

# Knowledge Management Concepts and Processes in Healthcare

## Research Plan for Doctoral Thesis

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## 1 STAGE OF THE RESEARCH

This study presents a research plan for a doctoral thesis about Knowledge Management in Healthcare. It outlines objectives, research problems, state of the art, methodology and expected outcome. The study introduces current knowledge management concepts, the research questions, and a conceptual framework of knowledge management processes. It also outlines data collection methods and data analyzing methods. In this study both qualitative analyzing methods with the grounded theory approach and quantitative data analysis with novel intelligent computing and analyzing methods are applied.

This doctoral study is planned to take a total of five (5) years (January 2012- January 2017) in which the output will be five (5) conference articles, and one journal article. Furthermore, a relevant introductory section of the thesis will be written in this period. One conference article has been accepted in 2012, another conference article was submitted for reviewing purpose in 2014, and one journal article is in preparation.

## 2 OUTLINE OF OBJECTIVES

It has been claimed that knowledge is conceptualized from different disciplines (Hernández and Noruzi, 2010). For instance accountants measure it on the balance sheet; information technologists want to codify it on systems; sociologists want to balance power with it; psychologists want to develop minds because of it; human resource managers calculate a return of investment on it; and training and development officers want to make sure that they can build it. An individual can decide on where and when to apply knowledge in order to get the best results (Hernández and Noruzi, 2010). Among health care

practitioners, knowledge is captured in social interaction, e.g. when physicians and nurses meet patients. Physicians transfer their knowledge and expertise in meetings and consultations sessions, and they can express and interpret diagnosis reports, create new expert knowledge by reading, by learning in traineeship, and having discussions (Nonaka, 1994; Alavi and Leidner, 2001). Collective knowledge exists in networks in organizations, and knowledge is internally ingrained in people (Alavi and Leidner, 2001), and people learn in the practice community through participation with each other, e.g. cardiologists can belong to a community of practice transferring and receiving knowledge on best practices (Grover and Davenport, 2001).

In this study, the primary objectives and goals are to discover and conceptualize knowledge management concepts and processes in healthcare, specifically in a hospital environment, by combining information systems science, knowledge management science, medical science, nursing science, sociology of knowledge, management science, and computational intelligence (Polanyi, 1966; Nonaka, 1994; Nonaka and Takeuchi, 1995; Nonaka and Konno, 1998; Alavi and Leidner, 2001; Dalkir, 2005; Mustonen-Ollila, 2005; Raitoharju et al., 2007; Oinas-Kukkonen et al., 2008; Mustonen-Ollila and Heikkonen, 2008a, 2008b, 2009; Oinas-Kukkonen et al., 2009; Lahtiranta, 2009; Koskinen, 2010; Greig et al., 2012).

## 3 RESEARCH PROBLEM

The research problems, research question (RQ) and related studies and theories of knowledge management processes are shown in Table 1 below.

Thus, the research questions (RQ) to be answered are as follows. RQ1) How do nurses and physicians acquire for new knowledge at the

Table 1: Knowledge management processes, research problems, research question (RQ) and related studies and related theories.

Knowledge management processes	Research problems	Research question (RQ) and related studies	Related theories
Knowledge acquisition (1)	Acquisition mechanisms	RQ1) How do nurses and physicians acquire for new knowledge at the research site? (Huber, 1991; Mustonen-Ollila and Heikkonen, 2003; Dalkir, 2005; Mustonen-Ollila, 2005; Whelan et al., 2009)	Organizational learning (Dalkir, 2005; Huber, 1991; Morr and Subercaze, 2010)
Knowledge creation and construction (2)	Social construction of knowledge	RQ2a) How do nurses and physicians create and construct knowledge at the research site? (Huber, 1991; Nonaka, 1994; Alavi and Leidner, 2001) RQ2b) What impact has organizational learning, unlearning and internal learning on knowledge creation and construction at the research site? (Hsiao and Chang, 2011)	Latour, 1991 Organizational learning (Huber, 1991; Morr and Subercaze, 2010). Learning in organizations (Ferriani et al., 2005; Morr and Subercaze, 2010). Organizational unlearning (Venable et al., 2010)
Knowledge transfer (3)	Knowledge transfer, transfer problems	RQ3a) How do nurses and physicians transfer knowledge at the research site? (Wang and Lu, 2010; Lauder et al., 1999; Dalkir, 2005) RQ3b) What are the knowledge transfer problems at the research site? (Mustonen-Ollila and Heikkonen, 2003; Morr and Subercaze, 2010; Ferlie et al., 2012)	Knowledge sharing and communities of practice (Dalkir, 2005; Eppler, 2007). Learning and knowledge transfer (Lauder et al., 1999; Wang and Lu, 2010; Morr and Subercaze, 2010; Ferlie et al., 2012)
Knowledge storage (4)	Knowledge management systems, information, data	RQ4) How do nurses and physicians store knowledge at the research site? (Hanvanich et al., 2006).	Organizational memory (Paoli and Prencipe, 2003). Knowledge management processes and management systems (Alavi and Leidner, 2001; Gold, 2001; Nonaka and Konno, 1998; Nonaka and Takeuchi, 1995)
Knowledge application (5)	Application mechanisms	RQ5) How do nurses and physicians apply knowledge at the research site? (Huber, 1991; Dalkir, 2005; Morr and Subercaze, 2010)	Knowledge application (Huber, 1991; Dalkir, 2005; Morr and Subercaze, 2010)
Organizational learning, unlearning and internal learning (6)	Learning and unlearning mechanisms	RQ6) How do nurses and physicians learn from existing knowledge and new knowledge at the research site? (Hsiao and Chang, 2011)	Organizational learning (Huber, 1991; Morr and Subercaze, 2010). Learning in organizations (Ferriani et al., 2005; Morr and Subercaze, 2010). Organizational unlearning (Venable et al., 2010)

research site? RQ2a) How do nurses and physicians create and construct knowledge at the research site? RQ2b) What impact has organizational learning, unlearning and internal learning on knowledge creation and construction at the research site? RQ3a) How do nurses and physicians transfer knowledge at the research site? RQ3b) What are the knowledge transfer problems at the research site? RQ4) How do nurses and physicians store knowledge at the research site? RQ5) How do nurses and physicians apply knowledge at the research site? RQ6) How do nurses and physicians learn from existing knowledge and new knowledge at the research site?

#### 4 STATE OF THE ART

Different types of knowledge have been identified and integrated into existing and emerging healthcare information management practices (Alavi and Leidner, 2001; Lahtiranta, 2009; Gold et al., 2001; Nonaka and Konno, 1998). We have expanded Alavi and Leidner's study (2001) to cover new theoretical knowledge concepts found in earlier research (Nyerwanire and Mustonen-Ollila, 2012) (See Table 2).

First, clinical medical expert knowledge is

bounded to physicians' medical knowledge and expertise both in practice and theory (Iwai and Ishino, 2009; Hill, 2010; Morr, 2010). Second, collective knowledge means that organizations learn from internal and external sources of organizations and sub-networks (Morr, 2010). Finally, knowledge is embedded in the members, tools, and tasks of the organization (McGrath and Argote, 2000; Wegner, 1986) and the knowledge of these three sub-networks and their combinations is important to find out what kind of knowledge the organization, and in our case especially the healthcare environment needs to be able to accomplish their work properly. Healthcare practitioners use their experience by applying it in medical practice. Evidence-based medicine is a form of organizational learning in the knowledge management context (Morr and Subercaze, 2010).

#### 4.1 Conceptual Framework of Knowledge Management Processes

Knowledge management processes are conceptualized in Figure 1.

In Figure 1, the research context is the Central Hospital of South Karelia Social and Healthcare District, and the unit of analysis is a department or several departments at the hospital. The processes in Figure 1 are shown as ellipses with a number ranging from 1 to 5 (knowledge acquisition, knowledge creation and construction, knowledge transfer, knowledge storage, and knowledge

application) or with dashed arrows (internal learning, organizational learning, and organizational unlearning).

Knowledge acquisition involves searching for valuable knowledge, and external knowledge may be acquired by importing knowledge components directly or by depending on intermediaries (Huber, 1991; Mustonen-Ollila and Heikkonen, 2003; Mustonen-Ollila, 2005). Whelan et al. (2009) argue that an organizational gatekeeper is the key individual who connects the organizational members to the external sources of information, and the organizational members are kept up-to-date with the outside information by communicating with the gatekeepers.

Learning influences knowledge creation, and according to Oinas-Kukkonen et al. (2009), knowledge provided by evidence-based medical guidelines and drug information databases help physicians to learn new things. Raitoharju et al. (2007) state that an electronic patient record enables creation of organizational knowledge, and it is a useful tool to survive in everyday work in primary care. According to Dalkir (2005), in decision-making and clinical practice knowledge is transferrable through individual learning for example by observation (Hall and Walton, 2004). It is also possible that knowledge transfer can occur without the individual being aware of it happening (Dalkir, 2005). Learning in groups occurs through discussions, meetings and lecture sessions in which people share their experiences (Dalkir, 2005).

Table 2: Knowledge concepts, definitions, examples, and past research.

Knowledge concepts	Definitions	Examples	Past research
Clinical medical expert knowledge	Knowledge dwells on the healthcare practitioners' medical degree, skills and experience	Expertise on diagnosis of patient needs	Iwai and Ishino, 2009; Hill, 2010; Morr, 2010
Collective knowledge	Knowledge exists in organizations and their sub-networks	Organizational learning	Morr, 2010
Member-member network knowledge	Knowledge is embedded in network members	Members are the human components of the organization	McGrath and Argote, 2000
Task-task-network knowledge	Knowledge is embedded in tasks	Reflects the organization's goals, intentions and purposes	McGrath and Argote, 2000
Tool-tool network knowledge	Knowledge is embedded in tools, such as information systems	Tools are the technological components (hardware, software, and systems)	McGrath and Argote, 2000
Member-task network knowledge	Knowledge about who knows certain tasks	Members are allocated to certain tasks	McGrath and Argote, 2000; Wegner, 1986
Member-tool network knowledge	Knowledge about who knows certain tools	Members are allocated to certain tools	McGrath and Argote, 2000; Wegner, 1986
Member-task-tool network knowledge	Knowledge about who knows certain tasks with certain tools	Members are allocated to certain tasks with certain tools	McGrath and Argote, 2000; Wegner, 1986
Task-tool network knowledge	Knowledge about what tasks are performed with what tools	Tasks are performed with certain tools	Wegner, 1986

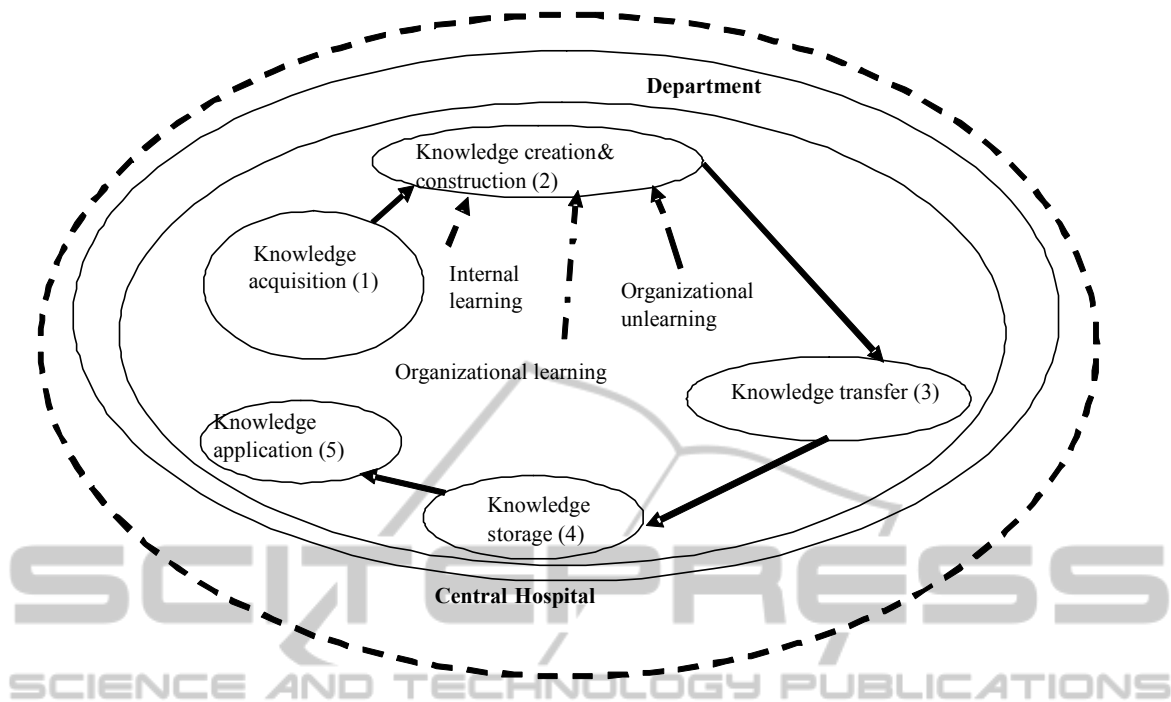


Figure 1: The conceptual framework of the study.

Lauder et al. (1999) state that knowledge transfer is the ability to apply knowledge gained in one situation in another similar situation, or to use metacognitive strategies to act in a novel situation. New knowledge is generated by the influx of information into an individual's mind, combined with the existing knowledge of this individual, and then communicated further and made explicit (Blumenberg et al., 2009). After knowledge creation, it needs to be transferred throughout the healthcare organization. The knowledge that is relevant and right to be transferred needs to be determined as well (Dalkir, 2005). The formal communities of practice include meetings, and the informal communities of practice will include discussion groups, study groups and online communities (Wang and Lu, 2010). The more knowledge is shared between individuals, the more opportunities there are for knowledge creation (Dalkir, 2005). Due to the reason that communities are formed with different ways of working and adoption of different vocabularies, they may not understand each other (Dalkir, 2005). For example human actors in IT and the business domain often speak different technical and procedural languages (Blumenberg et al., 2009). For instance one domain can articulate requirements, goals and constraints that another domain can think of as being unreasonable and uncooperative (Blumenberg et al., 2009).

Knowledge storage can be defined as the organization's memory which comprises the knowledge and information that the people working in the organization possess through their skills and experiences. The collective memory of the organization is the organizational culture expressed through the routines and attitudes inhabiting in groups and networks (Paoli and Prencipe, 2003). Organizational memory can be mental abilities and issues inside the organizational members, but also the information possible to retrieve, such as copies of memos, letters, spreadsheets, and data stored in computers constitute organizational memory (Paoli and Prencipe, 2003). Alavi and Leidner (2001) claim that knowledge management systems are a supporting class of systems to the organizational processes of knowledge management and knowledge storage. The organization's computer-based communication and information system applications contain databases, repositories, directories, and networks.

Knowledge application is the ability to use the learned material in new and concrete situations by applying rules, methods, concepts, principles, laws, and theories (Dalkir, 2005), and knowledge is shared from different sources. The use of external knowledge will create new knowledge (Huber, 1991).

Internal learning has two modes of knowledge: tacit and explicit knowledge. Tacit knowledge is

gained through clinical and practical experience (Dalkir, 2005). Räsänen et al. (2010) argue that the use of healthcare information systems has enhanced individual learning and group learning, and the physicians can achieve and create new knowledge by using information systems. A physician will require also other knowledge than medical and clinical knowledge, such as technical skills, academic knowledge, a hospital's and healthcare organization's cultural knowledge, management know-how, and administrative skills. The knowledge of healthcare organizations can be transferred to an individual, a group or a system (Williams and Baláž, 2008). According to Oinas-Kukkonen et al. (2008), a patient relationship management system is affected by the impact of the knowledge work performed by the physicians in a hospital, and the use of the case system seems to enhance knowledge creation. The knowledge transfer barriers are lowered between the physicians and the patients by enhancing communication through a follow-up system (Oinas-Kukkonen et al., 2008).

In organizational learning, knowledge is stored in databases in documents, and the learning entities are both the individual and organization (Mustonen-Ollila and Heikkonen, 2003; Morr and Subercaze, 2010). This kind of organizational learning is 'old organizational learning'. On the other hand, new organizational learning means discovering new theories, practices and innovation and then distributing or transferring that new knowledge to the organization (Mustonen-Ollila, 2005; Morr and Subercaze, 2010).

Organizational unlearning means that old organizational knowledge is disregarded. The knowledge considered for elimination is the same knowledge that led the organization to its previous success (Turc and Baurnard, 2007), and there is a need to remove or reject previously used practice from the organization (Mustonen-Ollila, 2005). Therefore, change and learning theories are relevant and should be included in a framework in order to draw a comprehensive image of processes at work in the changing organizations (Turc and Baurnard, 2007; Venable et al., 2010).

## 5 METHODOLOGY

### 5.1 Data Collection

The case study approach (Yin, 2003) has been chosen for this study. The primary data sources are both open-end and structured interviews conducted

at South Karelia Social and Health Care District's Central Hospital. Furthermore, archival records are used as secondary data sources. The interviews are transcribed and sent to the interviewees to be checked and corrected. The open-end interviews create the possibility for individuals or groups to express themselves freely questionnaires.

First, a pilot study was carried out in the Obstetrics and Gynecology department of South Karelia Social and Health Care District's Central Hospital in January - March 2013. After the pilot study, four other departments were included in the research, and new interview rounds have been and will be carried out in the following order: in January - April 2014, a second round of interviews was carried out in the Obstetrics and Gynecology department.; in March - May 2014 the first interview round was carried out in the Paediatric department.; in March - June 2014 the first interview round is carried out in the Paediatric Neurology department.; in May - June 2014 the first interview round will be carried out in the Surgical department.; and finally in May 2014 the first interview round will be carried out in the Anaesthesia and Surgery department.

The interview questions have been improved after each interview round to match the healthcare organization's knowledge management base better. The interviews have been and will be tape-recorded and transcribed. Before the interview, permission is asked from the interviewee to use the tape recorder. In the interviews, a predesigned interview protocol is used, called structured interview, and the interview questions are sent to the interviewees in advance (Creswell, 2007).

According to Creswell (2007), the individuals considered for the interviews need to have participated in the process or action, and they must be given the time and place to be interviewed. Our study is in line with this, because the hospital arranges the place and time for the interviews, and the Chief physician of the Obstetrics and Gynecology department of the Central Hospital acts as the research site coordinator. Creswell (ibid.) also highlights the importance of type of sampling and the number of interviews needed. In any needed legal permission or arrangements inside the hospital, the research coordinator is essential, because in the hospitals and healthcare organizations in Finland the national laws and regulations are very strict, and also the interviews need a specific time table, because they must not affect the patient care work.

## 5.2 Data Analysis

### 5.2.1 Qualitative Data Analysis with the Grounded Theory Approach

This study is a qualitative inquiry based on the case study approach (Yin, 2003; Creswell, 2007). This method is best suited for social sciences, as it allows the researcher to interact with the society through interviews and observations for the purpose of acquiring the desired data. The researcher will be able to combine various data sources such as archival records, interviews, observations, audio recording, and even quantitative data for the analysis without restricting the data formats (Joan and Pastor, 2007). The Grounded Theory (GT) approaches of Glaser and Strauss (1967), Pawluch and Neiterman (2010) and Corbin and Strauss (1990) are used in the data collection and analysis. According to Corbin and Strauss (1990), there are three levels of coding in the Grounded Theory: open, axial and selective coding. Open coding reveals similarities and differences in the data so as to unveil the concepts, classes and relationships between the concepts in the data. Similar concepts will be put into the taxonomy of categories. There is a need to set the dependencies and relationships between concepts and classes thus in axial coding categories are analyzed. Through this the development of the relationships between concepts will reveal new concepts and relationships. Selective coding integrates and refines the fully developed categories into theories. The main theme of the research emerges from the data during this phase, but after the main theory is established, the researcher still refines the categories by trimming off unwanted ones and filling in those still poorly developed. In our study, a department in a central hospital is the unit of analysis. The sample has not been limited to a certain number of departments, because the goal of the study is to achieve deep understanding of the selected case departments and to identify their knowledge management concepts, relationships and processes.

Finally, when a research is a collective case study by nature, it aims at creating a new theory. The multiple case study approach is applied when aiming at developing a new theory, and this study will also utilize a new methodological approach where both qualitative and quantitative research approaches are applied. As the quantitative research approach we use novel intelligent computing and analyzing methods, which are described in the next section. The theory creation should thus combine both multiple data collection methods. The

triangulation will make it possible for the multiple data collection techniques to provide stronger substantiation of concepts. Collecting different types of data by different methods from different sources produces a wider scope of coverage and may result in a fuller picture of the phenomena under study. Especially Eisenhardt (1989) suggests that both quantitative and qualitative data should be used in any study. The flexibility given by GT makes it possible for the respondents to express their views and opinions easily and freely.

### 5.2.2 Quantitative Data Analysis with Novel Intelligent Computing and Analyzing Methods

As this is study also quantitative, a large sample of data will be collected in order to carry out the needed statistical analyses (Kohonen, 1989). The exploratory data analysis approach is needed for generating hypothesis due to weaker assumptions and prior knowledge about the data. Classified hypothesis testing is applied to reject or accept hypotheses whenever available. Data mining techniques are tools for exploratory data analysis. These include clustering, regression, classification and association analysis techniques. The goal of data mining is to find unsuspected relationships and to summarize the data in novel ways that are both understandable and useful for the goals of the project. Especially data visualization methods, such as the Self-Organizing Maps (Kohonen, 1989, 1995), Bayesian networks (Heckerman, 1996), multidimensional scaling and hierarchical clustering, are needed for the understanding of deeper domain and variable dependencies. For data regression, linear and non-linear methodologies of classification and association analysis, combined with variable selection and uncertainty analysis are applied. As the general framework, the Cross Industry Standard Process for Data Mining (CRISP-DM) approach has been selected. The modeling part includes the methods mentioned above.

## 6 EXPECTED OUTCOME

The scientific contribution of the project will be to create a new theory called knowledge management life cycle in healthcare, based on the discovered empirical findings. The practical and managerial contribution will be helping physicians and nurses to understand their own valuable knowledge capital and practice, getting familiar with knowledge

management practices in the hospital, and helping to build up better healthcare information systems. The methodological contribution will be using diverse qualitative research methods such as the Grounded Theory and novel intelligent computing methods together.

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