management, Self-Assessment Scorecard, Exploratory Case Study Analysis

Biographical Notes

Kathryn Cormican (Ph.D.) is a lecturer in the Department of Industrial Engineering at the National University of Ireland Galway. Her research interests lie in the areas of enterprise modelling, product innovation management, and collaborative workgroups. Kathryn manages a number of European Union and industry funded research projects in this area. She also works with many leading organisations helping them to design, develop and deploy new processes and systems.

David O'Sullivan (Ph.D.) is director of research at CIMRU, at the National University of Ireland, Galway. CIMRU has 40 staff and an annual turnover of c€1.2m for research in the areas of innovation management, eBusiness, enterprise applications integration and design for the environment. David has over 60 publications including books entitled Manufacturing Systems Redesign (Prentice Hall), Reengineering the Enterprise (Chapman and Hall) and Handbook of IS Management (Auerbach).

1. Introduction

According to Robbins (1998) enterprise growth today depends upon innovation and innovation depends on knowledge. Drucker (1993) also defines innovation in terms of the application of knowledge to produce new knowledge. In this view, knowledge management not only acts as a catalyst for innovation and creativity, but also provides the means by which innovative ideas can be captured, shared and leveraged leading to new ideas. This requires systematic efforts and a high degree of organisation. Many researchers have identified knowledge as one of the most important resources that contribute to the competitive advantage of an enterprise (Haldin-Herrgard, 2000; Pan and Scarbrough, 1998; Grant, 1997; Wiig et al, 1997). To this end, knowledge must be effectively managed if improvement efforts are to succeed and businesses are to remain competitive. Specifically, organisations must seek to develop, use and distribute knowledge-based competencies in order help design, develop and deploy successful new products and processes. Consequently astute organisations are starting to pay more attention to the concept of managing their knowledge base (McDermott and O'Dell, 2001; Holtshouse, 1998; Leonard and Sensiper, 1998). Audits or scorecards can help managers and decision makers improve their knowledge management initiatives. They can help to assess whether the conditions necessary for effective knowledge management are in place and the degree to which best practice is used. The use of scorecards provide an overall assessment of the systems adopted with respect to best practice and enables decision makers to identify whether or not the required managerial processes and practices are in place (Chiesa et al, 1996). This paper aims to facilitate the understanding of knowledge and knowledge related work. Key concepts are defined from the outset. A knowledge management scorecard specifically designed to identify key success factors for successful knowledge management is developed using qualitative research techniques and presented in this

paper. This scorecard was applied in industry and findings from this analysis are discussed.

2. Understanding Knowledge, Information and Data

Understanding the key concepts of data, information and knowledge is important for setting the scope of this study. Many authors have noted that there is a difference between these concepts (see Knock et al, 1997; Wilson, 1996; Bohn, 1994). Data is characterised as a set of discrete facts about events and the world. Glazer (1991) contends that information is “*data that have been organised or given structure – that is placed in context – and thus endowed with meaning*”. In other words, information is the outcome of capturing and providing context to experiences and ideas. Knowledge on the other hand is composed of tacit experiences, ideas, insights, values and judgements of individuals (Bohn, 1994). It is dynamic and can only be accessed through direct collaboration and communication with experts who have the knowledge. According to Wilson (1996) by selecting and analysing data, we can produce information and by selecting and combining information we can generate knowledge. The processing hierarchy of data, information and knowledge is illustrated in Figure 1.

Insert Figure 1

It is important to note that information technologies can help translate data in to information. Information, on the other hand, is only converted into knowledge through social human process of shared understanding and sense making at both the personal level and the organisational level. According to Churchman (1971) “*to conceive of knowledge as a collection of information systems seems to rob the concept of all its*

life.....Knowledge resides in the user and not in the collection. It is how the user reacts to the collection of information that matters". Knowledge is not a corporate resource it belongs to individuals. Therefore, managing knowledge is about creating an environment that fosters the continuous creation, aggregation, use and reuse of both organisational and personal knowledge in the pursuit of new business value. Thus enterprise knowledge management is about creating an environment that encourages people to learn and share knowledge produce new knowledge that is usable and useful to the organisation.

3. Understanding Knowledge Work

The nature of knowledge work is ad hoc, demand driven and creative. Davenport et al (1998) contends that knowledge work focuses on the acquisition, creation, packaging or application of knowledge. In this view, knowledge work is complex and diverse and it is performed by professional or skilled workers with a high level of expertise and competence. A knowledge worker gathers, analyses, adds value and communicates information to empower decision-making. A knowledge worker's job entails doing work for which there is no finitely determined process. Their tasks are not prescribed in advance, but are determined just in time in response to issues, opportunities or problems as they arise. According to Laudon and Laudon (1999) not only do knowledge workers use their knowledge to interpret incoming information, but they also create new knowledge as well. Drucker (1993) believes that the great management task of this century will be to make knowledge work productive. Many researchers state that organisations' core competencies will centre on managing knowledge and knowledge workers in the future (Johannessen et al, 1999; Nadler and Tushman, 1999; Mendelson and Pillai, 1999; Davenport and Prusak, 1998). They add that industrial growth and productivity gains will depend heavily on

improvements in knowledge work. However, there is little evidence to suggest that adequate provision is made for promoting, capturing, sharing and disseminating knowledge in organisations. Also, as knowledge management initiatives and systems are just beginning to appear in organisations, there is little research and field data to guide the development and implementation of such systems or to guide the expectations of the potential benefits of such systems. Upon analysis it seems that these deficits must be addressed. Thus, a viable approach is critically needed for improving knowledge work. In this view, it is imperative to design an environment to support both knowledge work and knowledge workers.

4. Research Approach

Researchers are calling for greater employment of field based research methods in order to cope with the growing frequency and magnitude of changes in technology and managerial methods (Lewis, 1998). Consequently, this study uses case study analysis. Qualitative research methods such as case study analysis can help us to understand the social and cultural contexts within which people work. In this instance, no attempt is made to isolate the unit of analysis from its context, but instead the unit of analysis is of interest precisely because of its relation to its context. This approach is also suitable for exploratory, theory building research where the emphasis is on sense making and meaning. The strength of case study research is that it employs various sources of evidence to improve the accuracy and comprehensiveness of resulting theory (Johnston et al, 1999; McCutcheon and Meredith, 1993). Qualitative data sources include observation and participant observation (i.e. fieldwork), interviews and questionnaires, documents and texts, as well as the researcher's impressions and reactions. By adopting this approach, the strengths of one data collection method compensates for the weaknesses of the other. In addition, the subject can be

examined from different angles and a more complete picture of the situation is provided.

Five case studies were conducted during this study. The aim of this activity was to understand knowledge management in specific industrial contexts. The sample chosen for this analysis was selective, based on high tech organisations with mature capability systems and a reputation for adopting best practice and. The industrial sector of the organisation's selected consisted of companies from many sectors including medical devices, electronics and pharmaceuticals. The goal of this analysis was (a) to understand knowledge management practices in each organisation and (b) to identify factors that facilitate knowledge management in industry. Figure 2 illustrates the research methodology employed in this study.

Insert Figure 2

There are four key stages in this methodology. These are (a) background, (b) induction, (c) development and (d) validation. These are briefly discussed below.

- Background: This phase incorporates defining the theoretical domain, targeting the research, identifying the problem and determining the scope of the study.
- Induction: This phase comprises analysing the data within and across organisations or cases, developing initial hypothesis and comparing hypothesis to the literature and cases.
- Development: This phase involves developing and presenting the knowledge management scorecard.

- Validation: The final phase incorporates evaluating and verifying the scorecard against proven theoretical concepts and industrial practice.

The next section summarises the key findings from this study. Specifically, it presents critical factors that are important for developing an effective environment to facilitate successful knowledge management initiatives. From this a knowledge management scorecard is developed and presented.

5. Critical Factors for Effective Knowledge Management

The findings of this study revealed that the key to successfully managing knowledge resources in organisations is multifaceted. However, an organisation's attributes or characteristics can have a significant impact on knowledge management initiatives. Therefore, companies must purposefully construct strategies and structures so as to enhance knowledge generation, transfer and reuse. Consequently, if organisations wish to encourage these activities they must explore the range of identifying factors. Many researchers assert that organisations pay too much attention to managing explicit knowledge (codified knowledge) at the expense of tacit knowledge (implicit, personal knowledge) (Kreiner, 2002; Hildreth et al, 2000; Zack, 1999; Nonaka and Konno, 1998). It is important to remember that companies do not merely manage knowledge; they create it as well and everyone in the organisation should be involved in knowledge creation. Therefore, building an effective environment depends on developing an integrated socio-technical system (Ahmed, 1998). Here equal emphasis on the social side as well as the technical side of the organisation. From our study we have identified and grouped five key categories that enable effective knowledge management. These are; (1) Strategy and Leadership; (2) Culture and Climate; (3) Architecture and Structure; (4) Motivation and Performance; and finally; (5) Communication and Collaboration. Each of these categories were

Comment [KC1]: Introduce the scorecard – is it a checklist of success factors or is it intended as a more extensive continuous performance management instrument?
What level in the organisation is it used?
Has it been validated and tested? Practical Application and use of the scorecard...(testing and validation)

How do we redesign the organisation based on these findings?
Out a roadmap in place to help us

found to facilitate knowledge activities in organisations and therefore must be effectively managed.

5.1. Strategy and Leadership

The first key success factor to enable enterprise knowledge management is strategy and leadership. Many researchers highlight the importance of having an effective knowledge strategy (Salisbury, 2003; Campos and Sánchez, 2003; de Pablos, 2002). Systematic knowledge management is a means to an end not an end in itself (Bassi, 1998). Therefore, knowledge management initiatives must be linked to strategies. Organisations need the focus of a well-defined knowledge management strategy in order to establish the appropriate priorities. Defining a clear purpose and strategic intent are critical to the success of knowledge management endeavours (Ulrich, 1998; Kotnour et al., 1997). Organisations must also be able to illustrate how knowledge can have a clear impact on measures such as cycle time, cost, quality, productivity and profitability. Consequently, it is imperative that these strategies are linked to performance measures. Hansen et al. (1999) identify two strategies for managing knowledge. The first is the codification strategy. Here focus is on the computer. In this instance, knowledge is carefully coded and stored on database systems where it can be accessed and used by others. The second strategy is the personalisation strategy. Here the focus is on the person in order to help people communicate knowledge as opposed to storing it. These strategies are not mutually exclusive but rather complementary to each other.

Effective leadership is also important for successful knowledge management. Leaders have the ability to influence a group towards the achievement of goals (Robbins, 1998; Ahmed, 1998). To do this they must establish and communicate

goals (Finnie and Early, 2002) build trust and inspire teamwork (Thite, 1999; Robbins, 1998). They must also consider all projects in terms of a system of interrelated activities that combine to fulfil the overall strategy of the organisation (Englund and Graham, 1999).

5.2. Culture and Climate

Many researchers agree that creating a culture and climate for knowledge generation, transfer and use has a positive impact on organisational performance (Connelly and Kelloway, 2003; McDermott and O'Dell, 2001; Banks, 1999; Ahmed, 1998; Davenport and Prusak, 1998; Buckler, 1997). Culture and climate are interrelated (Schneider et al, 1996) and often these two terms are used synonymously. Culture is considered to be made up of a collection of fundamental values and belief systems which give meaning to organisations. It is created from a broad range of internal and external influences, some of which are difficult to manage (Alvesson, 1991). Climate is understood to be an observation of how an organisation deals with its members and environments. Climate develops specifically from internal factors that can be actively managed (Ostroff and Schmitt, 1993).

An organisation's culture and climate can either promote or inhibit knowledge management practices. For example, a culture of openness, confidence and trust is required to encourage the application and development of knowledge within an organisation, while factors such as suspicion, fear and detachment are found to inhibit this process (Scarborough et al., 1999; Banks, 1999). Improvements in how a firm generates, transfers and applies knowledge are rarely possible without simultaneously altering the culture to support new behaviours. To change an

organisations' culture, values, norms and attitudes must be amended so that they make the right contribution to the collective culture of the organisation.

Key success factors that support a knowledge oriented culture include (a) developing a visible connection between sharing knowledge and practical business objectives (b) integrating knowledge creation and transfer with an existing key business initiative, (c) aligning reward and recognition structures to support knowledge transfer and reuse.

5.3. Architecture and Structure

An organisation's architecture and structure has been identified as a lever for knowledge based work. Traditional functional oriented structures previously lauded for their effectiveness and control are no longer appropriate in today's dynamic environment. Knowledge creation and transfer demands interactions between different organisational functions whose expertise skills and experience are mutually reinforcing and cumulative. In addition, research indicates that organisations leverage individual talents into collective achievements through networks of people who collaborate (Hildreth et al., 2000; Swan et al., 1999).

Work teams are emerging as the dominant organisational component of the new economy. They are more consistent with flatter, more flexible and more responsive organisations. Here work is organised around value adding processes or projects that are carried out by small, multi skilled, self managed teams. Consequently, organisations are beginning to reorganise reporting lines and organisational structures not around traditional tasks or functional departments, but around cross functional teams and communities of practice.

Cross functional teams are an ideal mechanism for capitalising on multiple perspectives. The promise of cross functional teams rests on the foundations of systems thinking. In other words, they are comprised of people from different functions in an organisation and they take into account the vital linkages that connect functions within the organisation. Cross functional teams promote flexibility, responsiveness and mutual accountability. Communities of practice, on the other hand, are informal networks in which experience is shared among the members. These networks are not only mechanisms for communicating they also help to advance collective understanding by providing a forum for sense making (Warkentin et al, 2001; McDermott and O'Dell, 2001). In doing so, they create value for their individual members as well as the organisation.

5.4 Motivation and Performance

Peoples' ideas, skills, experience and motivation will drive the knowledge-based economy; therefore motivation and performance measurement systems must become a component of corporate strategy. Motivation theory suggests that individuals respond positively to stimuli that reward achievement and performance. Performance measurement and reward systems are key elements in aligning the interests of employees to that of the organisation (Liebeskind, 1996; Bukowitz and Pertrash, 1997). They can be adjusted to encourage the desired behaviour from all staff. Therefore, if organisations wish to encourage knowledge management activities such as knowledge sharing and reuse they must design motivation and measurement systems that incorporate these activities.

Knowledge management activities such as knowledge sharing frequently requires time and effort on the part of the owner of that knowledge to codify or represent the

practices, processes or information necessary to allow another person to apply the knowledge. However, there are few reports of practical incentive mechanisms linked to measuring and rewarding reuse of knowledge. Most companies still use traditional performance measures, which in many instances are inappropriate indicators of success. Performance indicators should be developed which demonstrate the value of knowledge to the organisation by monitoring its contribution to the bottom line and valuing it as an intellectual asset. However, companies are only beginning to look for ways to manage and measure the intangible assets that are now recognised as important factors for their market value. Work on intellectual capital indicators is still in its infancy. Much experimentation is going on in large firms and several competing theoretical frameworks have been developed. For example, the Balanced Scorecard was developed by Kaplan and Norton (1996) focuses on learning and growth, internal business and customer perspectives. Also Sveiby (1997) developed the Intangible Asset Monitor to examine the competence of the personnel and the internal and external structures.

5.5 Collaboration and Communication

The knowledge process can be described as an information transformation process where information is gathered, processed and transferred in a creative way. The right information must be made available to the right place, at the right time, and in the right format. Therefore, communication is a vital and basic necessity for knowledge management. Frequent communication increases the amount of information directly in that more communication usually yields more information. Collaboration facilitates the cross fertilisation of ideas. Communication among employees and with outsiders stimulates their performance. Thus, the better that

members are connected with each other and with key outsiders the better their performance.

Information technology can facilitate inter-organisational as well as intra-organisational communication (Handfield and Nichols, 1999; Mandviwalla and Khan, 1999). Advances in information Communication technology has created the opportunity for many organisations to establish collaborative networks of partners, with whom they may exchange strategic knowledge and achieve mutually beneficial objectives (Warkentin et al, 2001; Mandviwalla and Khan, 1999; Nadler and Tushman, 1999; Leidner, 1999). This technology makes it easier, faster and cheaper to identify and link development team members in order to share information and create knowledge to fulfil customers needs, wants and expectations. It is also a powerful enabler to knowledge management objectives. It can be said that the goal of a knowledge management tool is not to manage knowledge by itself but to facilitate the implementation of the knowledge process. Such tools can facilitate the process of generating, structuring and sharing knowledge across temporal, geographical departmental and organisational boundaries (Scott, 1996). They allow the joint development of experiences and insights and enable the creation of social networks. Thus, they not only support communication but also collaboration.

These five levers are a synthesis of best practice in the area of enterprise knowledge management and are useful to support the management of knowledge assets in organisations. These theoretical concepts can be translated into concrete statements through an audit, which forms the enterprise knowledge management scorecard (see Table 1).

Insert Table 1

6. Implementing the Scorecard

The scorecard was implemented in five high technology organisations. The identity of the particular organisations is concealed in order to maintain confidentiality. The organisations are profiled in Table 2. Analysts and senior decision makers were requested to complete the scorecard on behalf of their organisation. The survey required respondents to determine (a) how important they considered each statement to be for their particular organisation and (b) how their organisation performs with respect to each statement. This process gave them the opportunity to identify the factors or traits that are relevant to their particular facility taking into consideration the industry and operating environment. It also enabled them to understand the current or AS IS state by measuring activities and systems against best practices.

Insert Table 2

Taking an average score for each of the individual sub-headings enabled decision makers to identify how well the organisation is doing with respect to each major category. These values were then plotted on a 'radar diagram'. Figure 3 illustrates the average scores in each category for organisation AB1. This indicates that the organisation is not implementing adequate systems for all categories except communication and collaboration. Implementing the scorecard helps to provide an overview of a company's strengths and areas for improvement. It can be used as a mechanism to focus and prioritise improvements to where it is most needed. It can

also be used as a means of measuring progress over time through periodic comparisons.

Insert Figure 3

The next step in the process is to identify the TO-BE or desired state. From this, a migration plan can be developed. A migration plan is a time based plan that defines what the organisation wants to achieve and what it must do to meet these goals. It incorporates developing visions, defining strategies, setting goals, identifying performance indicators, establishing milestones, and lists of tasks with associated timelines. It helps focus resources on the critical tasks that are needed to meet those objectives. This process provides an important tool for collaborative planning and coordination for all key stakeholders. In this way, a team of experts can determine and prioritise critical goals in order to make and leverage appropriate investment decisions.

7. Discussion

All organisations that participated in this study engage in value added activities and knowledge based competencies such as capturing and prioritising customer requirements, designing new products, implementing new processes and marketing products and services. Consequently, all organisations considered enterprise knowledge management to be important to gain and maintain competitive advantage in their respective industries. The overall results from this analysis are presented in table 3.

Insert Table 3

The key findings of the study revealed that organisations that received higher scores enjoy a good fit between their current systems and the best practice criteria. Inversely, organisations that did not achieve high scores do not have adequate support systems and consequently experience more difficulty optimising their knowledge resources. All respondents indicated that they are not doing as well as they would like to be doing with respect to implementing best practice in order to support effective knowledge management initiatives. This is illustrated in table 3. In this view, the first column (NB) represents how important each organisation considered the statements to be for them while the second column (AS IS) represents how they actually fared with respect to the statements. These findings are in line with those of other researchers who indicate that best practice for enterprise knowledge management is still in its infancy and suggest that there is significant scope for improvement.

Further to in depth interviews and much discussion about the traits that appear on the scorecard, certain traits were highlighted for particular attention. For example, many managers believed that it is imperative to have flexible strategies in order to respond to changes in the environment. In this view agility, responsiveness and flexibility are vital to the success of high technology organisations operating in a dynamic environment. Particular attention was given to the importance of an organisation's culture. Specifically, managers note that the development of an environment that promotes idea generation from all members is essential. In this view, much value is placed on employee participation and contribution in the idea generation and problem resolution process. Furthermore, sharing knowledge throughout the organisation was identified as being key for success. To this end, organisations are attempting to facilitate communities of practice, collaborative networks and mentor systems in an attempt to leverage individual skills, promote

cross fertilisation of ideas and enhance knowledge reuse. Organisations also noted that leveraging individual tacit knowledge into explicit corporate know how was extremely difficult. These findings are similar to those of other studies (see Haldin-Herrgard, 2000; Nonaka and Konno, 1998; Holthouse, 1998). Interestingly many managers in this study asserted that they did not feel that encouraging risk taking was important. However findings from other studies indicate that innovative organisations take risks (Johannessen et al, 1999; Ahmed, 1998). In other words, they are prepared to gamble their resources (e.g. time, energy, money and equipment) on an idea that is not guaranteed to succeed. All decision makers noted that it was essential to structure the organisation in such a way that all operations are driven by the voice of the customer. They also noted that that this was not an easy thing to do. Performance measurement was believed to have a significant impact on promoting desired behaviour. To this end, performance measures must be aligned to knowledge strategies and goals and effectively communicated to all stakeholders in order to keep everyone focused in the same direction. This study also found that performance measurement systems were not as effective as they should be and more work should be conducted in this area. Finally, communication and collaboration was seen to be imperative for generating and sharing knowledge and information. Most organisations seem to have invested heavily in this area in recent years. Communication within project teams was very effective but many managers noted that they had problems communicating between teams and with extended team players.

7. Conclusions

Research indicates that an organisation's core competencies will centre on managing knowledge and knowledge workers in the future. It seems that industrial growth and productivity gains will depend heavily on improvements in knowledge work. Thus, a viable approach is critically needed for improving knowledge work. This paper aims to improve the understanding of knowledge and knowledge related work. It aims to develop a critical success factors model for managing knowledge management initiatives in industry. From this a scorecard is developed that aims to help managers and influencers understand their strengths and their weaknesses with regard to enterprise knowledge management. This scorecard was implemented and validated using case study analysis.

Self-assessment scorecards can help analysts and decision makers to identify gaps between their current and desired performance. They enable decision makers to identify where successful strategies can be further exploited and pinpoint where problems, or potential, problems lie. Furthermore, they provide the necessary information that can be used to develop action plans to improve performance. In other words, the self assessment process not only enables managers to draw in existing knowledge but also to apply it in a structured manner to their own priorities and concerns.

8. References

Ahmed, P.K. (1998) Culture and climate for innovation, *European Journal of Innovation Management*, 1, pp 30-43.

Alvesson, M. (1991) Organisational symbolism and ideology. *Journal of Management Studies*, 28, 3, pp 207-225.

Banks, E. (1999) Creating a knowledge culture, *Work Study*, 48, 4.

Bassi, L. (1998) Harnessing the power of intellectual capital, *The Journal of Applied Manufacturing Systems*, Summer, pp 29-35.

Bohn, R. (1994) Measuring and managing technological knowledge, *Sloan Management Review*, Fall, pp 61-73.

Buckler, S.A. (1997), The spiritual nature of innovation, *Research-Technology Management*, March-April, pp. 43-7.

Bukowitz, W. and Petrash, G. (1997) Visualizing, measuring and managing knowledge, *Research Technology Management*, 40, pp 24-31.

Campos, E. B. and Sánchez, P. S. (2003) Knowledge management in the emerging strategic business process: information, complexity and imagination. *Journal of Knowledge Management*, 7, 2 pp 5-17.

Chiesa, V., Coughlan, P. and Voss, C.A. (1996) Development of a technical innovation audit, *Journal of Product Innovation Management*, 13, pp 105-136.

Churchman, C.W, (1971) *The Design of Inquiring Systems: Basic Concepts of Systems and Organization*, Basic Books, New York.

Connelly, C.E. and Kelloway, E.K. (2003) Predictors of employees' perceptions of knowledge sharing cultures. *Leadership and Organization Development Journal*, 24, 5, pp 294-301.

Davenport, T.H. and Prusak, L. (1998) *Working Knowledge: How Organisations Manage What They Know*, Harvard Business Press, Boston.

Davenport, T.H., De Long, D.W. and Beers, M.C. (1998) Successful knowledge management projects, *Sloan Management Review*, Winter, pp 43-57.

de Pablos, P. O. (2002) Knowledge management and organizational learning: typologies of knowledge strategies in the Spanish manufacturing industry from 1995 to 1999. *Journal of Knowledge Management*, 6, 1, pp 52-62.

Drucker, P. (1993) *Post Capitalist Society*, Harper Business, New York.

Englund, R.L. and Graham, R.J. (1999) From experience: Linking projects to strategy, *Journal of Product Innovation Management*, 16, pp 52-64.

Finnie, W. and Early, S. (2002) Results-based leadership: an interview with Dave Ulrich. *Strategy and Leadership*, 30, 6, pp 23-29

Glazer, R. (1991) Marketing in an information intensive environment: Strategies and implications of knowledge as an asset, *Journal of Marketing*, 55, pp 1-19.

Grant, R., (1997) The knowledge-based view of the firm: implications for management practice, *Long Range Planning*, Vol. 30, No. 3, 1997, pp. 450-454.

Haldin-Herrgard, T. (2000) Difficulties in diffusion of tacit knowledge in organizations, *Journal of Intellectual Capital*, 1,4 pp357-365.

Handfield, R.B. and Nichols, E.L. (1999) *Introduction to Supply Chain Management*, Prentice Hall, New Jersey.

Hansen, M.T., Nohria, N. and Tierney, T. (1999) What's your strategy for managing knowledge?, *Harvard Business Review*, March-April.

Hildreth, P., Kimble, C., Wright, P. (2000) Communities of practice in the distributed international environment, *Journal of Knowledge Management*, 4, 1, pp 27-38.

Holthouse, D. (1998) Knowledge research issues, *California Management Review*, 40, 3, pp 277-800.

Johannessen, J., Olsen, B., and Olaisen, J. (1999) Aspects of innovation theory based on knowledge management, *International Journal of Information Management*, 19, pp 121-139.

Johnston, W. J., Leach, M.P. and Liu, A.H. (1999) Theory testing using case studies in business to business research, *Industrial Marketing Management*, 28, pp 201-213.

Kaplan, R.S. and Norton, D.P. (1996) Using the balanced scorecard as a strategic management system, *Harvard Business Review*, January-February, pp 75-85.

Knock, N., McQueen, R., and Corner, J. (1997) The Nature of data, information and knowledge exchanges in business processes: Implications for process improvement, *The Learning Organization*, 4, 2, pp 70-80.

Kotnour, T., Orr, C., Spaulding, J. and Guidi, J. (1997) Determining the Benefits of Knowledge Management Activities. In *IEEE International Conference on Systems Man & Cybernetics*, Vol. 1, Orlando, Florida.

Kreiner, K. (2002) Tacit knowledge management: the role of artefacts. *Journal of Knowledge Management*, 6, 2 pp 112-123.

Laudon, K.C. and Laudon, J.P. (1999) *Management information systems: Organization and Technology in the Networked Enterprise*, Prentice Hall, New York.

Leidner, D.E. (1999) Virtual Partnerships in Support of Electronic Commerce: The Case of TCIS, *Journal of Strategic Information Systems*, 8, pp 105-117.

Leonard Barton, D. and Sensiper, S. (1998) The role of tacit knowledge in group innovation, *California Management Review*, 40, 3.

Lewis, M.W. (1998) Iterative triangulation: A theory development process using existing case studies, *Journal of Operations Management*, 16, pp 455-469.

Liebesskind, J.P. (1996) Knowledge, strategy and the theory of the firm, *Strategic Management Journal*, 17, pp 93-109.

Mandviwalla M. and Khan, S. (1999) Collaborative Object Workspaces (COWS): Exploring the Integration of Collaboration Technology, *Decision Support Systems*, 27, 3, pp 241-254.

McCutcheon, D.M. and Meredith, J. (1993) Conducting case study research in operations management, *Journal of Operations Management*, 11, pp 239-256.

McDermott, R. and O'Dell, C. (2001) Overcoming cultural barriers to sharing knowledge, *Journal of Knowledge Management*, 5, 1, PP 76-85.

Mendelson, H. and Pillai, R.R. (1999) Information age organizations, dynamics and performance, *Journal of Economic Behavior and Organization*, 38, 3, pp 253-281.

Nadler, D.A. and Tushman, M.L. (1999) Organization of the future: strategic imperatives and core competencies for the 21st century, *IEEE Engineering Management Review*, 27, pp 96-107.

Nonaka, I, and Konno (1998) The concept of BA – building a foundation for knowledge creation, *California Management Review*, 40, 3, pp 40-54.

Ostroff, C. and Schmitt, N. (1993) Configurations of organisational effectiveness and efficiency. *Academy of Management Journal*, 36, 6, pp 1345-1357.

Pan, S.L. and Scarbrough, H. (1998) A Socio-Technical View of Knowledge Sharing at Buckman Laboratories, *Journal of Knowledge Management*, 2, 1 pp 55-66.

Robbins, S.P. (1998) *Organizational Behavior: Concepts, Controversies, Applications*, Prentice Hall.

Salisbury, M.W. (2003) Putting theory into practice to build knowledge management systems. *Journal of Knowledge Management*, 7, 2 pp 128-141.

Schneider, B, Brief, A.P. and Guzzo, R.A. (1996) Creating a Climate and Culture for Sustainable Organizational Change, *Organizational Dynamics*, Spring, 7-19.

Scott, J. (1996) The role of information technology in organisational knowledge creation for new product development. *Proceedings of the Second Americas Conference on Information Systems*, pp 28-30.

Sveiby, K.E. (1997) *The New Organizational Wealth: Managing and Measuring Knowledge Based Assets*, Berrett-Koehler, San Fransisco.

Swan, J., Newell, S., Scarbrough, H. and Hislop, D. (1999) Knowledge management and innovation: networks and networking, *Journal of Knowledge Management*, 3, 4, pp 262-275.

Thite, M. (1999) Identifying key characteristics of technical project leadership, *Leadership and Organization Development Journal*, 20, 5, pp 253-261.

Ulrich, D. (1998) Intellectual Capital = Competence * Commitment, *Sloan Management Review*, Winter, 1998, pp 15-26.

Warkentin, M., Bapna, R., and Sugumaran, V. (2001) E-knowledge networks for inter-organizational collaborative e-business, *Logistics Information Management*, 14, 1, pp148-163.

Wiig, K.M., de Hoog, R. and van der Spek, R. (1997) Supporting knowledge management a selection of methods and techniques. *Expert Systems with Applications*, 13, 1, pp 15-27.

Wilson, D.A. (1996) *Managing knowledge*. Butterworth Heinemann- Oxford.

Zack, M (1999) Managing codified knowledge, *Sloan Management Review*, pp 45-58.

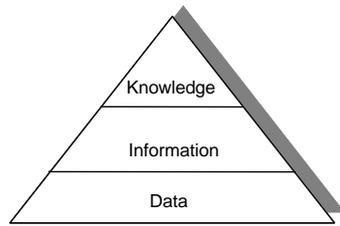
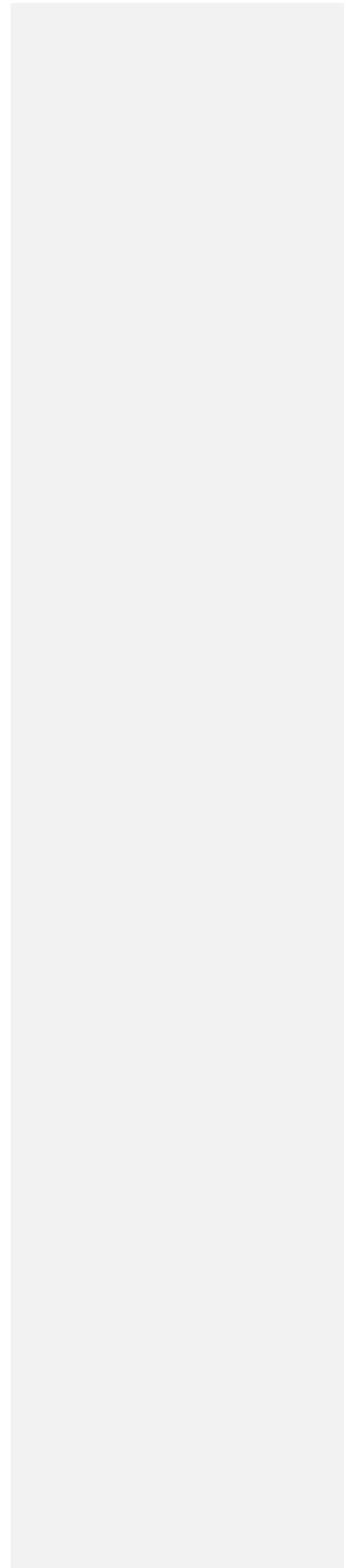


Figure 1 Hierarchy of Knowledge Assets



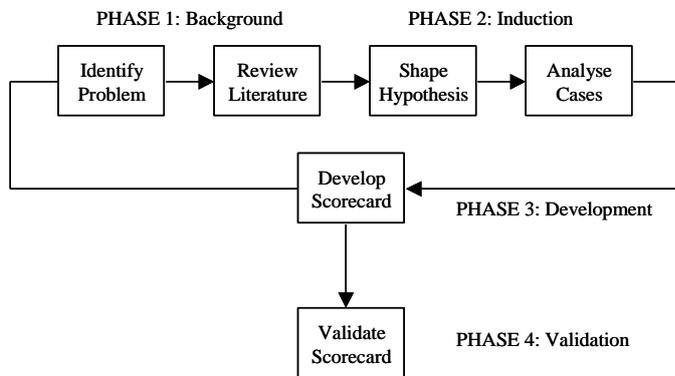


Figure 2 Research Methodology

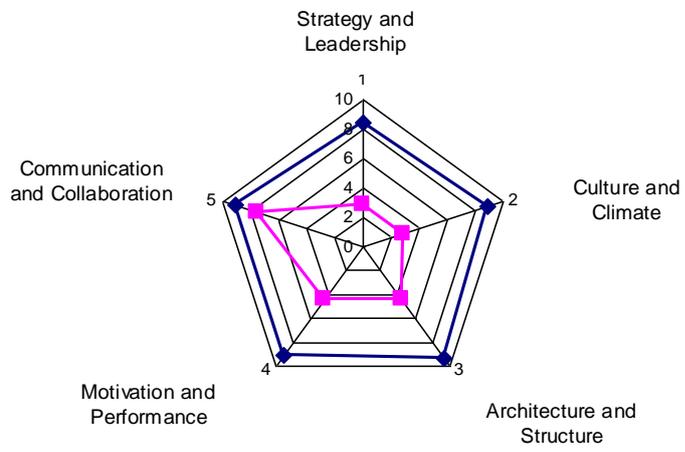
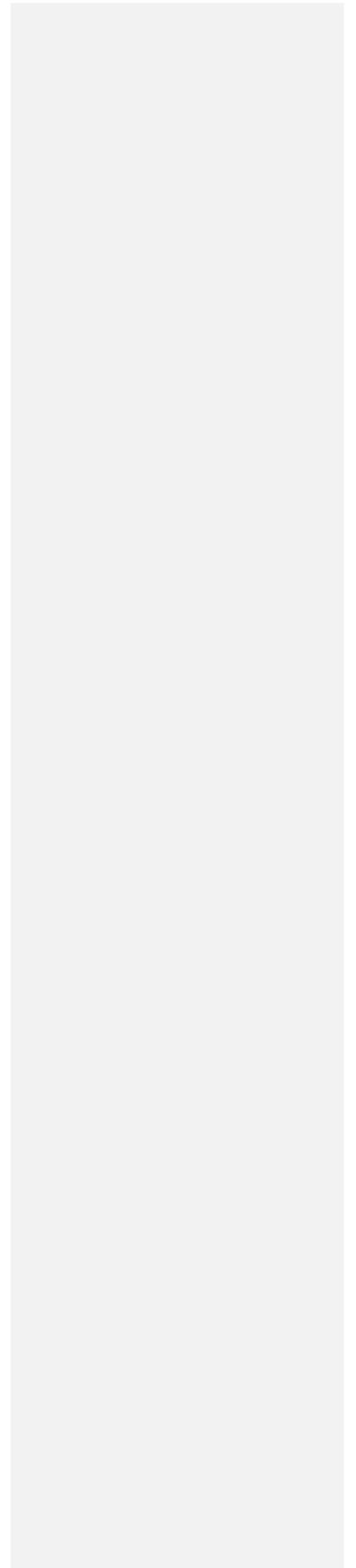


Figure 3 Comparative Analysis for AB1



Strategy and Leadership

1. Effective knowledge management strategies are defined
2. Knowledge management strategies are communicated to all employees
3. All knowledge management initiatives are linked to strategies
4. Knowledge management strategies are used to establish appropriate priorities
5. Knowledge management strategies are supported by key performance measures
6. Leaders create a vision and communicate this by setting clear objectives
7. Strategies are flexible enough to respond to changes in the environment
8. Top management teams collaborate effectively
9. Senior management are accountable for knowledge management results
10. Top management actively promotes the generation, transfer and use of information

Culture and Climate

1. The organisation's culture promotes idea generation
2. A formal idea generation process is in place
3. The organisation provides support for codifying (representing) critical information
4. Risk taking is actively encouraged
5. There is a high level of trust in the organisation
6. Adequate resources are dedicated to achieve knowledge management goals
7. All employees participate in generating ideas
8. Information and knowledge is shared throughout the company
9. All operations are driven by customer needs
10. An effective mentoring system is in place

Architecture and Structure

1. The organisational structure is flexible and organic
2. The structure enables the voice of the customer to be captured effectively
3. The organisational structure promotes knowledge generation and learning
4. Autonomous cross-functional teams are used to implement projects
5. Project teams are organic, flexible and agile
6. All team operations are driven by customer needs
7. Team members are mutually accountable
8. Team members are empowered to make decisions
9. Communities of practice are used to optimise core competencies
10. There is a high level of co-operation across the organisation's units

Motivation and Performance

1. Performance indicators are clearly defined and communicated to all employees
 2. Performance indicators are aligned with the organisation's goals
 3. Effective performance indicators are used to measure progress
-

-
4. Performance indicators encourage desired behaviour
 5. Knowledge sharing and reuse is rewarded
 6. The organisation measures performance against customer requirements
 7. Team members rewards are equitable
 8. All team members are mutually accountable
 9. The value of knowledge is monitored according to its contribution to the bottom line
 10. Adequate and effective training is provided to all employees

Communication and collaboration

1. Virtual team members are equipped with effective IT tools to communicate
 2. The right information is available at the right time and in the right format
 3. Collaboration is imperative to facilitate the cross fertilisation of ideas
 4. Alliances are formed with other organisations for mutual benefit
 5. Communication among team members is efficient and effective
 6. Communication between project teams is efficient and effective
 7. Information on ideas generated and problems raised are accessible to all
 8. Individuals collaborate to solve problems
 9. Individual skills are effectively leveraged within and between project teams
 10. Virtual team members are able to seamlessly communicate with each other
-

Company	Product	Strategic Focus	Level of Innovation	Manufacturing Typology	Culture
AB1	Medical Devices	Product and Process Innovation	Component Changes Addition to family	Make to Stock	Bureaucratic
AB2	Medical Diagnostic Instruments	Product Innovation	New Core Products and Enhancements	Make to Stock	Adaptive
AB3	Medical Devices	Process Innovation	New Process for Cost Improvement and Customer Service	Make to Stock	Bureaucratic and Systems Oriented
AB4	Aerospace	Product and Process innovation	New Part Production Development, Process Improvements	Make to Order	Dynamic
AB5	Semi-conductor Components	Product Innovation	Range from New Core Product and Process to Component Changes	Depending on Product	Innovative and Dynamic

Table 1 Scorecard for Enterprise Knowledge Management

Table 2 Table 2 Profile of Organisations

	AB1		AB2		AB3		AB4		AB5	
	NB	AsIs								
Strategy and Leadership	42	14	45	45	34	24	40	36	36	25
Culture and Climate	44	14	48	42	43	26	41	36	37	33
Architecture and Structure	47	22	44	41	43	25	42	29	42	30
Motivation and Performance	46	22	42	47	41	32	40	33	36	26
Communication and Collaboration	45	30	46	43	44	28	35	21	31	13
Total	224	102	225	218	205	135	198	155	182	127

Table 3 Scorecard Results