

## **Are Software Houses Using Knowledge Management to Capture and Distribute Knowledge?**

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### ***Introduction***

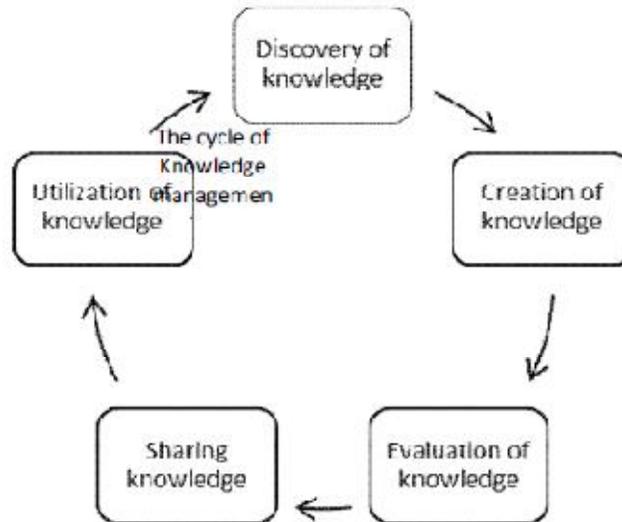
Intellectual capital refers to the intangible assets and non-physical value of companies other than devices, machines and buildings that are reported in the financial accounting. Intellectual capital is divided into three categories: human capital (the employees of the company), organisational capital (the way in which the employees carry out their assignments) and customer capital (the manner of communication between the employees and with interested parties, suppliers and customers). Knowledge management is the process that aims to bring knowledge to the surface in order to make it more accessible for the company and its employees. The principal aim of this article is to introduce the findings of research examining whether Icelandic software houses are utilising knowledge management in order to capture and distribute knowledge. Here, an attempt will be made to answer the research question: Are software companies systematically making use of knowledge management in software development?

### ***Research Methods and Information Retrieval***

A qualitative research method was chosen in order to answer the research question, as it is considered suitable when a researcher needs to understand how participants experience and sense their situations, as opposed to seeking direct statistical data. Qualitative research methods generate descriptive data, along with the actual words and behaviours of the interviewees in question. The research method involves trying to familiarise oneself with the environment, mindset and feelings of the persons being interviewed, and to understand, as much as possible, how they experience the reality they describe. An attempt is made to gain insight into the work methods of the participants, which can later be transferred to a larger group. A predictive value or generalisation is, thus, not an important issue in qualitative researches, whereas a great emphasis is placed on the integrity, authenticity and objectivity of the researcher (Sigríður Halldórsdóttir & Kristján Kristjánsson, 2003). Gephart (2004) points out that both data acquisition and analysis are necessary for qualitative researches, but Strauss and Corbin (1998) believe that the process needs to alternate between data acquisition and analysis. Participants were chosen by means of a so-called systematic sampling where the interviewees are specifically chosen in correspondence to the research topic (Esterberg, 2002). Managers of the larger software companies in the Reykjavik area were approached in the spring of 2013. Six hour-long interviews were conducted with six individuals, who have considerable expertise in knowledge management; either executives or project managers who manage or maintain how and to what extent knowledge management is being carried out in their company. By means of this method, the authors believed they had the greatest likelihood of selecting the individuals with the most vested interest and expertise in the subject matter.

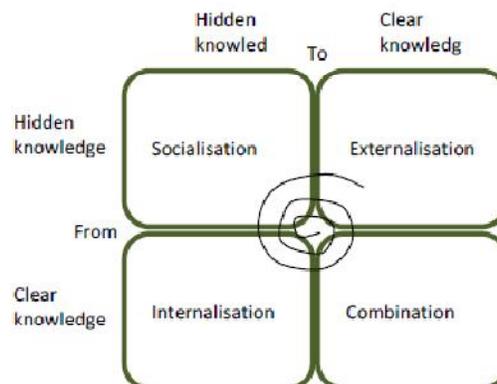
### ***Knowledge Management***

Knowledge management is the process which aids companies to bring knowledge to the surface and make it more accessible for both the company and its employees (Jashapara, 2004). According to Davenport and Porsak (1998), the aim is to retrieve the information which the organisational whole already possesses, with a good information system, change of management within the organisational whole and human capital management. Jashapara (2004), furthermore, divided knowledge management into five components, i.e. to discover, create, evaluate, share and utilise knowledge (Image 1). It is vital for company employees to be aware of the knowledge the organisational whole possesses, whether it involves data, information, knowledge, wisdom or truth. Data are known facts of all kinds or some objects which are used as the basis for either forming or coming to conclusions. Knowledge is in the mind of those who understand; the understanding is based on information and with that it is possible to react and make decisions. The ability to react in a practical manner under much pressure is called wisdom. It is always difficult to generalise about truth and it implies that there is only one possible way to understand things.



**Image 1: The Cycle of Knowledge Management**

The area where knowledge is shared, integrated, formed and applied is called *ba* in Japanese (Nonaka, 1994; Nonaka & Konno, 1998; Nonaka, Toyama & Konno, 2000; Senoo, Magnier-Watanabe & Salmador, 2007). The area or *ba* (Image 2; Nonaka & Konno, 1998) can thus either be a real place, digital area, or a metaphysical space (Nonaka et al, 1998). The *ba* area is defined, according to Nonaka (1994), as a shared mental space where an agile understanding of feeling, purpose and ability is developed. According to Nonaka and Konno (1998), it is necessary to share the knowledge of individuals, and reshape and strengthen it through synergy with others, in order to have knowledge created within an organisational whole. Additionally, to enable the organisational whole to control the knowledge formation process, it needs to create and control the *ba* space. In knowledge management, knowledge is commonly referred to as either hidden or clear. *Ba* is the place where knowledge is created, shared, integrated and applied. *Hidden knowledge* is unrecorded knowledge which is hidden within the individual; knowledge that is difficult to describe and share with others by direct recording, or general sharing of information (Jashapara, 2004). Nonaka (1994) points out that hidden knowledge is not easily explicable and that it can lurk in experience, know-how and information shared between individuals which is difficult to register. Hidden knowledge is an ability or an understanding which is obscure and difficult to grasp or develop through information delivery and experience. It is possible, however, to share through conversation and in the company of others. Blumentitt and Johnston (1999) defined hidden knowledge as a form of knowledge that can only be stored in the mind of an individual, whereas information can be found and stored in books and electronic form.



**Image 2Ba: with Hidden and Clear Knowledge (Nonaka & Konno, 1998).**

Jashapara (2004) notes that academics do not agree on whether hidden and clear knowledge are separate or consecutive terms. Polanyi (1967) believes the terms to be consecutive, while Nonaka and Takeuchi (1995) consider hidden and clear knowledge to be two separate concepts. The following is a more detailed explanation of Nonaka's theory regarding knowledge management.

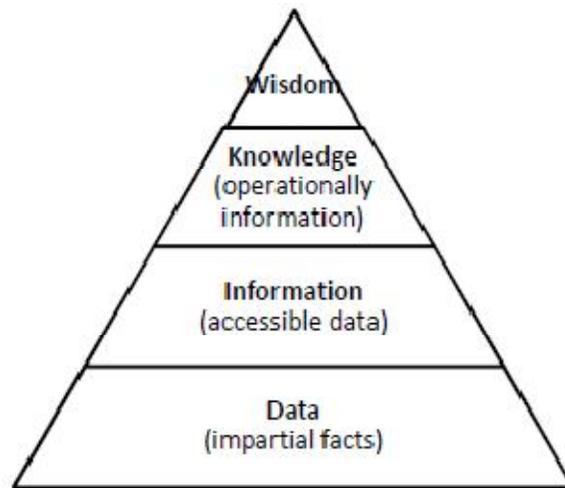
*Clear knowledge* is, on the other hand, much more approachable, for it can be systematically registered and shared, e.g. books, instructions, databases and documents. It is possible to keep track of clear knowledge by registration and explanation to others who can then make use of it. Clear knowledge has for a long time been used for teaching and sharing various studies and company executives have utilised it as a control tool in knowledge management. In this regard, Jashapara (2004) points out knowledge records, knowledge networks and the inner network connected to databases, in order to share the company's knowledge in and with informational and group work methods. Pan and Scarborough (1999) argue that it is possible to share clear knowledge in a formal and effortless way between individuals, and that a part of the clear knowledge within companies is structural and thus easy to share with specified procedures or data. A qualitative survey on knowledge management, conducted in New Zealand (Bhardwaj & Monin, 2006), showed that what worried executives of fast-growing companies the most was, indeed, the hidden knowledge of employees, as the survey revealed that smaller companies are more often than not dependent on a few individuals who keep a large part of the companies' knowledge to themselves.

The survey also highlighted that companies are vulnerable to this threat and that it is not easy for them to prevent it. Bhardwaj and Monin noted the importance for companies to have a clear procedure for the creation of knowledge and that executives should support knowledge creation, along with capturing and exploiting it. Sveiby's (1997) definition of knowledge management in innovative companies is that it involves activating intangible assets for the creation of capital goods. Such viewpoints are a valuable input in this research on the application of knowledge management in software houses. Knowledge management is the daily control of intellectual capital and it is generated by human capital, organisational capital and customer capital. In utilising these three resources, it is vital to think of the quality and how far it is possible to react to changing circumstances along with the adaptability of a changing environment (Ásta Þorleifsdóttir & Eggert Claessen, 2006). Knowledge management needs to be examined in terms of other fields, and in that connection Nonaka and Takeuchi (1995) and Sveiby (1997) point out the context between knowledge management and strategic planning. Nonaka and Takeuchi (1995), Sveiby (1997), O'Dell and Grayson (1998) and Beijerse (2000) indicate the context of knowledge management and innovation, and O'Dell, Grayson (1998) and Beijerse (2000) emphasise the context of knowledge management and organisation, as well as culture and system management. Academics, who have dealt with knowledge management, make a clear distinction between information, data and knowledge, whether it involves hidden or clear knowledge (Nonaka & Takeuchi, 1995; Awad & Ghaziri, 2001; Wiig, 2004). Most of the entrepreneurs in the field of knowledge management have their individual definitions of clear or hidden knowledge; this applies to Nonaka (1994), Wiig (1997), Davenport and Prusak (1998), Drucker (1999) and Jashapara (2004), while Faucher, Everett and Lawson (2008) have formulated their own definitions of data, information and knowledge.

*Data:* Defined as raw data, or data that are unprocessed in any way and reveal authentic findings. An example of data is a unique temperature measurement from a weather station.

*Information:* Data that have been processed in such a way that they receive meaning, for example, the mean temperature that has been processed from a summation of temperature measurements.

*Knowledge:* Defined as information which has been processed in a meaningful way, such as knowledge used to assess the value of the mean temperature based on temperature measurements and to determine, for example, the deviation from the information at hand.



**Image 3A: Traditional Knowledgepyramid (Awad & Ghaziri, 2001)**

Faucher et al. (2008) and Jaspara (2004) highlight that data, information and knowledge are different concepts that should not be combined. These three, including the concept of wisdom, form the basis of the knowledge pyramid (Image 3). One of the main goals of knowledge management is to improve the performance of companies. A positive correlation has been found between controlling the intellectual capital of companies specifically and an increased competition advantage. Intellectual capital refers to intangible assets and nonphysicalvalue; this mainly concerns valueother than devices, machines and buildings that are reported in the financial accounting. When measuring the components that are important to the success of a company, the financial components are not sufficient. It is, however, difficult to measure. In order to grasp and analyse this value, various methods are applied. By trying to register and measure knowledge and its related success, it is easier to get an overview of this intangible value, and with that an attempt is made to simplify any form of knowledge management.

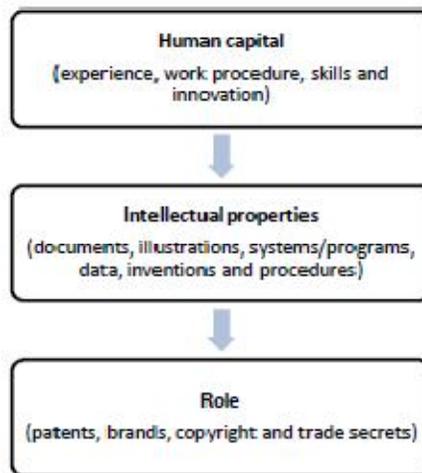
An example of a system used for measuring and registering intellectual capital would be Kaplan and Norton's strategic appraisal of success(Jashapara 2004). Another example is the European Foundation of Quality Measurement, EFQM's Model of Success.The Icelandic quality awards are based upon the same system (Stjórnvísi, e.d.). Financial factors are in the minority in the EFQM's success categories. While working with the model, a great emphasis is placed on employee participation and what lesson employees can learn by working with the strengths and weaknesses of their own processes and operations. The foundation of success is believed to be an ongoing self-evaluation, improvement and knowledge of these processes.



**Image 4: Relationship between Dimensions of Intangible Value of Companies (Petrash, 1996)**

As canbeseen in Image 4, Petrash (1996) divides intellectual capital into three categories: human capital, organisational capital and customercapital (Jashapara, 2004).

The initiative lies within human capital, the making of capital goods is within the customer capital and the part of the intellectual capital that involves the company's organisation and systems is the organisational capital. Value is created where these dimensions connect; this is how the connections are utilised and developed between them and the company's strategy which can be used to improve productivity and its competitive position. Organisational capital concerns more tangible items such as the value chain and the things that are left behind in the company when the employees go home. Where human capital is concerned, reference is being made to what goes home with the employees at the end of the day. This refers to such components as their personal expertise, communication with outside parties and their skills and qualifications (Jashapa, 2004). Customer capital, on the other hand, refers to all the other external connections of the company, such as its connections with collaborators, customers and suppliers (Ingi Rúnar Eðvarðsson, 2004).



**Image 5: Intellectual Capital is Mainly Based on Human Capital**

Image 5 shows Sullivan's model of intellectual capital which is mainly based on human capital. Human capital is defined as the expertise of the employees, subcontractors and suppliers to solve the problems of the clients. Sullivan presumes that organisational capital such as computers, information systems and buildings support human capital (Jashapara 2004). Procedure policies, registered procedures and systems are intellectual assets created by the experience, skills and knowledge of the employees: human capital. It is likely that well managed human capital will lead to increased intellectual assets and rights of intellectual properties which are among the few manifestations of intellectual capital that have a chance of finding their way into the financial records of companies. There are a number of models which analyse intellectual capital, but they are all based on the company employees (people), how they carry out their jobs (procedure) and how they communicate with one another and interested parties, suppliers and clients (connections). On the other hand, no person is an island; he or she is essentially a social being and companies have also been studied as communities. Jashapara (2004) believes that there are three dimensions of social capital, namely, the structural dimension, relational dimension and the cognitive dimension. These dimensions involve the connections and communications between individuals and contact networks, trust, habits and expectations, as well as interpretations and coordination of opinion.

### ***Processing and Analysis of Interviews***

The interviews were reviewed and analysed according to themes under observation in the research. These themes are summarised and interpreted in the final chapter of the article, Findings and Discussions. The three themes are the following: a) *storing of knowledge* – the manner in which the software houses capture and save knowledge in documents and work procedures; b) *distribution and transfer of knowledge* – an effort is made to reveal how software houses move knowledge from one employee to the next; and c) *intellectual fellowship* – it is examined how the software houses use the time their employees spend together in order to transfer knowledge between them and to increase their trust in one another. These three themes are part of the definition of Petersen and Poufelt (2002) – the classification system for knowledge management. Thus, it is useful to take this into account when the studies are compared with the data analysis. Each theme is discussed systematically, and aspects of knowledge management compared with the studies.

The interviews revealed that: in all the software houses, it seems that knowledge is being stored in an organised manner. For example, they are all storing knowledge within job descriptions or manuals where the job descriptions themselves are stored and every person's role described. In some software houses educational requirements are listed in the job descriptions for each respective job. A number of the software houses are also storing the personal knowledge of their employees, whether or not it directly relates to their jobs. This could apply to Microsoft-education, degrees in internet and information technology, or other education that is valuable for software houses and could be of use to them later on. Furthermore, knowledge or skills which are completely unrelated to the actual work in the company, such as musical or language skills, are stored. It seems that the software houses are doing a good job when it comes to organisational capital; they are all efficient in putting knowledge into procedures which are then stored in company systems and special databases, in the same manner as suggested by Jashapara (2004). All the software houses use a communication system in order to keep track of and store their communications with their clients. A common form of setup is that certain individuals within the companies manage the entire communication with the clients, and that all dealings are stored in the infrastructure. A few of these companies had already hired professional liaison managers in order to improve and make the connections with their clients more professional, which had clearly paid off, according to the interviewees. Older work methods, where the same person would always be working at the same project, are being changed. This is to avoid knowledge of the project being stuck with the same employee. One of the interviewees put it this way: "We are trying to encourage more group work by forming a board on particular topics or techniques and to establish a software review in order to prevent the one man one job". Another interviewee said: "Every day we are trying to make sure that no one person is left with all the knowledge," and added that they had a drawing board with tasks and the names of staff to make sure that at least two employees had the know-how for each task. All the software houses are utilising databases in order to distribute and transfer knowledge in accordance with the method described by Ingrid Kuhlman (2002). This method, called mentor/student, is used to distribute knowledge among employees, where the more experienced instruct those who are less experienced. Such a method, furthermore, requires that there is complete mutual trust between the employees who work together.

Most of the software houses have adopted a generally accepted method in software development such as the Scrum/Agile-project management system, or the Kanban work procedure system, which systematically aim at an organised distribution of knowledge. The software houses take other measures to reinforce the distribution and transfer of knowledge; for example, open spaces where help is available nearby, and an organisational culture that supports the distribution of knowledge between employees. One of the interviewees explained: "Nobody is reinventing the wheel in this business and people find they can speak with their neighbours or the one sitting next to them". The software houses are not afraid of using intellectual fellowship in many fields. One of the interviewees spoke of group work and promotional meetings, which he referred to as "work-shows". These have the exact purpose of transferring knowledge from one group to another. It is quite common for the software houses to have 10–20 minutes of standing meetings, which are referred to as rapid meetings or rapid presentations, in order to brief staff on a particular subject. Standing meetings guarantee that people stay on topic and that the meeting will not be longer than necessary. Some of these companies have also implemented a special type of meeting which they call "open office," where they discuss various topics that are unrelated to the actual work. In this way, the employees get to know one another better and become less afraid to turn to one another for help. In this context, the researchers noted, while visiting the software houses, that in nearly every case there was equipment for bringing employees together. Some would call them toys, for instance, a dart board, pool table, an air hockey table or a foosball table. There were often one or more of such equipment available in a special room and the researchers sometimes noticed the staff of the software houses playing there together. It is possible to come to the conclusion that this equipment is placed there in order to serve as an icebreaker for employees, although it is likely that there are some unwritten rules in place regarding the time people could spend using the equipment.

### ***Findings and Discussions***

The main goal of this article was to present the findings of a research performed during the spring of 2013, which examined knowledge management in Icelandic software houses. Six parties in six software houses were approached regarding their work procedures in software development, with the purpose of finding answers to the research question: Are software houses systematically making use of knowledge management in software development?

When these three themes are summarised and the findings evaluated, the answers of the interviewers indicate clearly that software houses are utilising the internet, databases, folders, lectures, websites and employee publication, in order to capture and distribute knowledge, which is a large part of the knowledge management of knowledge-based companies, as described by Petersen and Poulfelt (2002). This comparison confirms that knowledge management is employed in the software houses. In the previous chapter, it was also clearly shown how software houses store the knowledge of their employees within company work procedures. Similarly, Bingham, Eisenhardt and Furr (2007) place emphasis on the importance of work procedures as the basis of expertise within companies. This fact strengthens the researchers' belief that knowledge management is employed in the software houses. Ingi Rúnar Eðvarðsson (2004) points out that the distribution of knowledge takes place mainly through verbal communication. In examining the manner of intellectual fellowship in software houses, it becomes evident that this is being used systematically in order to manage knowledge. The software companies hold daily meetings for 10–20 minutes to capture and distribute knowledge, and intellectual fellowship hours have become so common that numerous names are used to describe their diverseness, such as workshow, kick off meetings, rapid meetings and open office, all with the purpose of bringing people together, and getting them to know each other in order to capture and distribute knowledge. As Ingi Rúnar Eðvarðsson (2004) and Daft (2001) note, intellectual fellowship is necessary for distributing hidden knowledge between staff. Again, this is prerequisite for making clear knowledge that can later be distributed, shared, transferred or registered in the procedure of the software houses. According to the above, it can be affirmatively stated that software houses are systematically making use of knowledge management in software development. The working environment of the software houses is characterised by rapid changes and great speed; the employees are academically educated and have considerable job experience. Thus, it is of importance for the software houses to minimise the danger that lost knowledge causes, such as when an employee suddenly quits for some reason. It is important not to over-interpret these findings and assumptions, as this is qualitative research, which makes it impossible to make generalisations about results and transfer them to other Icelandic software houses. The findings shed a relatively clear light on the knowledge management procedure in Icelandic software companies. The research shows that the position of knowledge management does not stand in the way of software development in Iceland.

### **References**

- Awad, E.M. & Ghaziri, H.M. (2001), *Knowledge Management*, Pearson Prentice Hall, New Jersey.
- Ásta Þorleifsdóttir & Eggert Claessen (2006), *Putting Intellectual Capital into Practice*. Nordic Innovation Centre, Oslo.
- Beijerse, R.P. (2000), "Knowledge management in small and medium-sized companies: Knowledge management for entrepreneurs," *Journal of Knowledge Management*, Vol. 4, No. 2, pp. 162–179.
- Bhardwaj, M. & Monin, J. (2006), "Tacit to explicit: An interplay shaping organization knowledge," *Journal of Knowledge Management*, Vol. 10, No. 3, pp. 72–85.
- Bingham, C.B., Eisenhardt, K.M. & Furr, N.R. (2007), "What makes a process a capability? Heuristics, strategy, and effective capture of opportunities," *Strategic Entrepreneurship Journal*, Vol. 1, Nos 1–2, pp. 27–47.
- Blumentitt, R. & Johnston, R. (1999), "Towards a strategy for knowledge management," *Technology Analysis & Strategic Management*, Vol. 11, No. 3, pp. 287–300.
- Daft, R.L. (2001), *Organizational Culture and Ethical Values*. *Organizations, Theory and Design* (7<sup>th</sup> ed.), Thomson Learning, Mason.
- Davenport, T.H. & Prusak, L. (1998), *Working Knowledge*, Harvard Business School Press, Boston.
- Drucker, J. (1999), *Management Challenges for the 21st Century*, Harper Collins, New York.
- Esterberg, K.G. (2002), *Qualitative Methods in Social Research*, McGraw Hill, Boston.
- Faucher, J.B.P.L., Everett, A.M. & Lawson, A.M. (2008), "Reconstituting knowledge management," *Journal of Knowledge Management*, Vol. 12, No. 3, pp. 3–16.
- Gephart, R.P. (2004), "Qualitative research and the Academy of Management Journal," *Academy of Management Journal*, Vol. 47, No. 4, pp. 454–462.
- Ingi Rúnar Eðvarðsson (2004), *Þekkingarstjórnun*. Akureyri University, Akureyri.
- Ingrid Kuhlman (2002), *Hversvegnafólkmiðlarekkiþekkingu*. Viðskiptablaðið, available at: <http://www.thekkingarmidlun.is/template23244.asp?pageid=4096&newsid=1091> (accessed 10 March 2013).
- Jaspahara, A. (2004), *Knowledge Management: An Integrated Approach*. Pearson Education, Harlow.

- Nonaka, I. (1994), "A dynamic theory of organizational knowledge creation," *Organization Science*, Vol. 5, No. 1, pp. 14–37.
- Nonaka, I. & Konno, N. (1998), "The concept of ba: Building a foundation for knowledge creation," *California Management Review*, Vol. 40, No. 3, pp. 40–54.
- Nonaka, I. & Takeuchi, H. (1995), *The Knowledge Creating Company*, Oxford University Press, New York.
- Nonaka, I., Toyama, R. & Konno, N. (2000), "SECI, ba and leadership: A unified model of dynamic knowledge creation," *Long Range Planning*, Vol. 33, No. 1, pp. 5–34.
- O'Dell, C. & Grayson, C.J. (1998), "If only we know what we know: Identification and transfer of internal best practices," *California Management Review*, Vol. 40, No. 3, pp. 154–174.
- Peteraf, M.A. (1993), "The cornerstones of competitive advantage: A resource-based view," *Strategic Management Journal*, Vol. 14, No. 3, pp. 179–191.
- Petersen, N.J. & Poulsen, F. (2002), "Knowledge management in action: A study of knowledge management in management consultancies," Working Paper 1-2002, Copenhagen Business School, Copenhagen.
- Senoo, D., Magnier-Watanabe, R. og Salmador, M. (2007), "Workplace reformation, active ba and knowledge creation: From a conceptual to a practical frame work," *European Journal of Innovation Management*, Vol. 10, No. 3, pp. 296–315.
- Sigríður Halldórsdóttir og Kristján Kristjánsson (ed.) (2003), *Handbók í aðferðafræði og rannsóknum í heilbrigðisvísindum*, Akureyri University, Akureyri.
- Strauss, A.L. & Corbin, J. (1998), *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory* (2<sup>nd</sup> ed.), Sage, London & Thousand Oaks, CA.
- Sveiby, K.E. (1997), *The New Organizational Wealth: Managing & Measuring Knowledge-Based Assets*, Berrett-Koehler, San Francisco.
- Wiig, K.M. (1997), "Integrating intellectual capital and knowledge management," *Long Range Planning*, Vol. 30, No. 3, pp. 399–405.