**Implementing a Knowledge Management System within an NHS hospital: A case study exploring the roll-out of an Electronic Patient Record (EPR)**

**Abstract**

This research aims to contribute to understanding the implementation of knowledge management systems (KMS) in the field of health through a case study, leading to theory building and theory extension. We use the concept of the business process approach to knowledge management as a theoretical lens to analyse and explore how a large teaching hospital developed, executed and practically implemented a KMS. A qualitative study was conducted over a 2.5 year period with data collected from semi-structured interviews with eight members of the strategic management team, 12 clinical users and 20 patients in addition to non-participant observation of meetings and documents. The theoretical propositions strategy was used as the overarching approach for data analysis. Our case study provides evidence that true patient centred approaches to supporting care delivery with a KMS benefit from process thinking at both the planning and implementation stages, and an emphasis on the knowledge demands resulting from: the activities along the care pathways; where cross-overs in care occur; and knowledge sharing for the integration of care. The findings also suggest that despite the theoretical awareness of KMS implementation methodologies, the actual execution of such systems requires practice and learning. Flexible, fluid approaches through rehearsal are important and communications strategies should focus heavily on transparency incorporating both structured and unstructured communication methods.

**INTRODUCTION**

There has been relatively little research about how to actually carry out knowledge management (KM) within healthcare organisations. Hospitals in particular still perceive implementing KM to be difficult: it has only been in the last 10 years that such implementation issues have begun to be tackled in the field of health. Hansen et al (1999) argued that this could be due to a gap between the theories, strategies and frameworks of KM that are presented and the approaches for their practical application. Maier and Remus (2003) concurred that uncertainty towards KM is fuelled by the lack of a commonly agreed method or procedure for implementing KM. This remains the case in 2014. Deciding to 'do' KM is not the same as actually 'doing it'(Edwards, 2009).

The Business Process Approach to KM provides a method for 'doing' KM and has been explored by a number of authors (Kwan and Balasubramanian, 2003; Maier and Remus, 2003; Edwards, Hall and Shaw, 2005). Studies exploring this approach have however not been in healthcare. This study therefore attempts to fill this gap and to contribute to the theory on KM implementation in health, by focusing on knowledge management system (KMS) implementation from the theoretical lens of Business Process theory. The overall goal is to understand better how to implement knowledge management systems effectively in healthcare.

The exploratory study reported here concerns the implementation of an Electronic Patient Record (EPR) system. At its most general, an EPR is simply a patient's medical records stored in digital form: the term EMR (Electronic Medical Record) is also used Phillips and Pugh (2000) define exploratory research as the type of research that is involved in tackling a new topic about which little is known. According to Collis and Hussey (2003), exploratory research focuses on gaining familiarity and insights with the subject area for more rigorous investigation subsequently. As a study specifically exploring the implementation of a KMS (the EPR) from the perspectives of the various 'customers' (i.e. clinicians and patients) it is unique.

This paper is structured as follows: the next section provides a literature review that summarises previous research on KM and KMS implementation with specific reference to health and the Business Process approach to KM. The following section explains the research methodology and the approach to data collection and analysis. Next, the findings are outlined and discussed. Finally, the paper closes with a concluding section providing limitations of the research and practical recommendations to support practice.

## LITERATURE REVIEW

### Knowledge Management

Definitions of both knowledge and KM vary from the broad practical to the conceptual. Space does not permit a thorough discussion here: for the purposes of this research we take the pragmatic approach that we regard something in an organisational context as being knowledge if people in that organisation say that it is.

Definitions of KM in health mirror more general definitions of KM but also acknowledge the benefits associated with managing knowledge for the delivery of and the quality of patient care. The Healthcare Information & Management Systems Society in the UK defines KM as the "aligning of people, processes, data and technologies to optimise information, collaboration, expertise, and experience in order to drive organisational performance and growth". Specific factors influence KM in health. Healthcare organisations and in particular hospitals are large and have a complex structure. Patient care is delivered through a collection of professional specialists who operate in distinct, hierarchical arrangements across organisational units. The delivery of care is thus said to be fragmented (Van Beveren, 2003). This unique operational arrangement has a profound effect on the ability of these organisations to create, distribute and share knowledge. Cegarra-Navarro and Cepeda-Carrion (2010) highlight the need for customised KM programmes in health.

Strategies for the implementation of KM, that is, how ideas and theories of KM are made relevant in an organisation are numerous (Hansen, Nohria and Tierney, 1999; Alavi and Leidner, 2001; Earl, 2001). Although these authors present theories on how to approach KM, there has continued to be a gap between these theories and how they can be executed (Edwards and Kidd, 2003). As Schiuma, Carlucci and Lerro (2012) observe (p.11) "One of the challenges of organisations is to extract the greatest value from these [knowledge] resources".

**Knowledge Management Systems**

There is no commonly accepted definition of KMS. Definitions of KM systems are dependent on the perspective of knowledge that is taken, that is what is termed as knowledge, how knowledge is created and held and its relationship with information and data (Moteleb and Woodman, 2007). Alavi and Leidner (1999) describe a KM system as a "system designed specifically to facilitate the sharing and integration of knowledge" that is, a way of creating, capturing, accessing and reusing knowledge throughout the organisation. Davenport (1998) describes KMS as systems designed and developed to give decision makers/users within an organisation the knowledge they require and need to perform their tasks and make their decisions. Unlike traditional information systems they provide context and depth to the data and information offered. Gallupe (2000, P4) refers to KMS as "tools and techniques that support knowledge management practices in organisations". He further suggests that the management part is "the stewardship of a resource; that is, the generation or acquisition of that resource, the storing of the resource, and the caring, security and on-going support of that resource" (Gallupe, 2000, P4).
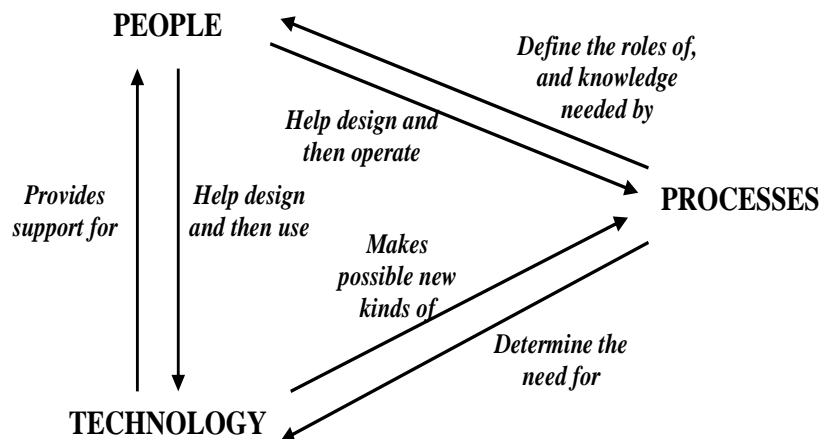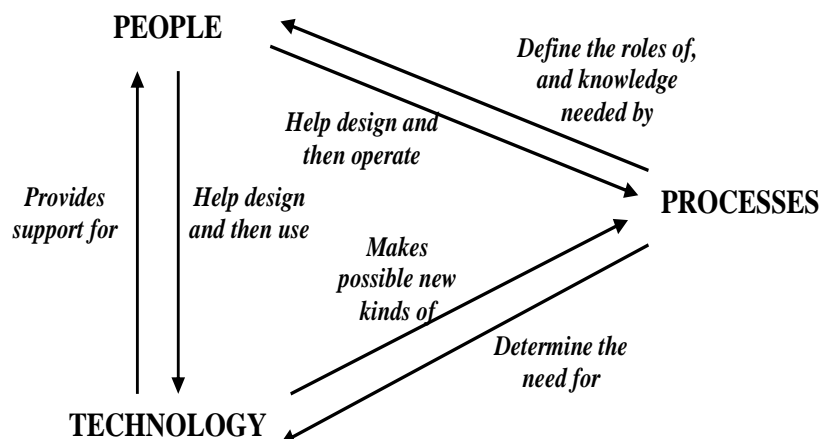


**Figure 1 People, processes and technology (Edwards, 2009)**

To summarise, a KMS can be thought of as comprising people, technology/tools and knowledge itself interacting

together to provide the knowledge needed to people within the organisation in order for them to perform their tasks and make decisions (Gallupe, 2000). Figure 1 shows a representation of a KMS, where the elements people, processes and technology are linked and interact in a reciprocal relationship with one another. The people could be thought of as the 'who' element (i.e. the actors), processes as the 'how' element (i.e. how things operate - the steps or chain of events) and technology as the 'what' element (i.e. the technology required to enact, support or improve the process).

**Business Process Approach to Knowledge Management**

Business processes represent how an organisation does business. So, thinking process enables the organisation to visualise itself as a whole. This plays a key role in the knowledge value chain (Carlucci, Marr and Schiuma, 2004) linking KM to value creation, organisational (business) processes (Schiuma, Carlucci and Lerro, 2012) being an element in that chain. A holistic view in KM terms means that emphasis is placed not only on what the organisation actually does but also on *how it does it* (Edwards, 2009), something that does not appear on a typical organisational chart. This approach also offers other key benefits: it allows knowledge to be integrated and incorporated into the underlying procedures and key practices of the organisation; and, as highlighted by Braganza (2001) it can assist an organisation to think about the demand for knowledge across each process, not just the supply of it. This leads to the consideration of the participants in the process and their knowledge requirements in enacting the process.

According to Grover and Davenport (2001), the alignment of KM strategy with business strategy lets the organisation consider how business strategy can be enhanced through the more effective management of knowledge. From a strategic perspective this is important as process knowledge can be considered to be a source of core competence, hence its management can provide a strategic contribution (Hammer, 1990; Kwan and Balasubramanian, 2003). The process approach provides the missing link between KM and business strategy (Maier and Remus, 2003). The alignment of a KM initiative to business strategy allows an organisation also to consider factors such as the current and future culture and learning environment (Grover and Davenport, 2001).

Process orientated KM highlights the importance of the processes of an organisation and the knowledge used by each process. Barcelo-Valenzuela et al. (2008) claim that over 90% of an organisation's activities can be described in terms of processes, which they define as (p.324) "a collection of interdependent activities or tasks organised to achieve specific business goals". Moreover, Edwards (2009) proposes that business processes display a number of key characteristics which substantiate why they should be used as the foundation for KM: They comprise a set of structured actions (they flow), they have identifiable customers (they do things for people), they cut across organisational boundaries and they can be measured.

The majority of KM projects within healthcare have typically tended to be either technology or people driven, rather than process-driven. Edwards et al (2005) argue that the application of a process view of KM within healthcare would give a better overview of the whole care process, allowing the knowledge needs of all

stakeholders to be met. Rothschild et al (2005), also advocate a system-oriented perspective to assist in the improvement of the delivery of health information systems, particularly within Acute Care.

A typical hospital tends to be structured departmentally according to medical specialities with their focus internal - functional silos (Edwards, 2011). Clinicians however need to be able to share knowledge regarding patients across various speciality departments and processes, following a patient along a care pathway. Business processes typically cut across organisational boundaries, consequently boundary spanning knowledge needs to be provided across the organisational silos (Edwards, 2011). Thus process thinking allows those involved in "adjacent" or connecting activities within a process to share knowledge (Edwards, 2011) which is of particular importance in health. Studies focussing on the process approach to KM in health include Reuthe and Allee (1999) who argue for the arrangement of knowledge through an entire clinical care process as opposed to around what they term an 'episode' of care. Batalden and Splaine (2002) advocate a process view of health care provision with an emphasis on what they describe as microsystems (a group of people that are involved in the care of an individual patient). Others include Desouza (2002) and Berg and Toussaint (2003).

**Implementation**

The emphasis on integration and boundary spanning means that it is essential to take account of implementation aspects specific to KM, and not treat a KMS as 'just another information system'. In the earliest days of KM, Tenkasi and Boland (1996) argued that "the current tradition of information systems lacks a strong basis of what it is to integrate differentiated knowledge and expertise and facilitate mutual learning" (p.80). Their characterisation of knowledge integration as perspective taking is very relevant to an EPR, and the examples of a new (KMS) tradition they give are still much more like decision support systems work than traditional information systems. Shift patterns and geographical distance in a large hospital also mean that KM support takes on many of the features necessary for virtual teams as discussed by Alavi and Tiwana (2002). More recent research, such as that by Setia and Patel (2013) in the field of operations management, shows that the relationships between KM and IT support are still open to discussion.

Many studies have looked at the implementation of technology based KMS, for example Chalmeta and Grangel (2008) develop a method to assist in the process of developing and implementing a KMS in any type of organisation. They include capturing tacit knowledge as one of the goals of their method, but the strongly technology-based approach they advocate seems unlikely to be able to achieve this. In any case, since healthcare organisations are unique in the way in which they are structured and in how they operate such methodologies are tricky to apply. Studies examining KMS in health include Ghosh and Scott (2007) who investigate KM processes and organisational enablers associated with effective KMS within the clinical nursing setting; Fahey and Burbridge (2008) who use the development and implementation of a KMS within a hospital to illustrate the diffusion of innovation processes and why the implementation of some KMS fails. Other studies of IT based KMS in health include: Davenport and Glaser (2002), Pedersen and Larsen (2001), and McNulty (2002). None of these studies

specifically takes a process approach, nor do any of them look at an EPR system, even though such systems are becoming the backbone of operational support in hospitals.

A key element of this study is that we propose an EPR system can be described as *'an IT system which makes knowledge available to clinicians at the point of care in order to enhance the communication and decision making processes'* and is thus a KMS by any of the definitions mentioned earlier. We have found just one previous paper taking a similar view, that of Gastaldi et al. (2012). They examine the Electronic Medical Record systems (our EPR) in three large Italian hospitals in Lombardy. However, their work differs from ours in that our focus is on the implementation of the EPR, whereas theirs is looking at the "feasibility of EMR as a trigger and an enabler of improved knowledge asset dynamics within hospitals" (p.17).

**METHODOLOGY**

The research goals of the study are (a) to understand better how to implement knowledge management systems effectively in healthcare; and (b) to understand if concepts from the process approach can help in this. Specifically, the study aims at providing an in-depth understanding of how an EPR was developed and implemented in a hospital. A qualitative inductive approach was chosen as our work is theory-building and theory-extending. This approach enabled us to explore our assumptions and examine relationships and concepts (Eisenhardt, 1989). It also assisted with the examination of subjective descriptions of the participants, their thoughts and feelings which helped us to increase our insight and understanding of the development and adoption of the KMS. Due to the nature and structure of the UK National Health Service (NHS), all NHS hospitals have a certain similarity. For example, all NHS hospitals are currently expected to introduce an EPR, and many have already done so. The case chosen represented a typical large NHS Foundation Trust teaching hospital. A single case study offered an opportunity to provide a rigorous and fair presentation of the empirical data which is particularly appropriate when researching a "contemporary phenomenon in its real life context" such as systems implementation (Yin, 2009).

The particular EPR system was a commercial product that was customised by the Trust's own ICT staff before installation. The system incorporated an electronic version of the patient notes and other electronic information, together with a series of additional inter-linked components: medical imaging; digital dictation; link to the rules-based electronic prescribing system; document repository of other electronically produced and scanned in correspondence; access to results such as pathology; access to General Practitioner practice page where available; order communication system; Emergency Department case cards. Development and implementation was overseen by an "EPR Board", which comprised a mix of senior managers, IT professionals and clinical leads.
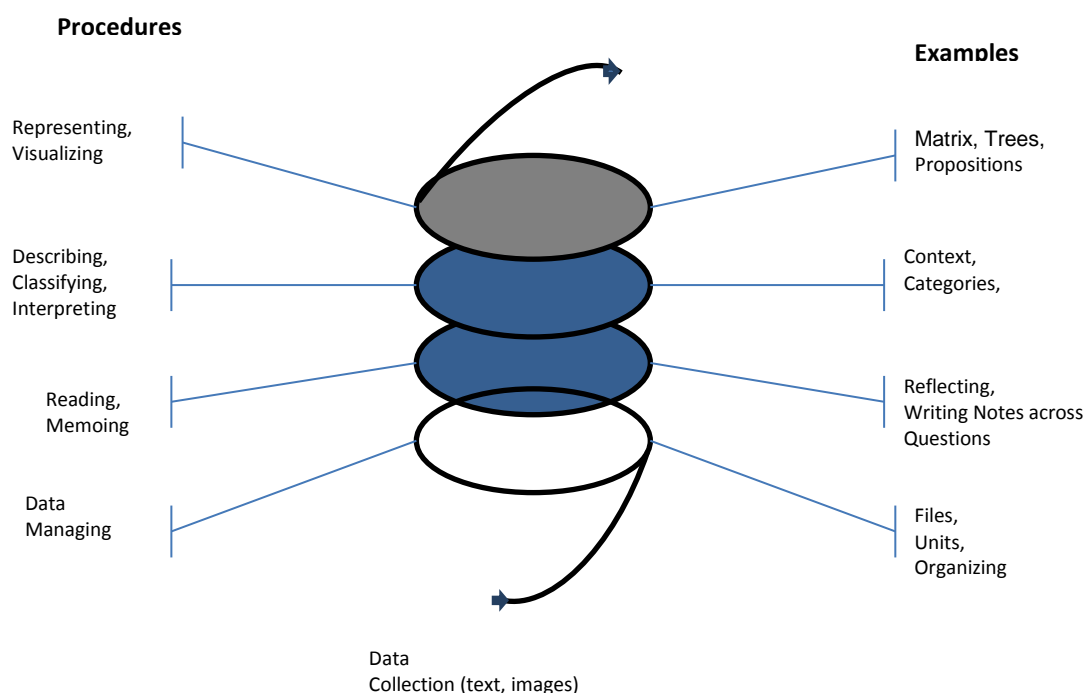
**Data Collection**

The investigation was carried out over a two year period (2009-2011) beginning before the EPR roll-out, with data collected from four main sources: Interviews, non-participant observation, documentary data and process maps. Multiple sources of data were used to avoid potential bias resulting from a single source (Eisenhardt, 1989).

Semi-structured interviews were conducted with all eight members of the EPR board, 12 clinicians and 20 patients. Based on the literature review, three related but distinct interview guides were produced, one for each type of stakeholder. Space does not permit their inclusion here. This provided a flexible structure, and helped yield rich detailed information of the participants' thoughts and beliefs and accounts of their particular experiences. Interviews also revealed details of the process of implementation and adoption. EPR board meetings at the hospital were observed in a non-participatory manner, providing detail on the strategy and implementation and the decisions taken. Process maps developed by the hospital provided information on process changes. Additional secondary data was collected from internal documents such as reports, meeting minutes, policy documentation, promotional literature and stakeholder websites.

**Data Analysis**

The theoretical propositions strategy as described by Yin (2009) was used as the overarching approach for data analysis. Here initial theoretical research themes and propositions were used to help shape and organise the case study analysis. An advantage of this strategy was that it allowed us to define and examine alternative explanations (Yin, 2009). Figure 2 shows Creswell's (2007) model of the data analysis process. Rather than advancing in a fixed linear manner, analysis follows the contours of a spiral, entering with data represented as text and spiralling in loops through the analysis process (Creswell, 2007).

**Procedures**

**Examples**

Representing,
Visualizing

Matrix, Trees,
Propositions

Describing,
Classifying,
Interpreting

Context,
Categories,

Reading,
Memoing

Reflecting,
Writing Notes across
Questions

Data
Managing

Files,
Units,
Organizing

Data
Collection (text, images)

**Figure 2: Data analysis process (after Creswell, 2007)**

Data analysis commenced with data management: the organisation of data into files or folders for easy location. The reading and memoing loop which followed allowed a sense of the whole database to be obtained by "immersing oneself in the data". For example interview transcripts in their entirety were read several times to try and get a sense of the interview as a whole before they were segmented into parts. Notes were written in the margins of the transcripts and field notes for ideas and key concepts that occurred.

Moving up the spiral into the describing, classifying, and interpreting loop represents the crux of the qualitative data analysis process (Creswell, 2007). In this loop codes and categories were developed through the assignment of words or descriptions to sections of text through themes generated from the contextualisation and interpretation of the theoretical literature (in this case the Business Process Approach to KM and the wider KM literature). Codes were then sorted and categorised to winnow out (Creswell, 2007), reduce and discard surplus values. An exercise of classification followed, which consisted of a further analysis of the developed codes to observe patterns and regularities in the data. Data was then categorised by organising, linking and grouping into similar themes or 'families' that shared some theoretical characteristics or logical rationale from the perspective of

the analyser and from the views from the literature. A second coder analysed a sample of the transcripts in order to check the reliability of the themes and codes that were developed. Data analysis, coding and theme development was supported by the software tool NVivo 8.

**FINDINGS AND DISCUSSION**

The findings are presented in an order running roughly from the conception of the project to the later stages of implementation, although of necessity all aspects inter-relate and overlap.

**Business strategy**

Members of the group were asked how they perceived their strategy for KM fitted in with the Trust's overall Business Strategy. Most members of the group agreed that there was a correspondence, with one Board Member observing *"It [the Trust's strategy for KM] fits in very well with the overall Trust's strategy"* Boardmember 2.

It has been widely observed that a successful KM implementation requires a clear identification of the business problem to be solved and an alignment of the KM project with overall business objectives (Kwan and Balasubramanian, 2003; Maier and Remus, 2003; Bou and Sauquet, 2004; Edwards, 2009). A move to a new facility and the corresponding lack of space for paper records presented a problem for the Trust. This problem prompted a decision to go electronic. The Trust viewed the development of the EPR system as a means of tackling this situation and at the same time realising a competitive advantage. As mentioned by Boardmember 2 *"[the system] is now becoming one of the cornerstones of our objectives and development going forward"*. This provides further evidence to support Edwards (2011) in that the EPR was not seen as a short term 'project' that was done and finished, but viewed as a larger on-going KM activity which was embedded within the Trust's strategy.

The quotes from Boardmember 2 show that the Trust's strategy for the EPR was closely connected to their overall business strategy. The Trust would use innovation in the form of the EPR to provide a mechanism to deliver their core values and mission. Thus the success of the KM initiative would provide strategic value to the organisation.

**Fluid approach**

An initial pilot phase enabled the Trust to test out their assumptions and address any teething problems. A decision to subsequently instigate a series of smaller projects being delivered along medical specialities gave them the opportunity to construct clear but adaptable relevant measures to demonstrate progress. Flexibility enabled the Trust to be more responsive to the needs of the specialities and be reactive to the changing environment:

*"We have made a conscious decision that the strategy stays very fluid because it is a very changeable and fast moving area we've quite deliberately never had any rigid sort of project plan for the overall thing"* Boardmember 8

*"A development can get kind of constrained if you start saying write this up and write that up, you know there is a balance, but actually as you begin to test and try out the assumptions that you made, by not having it formally written down does give you the autonomy and freedom"* Boardmember 5

As Boardmember 8 says, the Trust's strategy meant that they chose not to follow any particular project management practice. Authors such as Chua and Lam (2005) advocate that KM projects are treated as typical projects so there is a need for a suitable project management methodology. On the other hand, authors including Wenger et al. (2002) do not see KM initiatives as being suited to typical milestone-driven project management approaches. The flexible, fluid approach used by the Trust strikes a chord with the move from the waterfall and similar big developmental approaches in IS towards more agile methods. It also provides evidence within the area of health for Edwards and Kidd's (2003) proposition that "staged approaches to … knowledge management may be the most effective". Within hospitals, although care processes largely stay consistent, the environment itself is dynamic and fast moving, thus adaptable and flexible strategies for KM projects can prove to be more effective.

**Communication plan**

Members of the board were asked if they had a written communications strategy. All members responded that although there was no formal written communications strategy, an informal plan was adopted, targeted at *"winning hearts and minds"* Boardmember 5.

Opportunities were highlighted to maximise positive messages about the system and its introduction, through digital media such as screen savers, intranet pages and emails. Non-digital modes included internal newspapers, talks to engage people at forums, meetings and other gatherings. For example:
*"In the early phases we had lots of forums where we did demos even when we hadn't got a system we … did screen mock ups to show people what it could look like and then when we'd got the bones of the system we went out and demoed what we'd got which acted a bit like a requirement enhancement workshop as well opening it up to everyone"* Boardmember 1.

The remit was to engage clinicians early on, understand the way in which they work, address their issues and concerns and sell the positive impact of the system almost on an individual basis. Further impetus came through the engagement of key influencers and *"hypothesising about what it means for you? How will you use it? How will it have an impact on the way that you run your clinic? How you can take advantage of that?"* Boardmember 8.

Although not formally documented, the Trust were committed from the start to a simple and clear communication strategy which was to win hearts and minds. These findings suggest that communications strategies for KM projects should heavily focus on transparency including both structured and unstructured communications methods.

Another key outcome of the communications strategy was that implementation became driven by word of mouth:

*"The momentum started off with trying to encourage specialities to want to use it and try and come up with reasons why they should. But the momentum has now swung the other way where we now have specialities who are saying when am I going to get the system? And that's a very different type of mind-set because they've talked to their colleagues. This sort of unstructured communication by word of mouth has proved to be most powerful where we got the early implementers to actually get that mentality and actually that what's driven it quite hard."* Boardmember 5

The literature on KMS implementation hardly ever mentions communications strategy explicitly. An exception is the paper by Mei, Lee and Al-Hawamdeh (2004), who design a communication strategy as part of the KM strategy for the Singapore Civil Service College. However, their empirical focus group work did not cover the actual implementation, and all the participants were involved in proposing the KM initiative. The 'word of mouth' aspect of the Trust's strategy is akin to what Smith et al (2010) describe as the creation of a KM mind-set. This is "a state in which people think about how knowledge is or can be used in…everyday work". Further Marchand et al (2001) suggest that this sort of mind-set is something which develops incrementally and involves a number of interdependent beliefs and behaviours. The Trust embarked on a strategy of winning hearts and minds, which included transparency and management support. Clinicians were encouraged to speak out so that their issues and concerns could be addressed and subsequent learning could take place, thus inspiring the establishment of a knowledge-sharing culture.

**Process mapping**

Before the implementation of the KMS a process mapping exercise was conducted to map out a "*process flow for every service in its current state*" Boardmember 6. Figure 3 shows an example process map, for the liver clinic. The way in which the mapping exercise was conducted was standardised across all specialities:

*"We've been consistent in the way that we've rolled it out we've met with the clinical service lead and the wider consultant team first, we've agreed a go live date with them then we've gone in and we've mapped their service"* Boardmember 5

The reasoning for conducting process mapping was consistent across all eight members of the Board:

*"There were two main reasons for doing the process mapping, one was to map the administrative processes and the other was to map out the clinical processes…understanding what it was that happened to individual patient as they went through the process and put together a flow chart diagram for the service"* Boardmember 4.

*"from the clinical perspective the requirement to process map was about understanding what it was that happened to […] patients as they went through the process"* Boardmember 3.

When probed about specific insights, most respondents felt that physically sitting down with the clinicians allowed the process mapping team to analyse particular processes and determine the process needs. Processes were mapped out by a team who *"actually sat down with [those] people to almost go through [typical business analyst*

*type process where they have documented and analysed] their business processes"* Boardmember 3. The aim being to try and *"understand what bits of paper they use or what electronic information they gain access to and how they run their clinics"* Boardmember 3.

*"We have had support teams coming in to tell us about the deployment and help us out with our clinical flows"*
Clinician 3

*"There was process mapping done by the implementation team with the nursing staff and the clinicians in the clinical area to look at the workloads and the systems that we had in place and how these would translate into the EPR"* Clinician 8
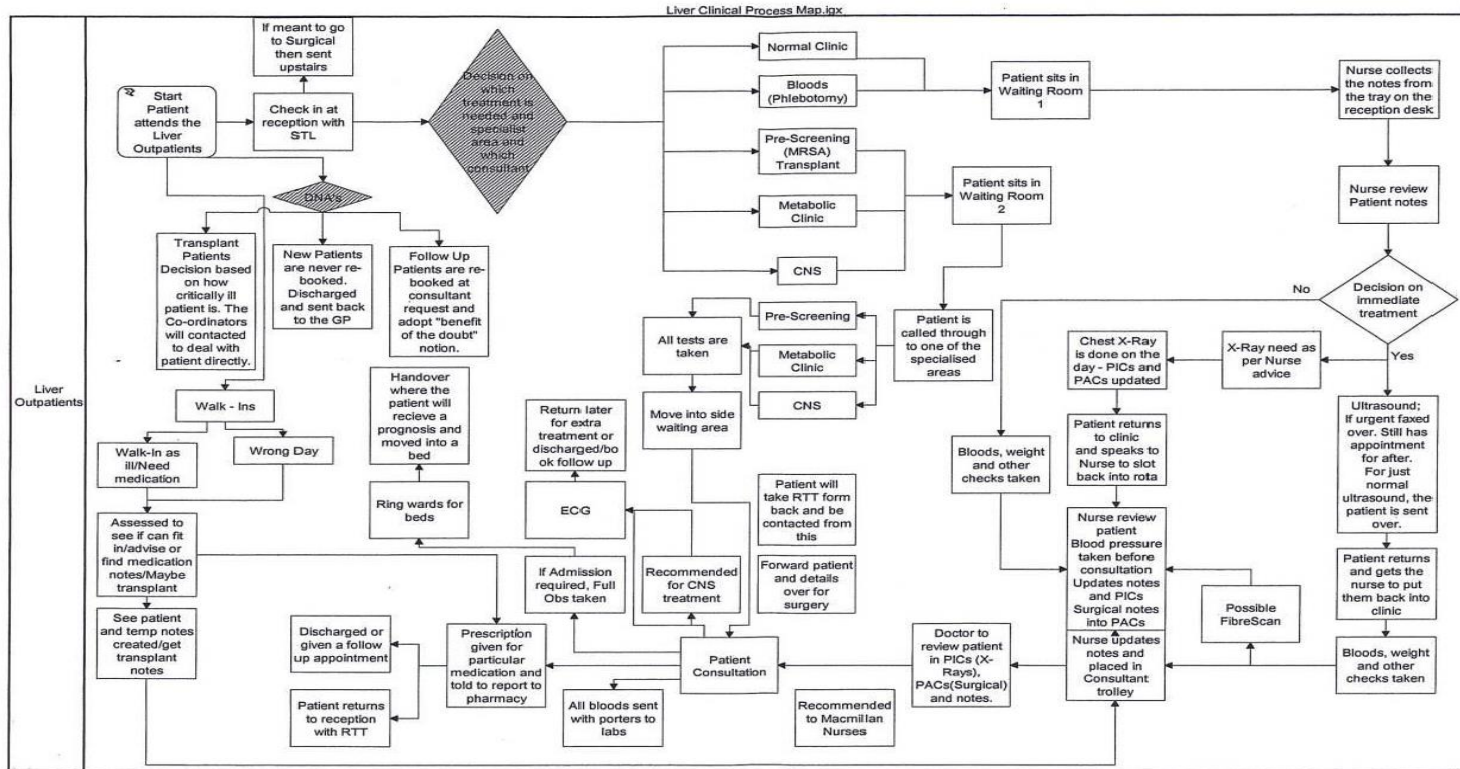
**Figure 3: Liver clinic process map**

All eight Board Members felt that the process mapping phase represented a critical component of the development and implementation procedure, not only revealing some interesting insights into their current processes but also enabling them to tailor the system to incorporate core work processes:

*"We've uncovered subtle ways of working on our journey, people don't even realise they're doing certain things until you've sat down and you "process-matic" with them. They've not highlighted the way they've used the paper because they've not realised they've done it that way until it wasn't there to write on"* Boardmember 5

*"We try very hard to say to the clinicians what is your work flow, how do you work and what irritation can we help with, to try to streamline the processes but in a way in which it is in-line with the way that the staff historically have worked"* Boardmember 4

This evidence supports the analysis of business processes as a good starting point to design and introduce KMS (Maier, 2007). Information derived from processes can be used to specify KMS more precisely. In this case this was done through the construction of process maps. Mapping out each service provides an opportunity to effectively visualise the operation of the organisation through its underlying business processes.

**Silo thinking and organisational structure**

Although the Trust implemented the EPR system in stages in individual specialities, the system itself was designed around business processes that followed patient care pathways:

*"We've worked with [each speciality] to understand what it is that they do and therefore how best to adopt the system to support their needs, and often on the back of that there's some benefits in terms of their processes i.e. I'll …'lean' some of their processes in terms of the efficiency and productivity side of a care pathway, but also in terms of the clinical side of the care pathway and what overlap we have with other speciality paths"* Boardmember 5

*"We will make the EPR work for patients … so you can follow the patient pathway. So if somebody comes into our A&E department and goes into surgery has an operation and gets discharged then comes to an outpatient appointment - then it'll follow them all the way through - all the data and information will be available all the way along that pathway"* Boardmember 6

*"I can sit here and say 'Oh I know that somebody saw Mr X, Dr Y saw this patient this morning; I wonder what they thought.' So you know I can look at other people's records, this is especially important when I have got some results and I don't quite know what to do – has it been dealt with. I could just go and look at the records from wherever I am sitting and get an instant answer"* Clinician 2

The ability to combine information across departments was also seen as a clear benefit by patients.

*"Clinicians can access things like x-rays, my bloods and other information more rapidly, which they have used to show me and where it also helped is when I went to other departments, the doctors can see these things there, it helps to integrate your healthcare"* Patient 17.

Other benefits to patients were that instant access to the EPR supported the clinician in being able to explain and discuss emergent factors with them. This in turn helped patients to understand the implications of such factors and their effects on their conditions:

*"What we have now with the system enhances that decision making process because it is just so much easier now to reliably look up and find relevant clinical information... I just do it now and do it without really thinking about it. Whereas previously, I might have seen a patient for example, who has got some kind of liver history. They may have been treated a bit but their information might not have been available. Whereas now, in terms of being able to access quickly and easily concise records that other specialists have made"* Clinician 5

*"I was in nurse-led clinic and this particular gentleman had been referred to Cardio. It was all there for me to see. So I was able to see what they were doing with him as he had been re-referred because he had got some problems with arrhythmia. So it actually helped me to pick that up which is essential from the safety aspect"* Clinician 3

*"Whilst on the screen they can do all this quite easily and you're pretty confident that we haven't missed anything. Also by showing the results and discussing them with you, it leads to other questions"* Patient 16

As explained by Edwards (2011) business processes frequently cut across hierarchies and functional boundaries within an organisation, they also have specific customers. Although a typical UK hospital tends to be structured departmentally along medical specialities, they do apply the process orientated view in the design of treatment or patient care pathways. These care pathways can involve many different health professionals across varying numbers of specialisms hence the crossover of care is a common occurrence.

Clinicians in particular need to be able to share knowledge regarding patients across various speciality departments and processes to provide appropriate care. Thinking process enabled the Trust to visualise each individual care process and its connections and links with associated processes within the whole. Examining what each process did and 'how it did it' (Edwards, 2009) from the perspective of each stakeholder group also allowed the Trust to obtain a comprehensive understanding of potential process overlaps. Involving all the stakeholders in the process allowed the whole of the care process to be reviewed from diverse perspectives. *"So instead of looking down on a care pathway you are perhaps also looking up"* Boardmember 5. These findings are consistent with the business process approach to KM which advocates that knowledge should not be constricted to the artificial boundaries within an organisation but rather it should flow with and along business processes (Edwards, 2011; Schiuma, Carlucci and Lerro, 2012). The following of patient pathways allows the distribution of boundary spanning knowledge across the organisation. This in turn reduces silo mentality (Edwards, 2011).

Our findings show that a benefit of using the EPR system was the ability for clinicians to put together patient information from various sources. This was particularly useful for patients with multiple conditions. Clinicians were able to see a complete picture of the patient and hence see things emerge across specialisms. The ability for clinicians involved in adjacent connecting specialities to share knowledge provided clear benefits for patients.

Thinking process is highly pertinent within the field of health as the understanding of the potential crossovers and overlaps in care is critical for patient safety and outcomes. Taking a more holistic view of the service process also contributes to quality and patient satisfaction which are part of the outcome measures in healthcare. Hence process knowledge can be used to continuously improve efficiency, effectiveness, productivity, and quality.

**Demand for knowledge**

The process mapping exercise also provided an opportunity for the team to gain a thorough understanding of how the current knowledge supplied to each speciality process was used. Discussions with key stakeholders involved in each process allowed additional knowledge needs to be collected:

*"We picked up in our process mapping big differences between different specialities and different speciality clinics and how they work. We've been able to sort out some operational issues by identifying additional information needed by individuals in specific speciality to drive improvements up"* Boardmember 4

*"We've uncovered subtle ways of working on our journey, people don't even realise they're doing certain things until you've sat down and you "process-matic" with them. They've highlighted the way they've used specific bits of paper, and highlighted other bits that are needed and which we hadn't provided. We've been able to provide essential generic information but also incorporate these other specific bits that they needed"* Boardmember 5

*"We were asked to come up with common procedures and clinical diagnosis that we come across so they could be put into the electronic patient record. So there was some discussion about the type of information that we needed access to and other additional information I used myself and that needed for the speciality."* Clinician 6

The data represented above is consistent with Maier (2007) who suggests that "knowledge about processes can provide part of the context that is important for the interpretation and construction of process-relevant knowledge". Process mapping provided two benefits; firstly, it encouraged clinicians to consider more externalised thinking so in addition to reflecting on the potential use of the KMS to support their own local operational needs, it enabled them to consider how the system could provide beneficial global knowledge needs. Secondly, by recognising a) the knowledge that would currently be provided and b) the knowledge that was required or demanded by the process, clinicians were able to incorporate their requirements into the development. Externalised thinking enabled clinicians to reflect on how the EPR system could be used to assist in the integration of their knowledge demands and how the supply of this knowledge could help with providing improvements in

efficiency, functionality and quality of the process. These findings are consistent with Beer (1985) and Earl (1994) who both focus on what organisations do, and hence on the demand-side perspective of KM.

**Summary**

The main research findings under the various headings in this section are summarised in Table 1.

| Factor | Findings and Implications |
|---|---|
| **Business strategy** | KM initiatives provide strategic value to the organisation.<br>Identification of business problem to be solved and alignment of the KM project with overall business objectives. |
| **Fluid approach** | ***Fluid and flexible approaches are more effective for KM initiatives***.<br>KM initiatives are on-going activities - not "projects" that are done and finished. |
| **Communication plan** | ***Communication strategies should heavily focus on transparency including both structured and unstructured communication methods.***<br>Opportunities to highlight and sell positive messages about the KM initiative<br>Engage all workers and address issues and concerns<br>Subsequent development of a nascent mindset generated through word of mouth to send positive endorsement and encourage people to learn and share what they know<br>Communication strategies play a large role in changing attitude and mentality of workforce. |
| **Process mapping** | Allows examination of the process flows for each business process<br>***Process mapping can be a good starting point to design and Introduce KMS as it provides an opportunity to visualise the effective operation of the organisation through its underlying business processes.***<br>***Working alongside individuals specifically involved in the operation of the process allows close examination of the structure and function of each process providing an opportunity to highlight issues and changes to add value.*** |
| **Silo thinking and organisational structure** | Assists in the breaking of 'silo thinking' by allowing people to share knowledge across departments or specialities.<br>Allows the distribution of boundary spanning knowledge across the organisation following business processes.<br>Reduces silo mentality and ensures that the initiative is truly taking place across the organisation.<br>Enables recognition of various process boundaries and understanding of potential crossovers and overlaps.<br>Enables knowledge from "adjacent" or connecting activities within the process to be shared reducing internalised thinking.<br>Where there is a business process cutting across the silos, someone has to have the overview of it as a process. |
| **Demand for knowledge** | ***Following patients along care pathways encourages the knowledge needs of all stakeholders to be met***<br>Allows reflection on how the system can deliver and integrate the knowledge needs of the process to provide continuous improvements in its efficiency, functionality and quality. |

**Table 1: Main Research Findings**

These findings are based on a single case, with the intention of theory building and theory extension. The approach taken aims at understanding that case, rather than generalisability *per se.* However, the potential

generalisability may be considered by splitting the findings into two categories, shown in regular font style and bold italics respectively.

The findings in regular font style confirm those of KM work in sectors other than healthcare, as discussed in the preceding sub-sections. This case is thus an example of generalisability of these findings into the health care sector.

The findings in bold italics represent first empirical findings on aspects of KMS implementation in healthcare. Given that all UK NHS hospitals are similar to each other to a considerable extent, and to public hospitals more generally to some extent, and that none of these findings appears to rely on features unique to the case study Trust, it is reasonable to consider that this set of findings from the case may be more generally applicable. Thus the five findings shown in bold italics in Table 1 lead us to derive the following propositions for testing in future research on KMS in healthcare.

*P1. Fluid and flexible approaches are positively associated with the success of KMS initiatives in healthcare.*
*P2. Communication strategies that include both structured and unstructured communication methods are positively associated with the success of KMS initiatives in healthcare.*
*P3. KMS initiatives in healthcare that include organisation-wide process mapping at an early stage are more successful than those that do not.*
*P4. KMS initiatives in healthcare where the project team works alongside those specifically involved in the operation of the process are more successful than those where it does not.*
*P5. KMS designed around patient care pathways are more effective than those organised by department.*

Further justification for the possibility of generalisation is that there is some support for propositions P2 (e.g., Broechner and Badenfelt, 2011), P3 (e.g., Millet, Schmitt and Botta-Genoulaz, 2009), and P4 (e.g., Kautz, 2011), from non-KM work in fields such as change management and the implementation of other types of software. However, having argued earlier that KM systems implementation is different, we believe these propositions need to be tested more widely in relation to the implementation of KM systems in healthcare. This should include other UK public hospitals, other public hospitals, and if supported there go on to other types of hospital and other areas of health care provision than hospitals.

**CONCLUSIONS**

KMS in healthcare have potential to improve the quality of patient care and produce better outcomes. EPR systems in particular are uniquely positioned to capture, store and make available essential knowledge to decision makers at the point of care. Although KM within organisations has been researched over some 20 years (Nonaka, 1994; Davenport and Prusak, 1997), organisations particularly within health still find KM to be difficult and especially struggle when it comes to implementing the plans they have decided upon: KMS implementation is significantly different from implementing other types of system. This case study offers a detailed analysis of how

the business process approach to KM can provide a mechanism for 'doing' KM in healthcare. This achieves our overall goal of understanding better how to implement knowledge management systems effectively in healthcare.

A KMS consists of people, process and technology (Edwards, 2009) interacting together. Process mapping provides the opportunity for hospital Trusts to effectively visualise the structure of organisational care pathways. Crossover of care is a key element of patient care pathways, hence 'thinking process' provides an opportunity to picture individual processes, their connections and links with associated processes and how they fit into the whole care process. A true patient-centred approach to care delivery benefits from the process approach as it places emphasis on 1) The activity of the care process, 2) Where crossovers in care occur, 3) Knowledge demands, and 4) Knowledge sharing for the integration of care.

Our findings also show that regardless of a theoretical awareness of KMS implementation methodologies, the actual execution of such systems requires practice and learning. Flexible and fluid approaches through rehearsal are important. Communications strategies should focus heavily on transparency incorporating both structured and unstructured communication methods.

Although there is substantial literature on the factors associated with the success or failure of information systems in general, the implementation of a KMS particularly in health undoubtedly requires an in depth understanding of the process part of KM theory. Understanding the tensions between the three elements processes, people and technology can provide the key to potential implementation success.

Being a qualitative study, in which we collected data from one hospital where a specific type of KMS (EPR) was implemented, is a limitation of this study. However, this hospital represents a typical NHS hospital, so we see no reason why the results should not be relevant, or transferable, to other UK public hospitals or indeed hospitals globally, according to the similarity of the context. In order to confirm the results from this study and to generalise the findings to other hospitals, a larger-scale comparative study using a representative sample of public and private hospitals would be desirable. The five propositions at the end of the previous section serve as hypotheses that could be tested in such a study,

**REFERENCES**


ALAVI, M. & LEIDNER, D. E. (1999) Knowledge management systems: issues, challenges, and benefits. *Communication for the Association for Information Systems,* **1(2es),** 1.

ALAVI, M. & LEIDNER, D. E. (2001) Review: knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly,* **25,** 107-136.

ALAVI, M. & TIWANA, A. (2002) Knowledge integration in virtual teams: The potential role of KMS. *Journal of the American Society for Information Science and Technology,* **53(12),** 1029-1037.

BARCELO-VALENZUELA, M., SANCHEZ-SCHMITZ, G., PEREZ-SOLTERO, A., RUBIO, F. M. & PALMA, J. (2008) Defining the problem: key element for the success of knowledge management. *Knowledge Management Research & Practice,* **6(4),** 322-333.

BATALDEN, P. & SPLAINE, M. (2002) What will it take to lead the continual improvement and innovation of health care in the twenty-first century. *Quality Management in Health Care,* **11(1),** 45-54.

BEER, S. (1985) *Diagnosing the System for Organisations,* Wiley, Chichester.

BERG, M. & TOUSSAINT, P. (2003) The mantra of modeling and the forgotten powers of paper: a sociotechnical view on the development of process-oriented ICT in health care. *International Journal of Medical Informatics,* **69(2-3),** 223-234.

BOU, E. & SAUQUET, A. (2004) Reflecting on quality practices through knowledge management theory: uncovering grey zones and new possibilities of process manuals, flowcharts and procedures. *Knowledge Management Research & Practice,* **2(1),** 35-47.

BRAGANZA, A. (2001) Knowledge (mis)management…and how to avoid it. Presented at *Information Management 2001*, Olympia, London, 1st-2nd November.

BROECHNER, J. & BADENFELT, U. (2011) Changes and change management in construction and IT projects. *Automation in Construction,* **20(7),** 767-775.

CARLUCCI, D., MARR, B. & SCHIUMA, G. (2004) The knowledge value chain: How intellectual capital impacts on business performance. *International Journal of Technology Management,* **27(6/7),** 575-590.

CEGARRA-NAVARRO, J. & CEPEDA-CARRION, G. (2010) How to implement a knowledge management program in hospital-in-the-home units. *Leadership in Health Services,* **23(1),** 45-56.

CHALMETA, R. & GRANGEL, R. (2008) Methodology for the implementation of knowledge management systems. *Journal of the American Society for Information Science and Technology,* **59(5),** 742-755.

CHUA, A. & LAM, W. (2005) Why KM projects fail: a multi-case analysis. *Journal of Knowledge Management,* **9(3),** 6-17.

CRESWELL, J. W. (2007) *Qualitative Inquiry and Research Design: Choosing Among Five Approaches,* Sage Publications, Thousand Oaks, CA.

DAVENPORT, T., DE LONG, D. W. & BEERS, M. C. (1998) Successful Knowledge Management Projects. *Sloan Management Review* **39(2),** 43-57.

DAVENPORT, T. H. & GLASER, J. (2002) Just-in-Time Delivery Comes to Knowledge Management. *Harvard Business Review,* **80(7),** 107-111.

DAVENPORT, T. H. & PRUSAK, L. (1997) *Information ecology : mastering the information and knowledge environment,* Oxford University Press, New York.

DESOUZA, K. C. (2002) Knowledge management in hospitals: a process oriented view and staged look at managerial issues. *International Journal of Healthcare Technology and Management* **4(6),** 468-497.

EARL, M. (2001) Knowledge management strategies: toward a taxonomy. *Journal of Management Information Systems,* **18,** 215-233.

EARL, M. J. (1994) The new and the old of business process redesign. *The Journal of Strategic Information Systems,* **3(1),** 5-22.

EDWARDS, J., S & KIDD, J. B. (2003) Knowledge Management sans Frontieres. *The Journal of the Operational Research Society,* **54(2),** 130-139.

EDWARDS, J. S. (2009) Business processes and knowledge management. In *Encyclopedia of Information Science and Technology* (KHOSROW-POUR, M., Ed), pp 471-476. IGI Global, Hershey, PA.

EDWARDS, J. S. (2011) A process view of knowledge management: it ain't what you do, it's the way that you do it. *Electronic Journal of Knowledge Management,* **9(4),** 297-306.

EDWARDS, J. S., HALL, M. J. & SHAW, D. (2005) Proposing a systems vision of knowledge management in emergency care. *Journal of the Operational Research Society,* **56(2),** 180-192.

EISENHARDT, K. M. (1989) Building Theories from Case Study Research. *Academy of Management Review,* **14(4),** 532-550.

FAHEY, D. & BURBRIDGE, G. (2008) Application of diffusion of innovations models in hospital knowledge management systems: lessons to be learned in complex organizations. *Hospital Topics,* **86(2),** 21-31.

GALLUPE, R. B. (2000) Knowledge Management Systems: Surveying the Landscape. *Framework Paper 04 - Queen's University at Kingston, October 2000*.

GASTALDI, L., LETTIERI, E., CORSO, M. & MASELLA, C. (2012) Performance improvement in hospitals: leveraging on knowledge asset dynamics through the introduction of an electronic medical record. *Measuring Business Excellence,* **16(4),** 14-30.

GHOSH, B. & SCOTT, J. E. (2007) Effective Knowledge Management Systems for a Clinical Nursing Setting. *Information Systems Management* **24(1),** 73-84.

GROVER, V. & DAVENPORT, T. H. (2001) General perspectives on knowledge management: fostering a research agenda. *Journal of Management Information Systems,* **18,** 5-21.

HAMMER, M. (1990) Re-engineering Work: Don't Automate, Obliterate. *Harvard Business Review,* **68(4 (July/August)),** 104-112.

HANSEN, M. T., NOHRIA, N. & TIERNEY, T. (1999) What's your strategy for managing knowledge? *Harvard Business Review,* **77(2),** 106-116.

KAUTZ, K. (2011) Investigating the design process: participatory design in agile software development. *Information Technology & People,* **24(3),** 217-235.

KWAN, M. M. & BALASUBRAMANIAN, P. (2003) Process-oriented knowledge management: a case study. *Journal of the Operational Research Society,* **54(2),** 204-211.

MAIER, R. (ed.) (2007) *Knowledge Management Systems - Information and Communication Technologies for Knowledge Management,* Springer, Berlin Heidelberg New York.

MAIER, R. & REMUS, U. (2003) Implementing process-oriented knowledge management strategies. *Journal of Knowledge Management,* **7(4),** 62-74.

MARCHAND, D., KETTINGER, W. & ROLLINS, J. (eds.) (2001) *Making the Invisible Visible: How Companies Win with the Right Information, People and IT.,* John Wiley and Sons, Chichester.

MCNULTY, T. (2002) Reengineering as Knowledge Management: A Case of Change in UK Healthcare. *Management Learning,* **33(4),** 439-458.

MEI, Y. M., LEE, S. T. & AL-HAWAMDEH, S. (2004) Formulating a communication strategy for effective knowledge sharing. *Journal of Information Science,* **30(1),** 12-22.

MILLET, P.-A., SCHMITT, P. & BOTTA-GENOULAZ, V. (2009) The SCOR model for the alignment of business processes and information systems. *Enterprise Information Systems,* **3(4),** 393-407.

MOTELEB, A. A. & WOODMAN, M. (2007) "Notions of Knowledge Management Systems: a Gap Analysis". *The Electronic Journal of Knowledge Management,* **5(1),** 55-62.

NONAKA, I. (1994) A Dynamic Theory of Organizational Knowledge Creation. *Organization Science,* **5(1),** 14-37.

PEDERSEN, M. K. & LARSEN, M. H. (2001) Distributed knowledge management based on product state models — the case of decision support in health care administration *Decision Support Systems,* **31(1),** 139-158

PHILLIPS, E. & PUGH, D. (eds.) (2000) *How To Get A PhD,* Open University Press, Philadelphia, PA.

REUTHE, E. & ALLEE, V. (1999) Knowledge management: Moving the care model from a "snapshot" to a "story". *Health Forum Journal,* **42(3),** 26-28.

ROTHSCHILD, A. S., DIETRICH, L., BALL, M. J., WURTZ, H., FARISH-HUNT, H. & CORTES-COMERER, N. (2005) Leveraging systems thinking to design patient-centered clinical documentation systems. *International Journal of Medical Informatics,* **74(5),** 395-398.

SCHIUMA, G., CARLUCCI, D. & LERRO, A. (2012) Managing knowledge processes for value creation. *VINE: The journal of information and knowledge management systems,* **42(1),** 4-14.

SETIA, P. & PATEL, P. C. (2013) How information systems help create OM capabilities: Consequents and antecedents of operational absorptive capacity. *Journal of Operations Management,* **31(6),** 409-431.

SMITH, H., MCKEEN, J. & SINGH, S. (2010) Creating the KM mindset: why is it so difficult? *Knowledge Management Research & Practice,* **8(2),** 112-120.

TENKASI, R. V. & BOLAND, R. J. (1996) Exploring knowledge diversity in knowledge intensive firms: A new role for information systems. *Journal Of Organizational Change Management,* **9(1),** 79-91.

VAN BEVEREN, J. (2003) Does health care for knowledge management? *Journal of Knowledge Management,* **7(1),** 90-95.

WENGER, E. C., MCDERMOTT, R. & SNYDER, W. M. (2002) *Cultivating Communities of Practice: A guide to managing knowledge,* Harvard Business School Press, Boston, MA.

YIN, R. K. (ed.) (2009) *Case Study Research: Design and Methods,* Sage Publications Ltd, London.