

Migration from Resource Based To Knowledge Based Strategy for e-Health Implementation in Developing Countries

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ABSTRACT This paper investigated how knowledge acquisition and transfer impact on usage of ICT and e-health resources in state hospitals in South Africa. A case study approach was used. Ten participants were purposively selected from five state hospitals in North West Province. Data collected used semi-structured open ended interview questions. Interviewees were asked to tell ICT and e-health tools available in their hospitals and which e-health application was frequently used; how hospitals transfer and store knowledge about ICT or e-health application for workers. Findings revealed that much ICT and e-health infrastructure have been procured for hospitals but usage of these infrastructure by doctors is low due to lack of know how. There is no knowledge management system to support doctors to use ICT and e-health facilities. The research further revealed that ICT and e-health knowledge are transferred from friend to friend through verbal communication. The results led to a proposed Knowledge Based Migration Framework (KBMF) to assist hospitals move from resource-based concept to knowledge-based concept to empower doctors use e-health facilities which are in hospitals.

INTRODUCTION

e-health has been defined as any electronic exchange of health related data collected or analyzed through electronic connectivity to improve the efficiency and effectiveness of healthcare delivery (World Health Organization 2014). The department of health in South Africa has formulated an e-health strategy document to monitor healthcare service delivery and the overall performance of health systems in South African (Department of Health (DOH) 2010). The document explains that effective implementation of the strategy will depend on functional health information systems capable of producing real time information for decision making in hospitals. The government has therefore invested substantial sum of money into the purchases of physical resources (that is, computers, software and internet connectivity) to improve the functionality of the health information system. Although large sums of money have been used to procure these health Information and Communication Technology (ICT) resources, the usage and performance of ICT do not meeting the requirements needed to support business processes of health institutions in South Africa. This renders the healthcare information system incapable of adequately producing data and information needed by health authorities to monitor and evaluate the perfor-

mance of the national health information system (DoH 2010).

The e-health strategy document again places emphasis on Knowledge Management as a workforce tool in South Africa. Knowledge management has been regarded as a key factor in enhancing organizational performance in organizations across the globe (Bordoloi and Islam 2012). The pivotal role of knowledge management is more pronounced in knowledge-intensive organizations such as those involved in research and development, and new product development. However little attention has been paid to knowledge management within the healthcare sector to empower the workers who are expected to use e-health tools placed at their disposal in the hospitals. Knowledge as a resource to improve work performance of health workers cannot be over emphasized but the health authorities concentrate more on ICT equipment and physical infrastructure as the main resource to improve healthcare delivery. It positions the health authority as resource based view proponents. Resource based view (RBV) proponents argue that a firm performance and competitive advantage are end products of resources and capabilities (tools and equipment) which are very specific to a firm and difficult for competitors to copy (Barney 1991). As RBV proponents recognize capabilities and resources as being the main driver for firm's performance and

competitive advantage, it does not recognize knowledge in the same manner that Knowledge based theorist (KBT) recognizes knowledge as a driving force for organizational success. Instead, RBV proponents treat knowledge as a generic resource (Kaplan et al. 2001).

Despite the large sums of money invested in the procurement of ICT equipment and other physical resources to improve healthcare delivery, these resources do not meet the requirements to support the business processes of the hospital to deliver quality healthcare services to the citizens.

Objective

Therefore the objective of this paper is to evaluate how knowledge acquisition and transfer impact on the usage of ICT and e-health resources in the hospitals. Based on the findings, the researcher will propose a knowledge based Migration framework (KBMF) to aid efficient use of ICT and e-health tools which have been deployed in hospitals in South Africa to improve healthcare delivery.

The remaining section of the paper is structured as follows, related works, methods, findings, analysis and framework and, finally the conclusion.

Related Work

Knowledge based theorist consider knowledge as the most important resource of a firm. It argues that knowledge is unique to a firm hence it is difficult to imitate. The theory argues that knowledge is embedded and carried through multiple entities within the organization such as organizational culture and identity, policies, routines, documents, systems and employees, (Grant 1996). This theory builds and extends on the resource-based view (RBV) of the firm which has its roots in strategic management, (Alavi and Leidner 2001).

RBV argues that a firm performance and competitive advantage are end products of resources and capabilities which are very specific to a firm and difficult for competitors to copy, (Barney 1991). While RBV recognizes capabilities and resources as being the main driver for firm's performance and competitive advantage, it does not recognize knowledge in the same manner that KBT recognizes it, instead, RBV treat knowledge as a generic resource (Kaplan et al. 2001).

According to Pemberton and Stonehouse (2000), the success of KBT is governed by the organizational capabilities in creating new knowledge-based. Organizational Knowledge Creation Theory (OKC), emphasizes that knowledge is created through a continuous dialogue between tacit and explicit knowledge through four patterns of interaction which are; socialization, internalization, externalization and combination. OKC further argues that knowledge creation takes place when all four modes of knowledge conversion form a continual cycle triggered by actions such as dialogues, team interaction, metaphors, documentation, coordination, experimentation and learning by doing (Nonaka 1994). In problem solving, organizations develop and apply new knowledge and thus, new knowledge is developed in problem solving, (Nonaka and Teece 2001). OKC also acknowledges that individual, group, explicit and tacit knowledge is very unique in a sense that each does work others cannot.

Early research suggested that a successful knowledge management effort needs to convert internalized tacit knowledge (Knowledge embodied in individuals) into explicit knowledge (embedded in organizations) in order to share it, but the same effort must also permit individuals to internalize and make personally meaningful any codified knowledge retrieved from the knowledge management effort (Alavi and Leidner 2001).

Subsequent research into knowledge management proposed a model SECI which stands for Socialization, Externalization, Combination, and Internalization (Nonaka and von Krogh 2009). This model considers a spiraling knowledge process interaction between explicit knowledge and tacit knowledge. In this model, knowledge follows a cycle in which implicit knowledge is 'extracted' to become explicit knowledge, and explicit knowledge is re-internalized' into implicit knowledge. An active strategy for creating and managing explicit knowledge is, where individuals strive to explicitly encode their knowledge into a shared knowledge repository, such as a database, as well as retrieving knowledge they need that other individuals have provided to the repository (Ashok 2011). Another strategy to knowledge management involves individuals making knowledge requests of experts associated with a particular subject on an ad hoc basis. In such an instance, expert

individual(s) can provide their insights to the particular person or people (Snowden 2002). This is also commonly known as the Personalization approach to knowledge management (KM).

Information and Communication Technology (ICT) from a KM enabler perspective is the fundamental building block that supports and coordinates knowledge management which among others include database, knowledge platform, performance evaluation management system, and integrated performance support system, etc. (Yeh et al. 2006). One of the main roles of information technology in KM is to accelerate the speed of KM transfer and creation (Carvalho and Ferreira 2001). In other words, in order to ensure the success of bringing in knowledge management, it is crucial to be able to acquire the key enablers (that is, ICT) so as to make it possible to effectively utilize an organization's limited resources, reduce the use of manpower, material, and time, and still be able to achieve the expected results (Yeh et al. 2006).

METHODS

In order to achieve the objectives of this paper, the researcher carried out the study in the North West Province of South Africa. Five governments owned hospitals in the North West Province of South Africa were purposefully selected. These hospitals were selected based on their geographical locations which spans across the entire province. The participants for the study were drawn from the population of doctors in the five hospitals. In describing population, Polit and Beck (2008) indicate that it is the aggregate of cases having a common and designated criterion that is accessible as subjects for a study. A purposive sampling technique was used in selecting the participants. Two doctors from each of these hospitals were selected. The participants were selected by their professions which was relevant to the study. The ten selected doctors volunteered to participate in the study. Data was collected using semi structured open ended interviews. The interviewees represented different roles ranging from specialist doctors to general practitioners. The interviewees were asked to tell in their own words;

1. The ICT and e-health tools available in the hospital and which e-health application he frequently uses in his work process.

2. How he acquired the knowledge of how to use the ICT or the e-health tools in the hospital.
3. How the hospital transfers knowledge about ICT or e-health application to the workers.
4. How knowledge on how ICT and e-health applications are storing

The interviews lasted for one hour with each interviewee and were audio-recorded and transcribed by the researcher. Integrity of data entry from the study was checked by another independent researcher. Transcripts were coded using Wolcott's (1994) method of case study analysis techniques. After the initial coding, an independent researcher and the main researcher met to check the consistency of their respective interpretation of the transcripts and the codes. The researcher then coded the final transcripts, identified the main themes, and traced possible relationships. Some broad categories of themes were identified by searching for patterns in the participants' responses. The different broad categories that were noted are discussed below.

RESULTS AND DISCUSSION

The categories identified were availability of ICT and e-health tools; Knowledge acquisition of ICT and e-health tools; Knowledge transfer and storage of information regarding ICT and e-health application usage. These headings are discussed below.

Availability of ICT and e-health Tools

The ICT access level in relation to its availability, accessibility and usability in this hospital is as follows. The hospital has laptop computers which are available mostly to the administrators of the hospital. There is an average of 46 desktop computers, 45 printers, 3 fax machines and 3 photocopiers in each hospital. The ratio of doctors in each hospital to desktop computers is approximately 2:1. However, this ratio does not represent the utilization of computers as evidenced from the interviews done at the hospital. It was revealed that there were computers in the consultation rooms of the doctors. However, doctors do not use computers in the execution of their daily clinical duties. The non-usage of ICT according to Carvalho and Ferreir (2001) will slow down doctors work activities and

knowledge transfer to other health workers. Again this will impact negatively on the process of acquiring, storing, diffusing and implementing both tacit and explicit knowledge inside and outside the organization's boundaries with the purpose of achieving corporate objectives in a most efficient manner (Magnier-Watanabe and Senoo 2008).

One doctor interviewed stated; *"These computers are difficult to use for my daily work because it consumes my time which I could use to treat a patient."*

This means that even though there are computers in the hospital, they are used for activities which are not directly related to clinical work like e-patient health record keeping, e-consultation, e-prescription or e-referrals. The computers operate on Windows XP. Internet access is available in the hospital but not all the healthcare professional workers have access to the Internet connection. The main purpose of the Internet connection is to link the hospital administrators to the North West Health Department's database where patient demographic information is transferred and stored on a monthly basis. Despite the Internet facility which is available in the hospital, its connectivity is slow and often down at an average of three times per week due to poor electricity supply and broken telephone lines.

There is also a transmission of patient data from the hospitals to a database of the North West Health Department which is done through a Patient Administration and Billing (PAAB) system, which is an e-health solution system available in the hospital. The PAAB system was implemented to support and enhance revenue collection and patient administration by capturing patient personal and geographical information and transmitting this information to the provincial database on a monthly basis. Apart from the PAAB system, the hospitals are planning to install other e-health solution system like e-patient health record, e-consultation, e-prescription and e-referrals system as a government e-health strategy for the North West Province. One of the interviewee said,

"I do not have the slightest Idea how this existing e-health tools work and I do not believe we will know how the new ones will work if they are installed in our hospital"

From the findings, ICT and e-health resources are available in the hospitals but the individ-

ual users do not have the required knowledge to use these tools.

The next section will discuss on Knowledge acquisition of ICT and e-health tools

Knowledge Acquisition on ICT and e-health Tools in the Hospitals

The interviewee expressed that the installation of ICT and e-health tools could help them in the following ways:

- ♦ Save time in recording patient information, diagnosing and treatment of patients;
 - ♦ Decrease time spent in searching for paperwork and patient record;
 - ♦ Protect the confidentiality of patient information; and
 - ♦ Help doctors, nurses and other healthcare professionals to access and capture real-time patient statistics.
- ♦ According to Easterby-Smith and Lyles (2003) knowledge acquisition and management can be enhanced and supported through applications of advance ICT tools to create an infrastructure that support the timing, scope, and efficiency of the underlying knowledge management processes such as creation, storage, retrieval, transfer and application of knowledge. However to acquire the knowhow of how to use these tools will be a great challenge. The interviewee expressed that knowledge on existing e-health tools were acquired from individuals who work with them or sometimes from an outside friend. These individuals or friends transfer this knowledge on voluntary basis and the recipients also acquire it on voluntary basis. The hospitals have no structured organizational means of empowering the doctors to acquire the technical knowhow of using e-health tools. Knowledge about ICT and e-health tools are acquired from one person to person. This according to Alavi and Leidner (2001) is termed tacit to tacit knowledge transfer and takes place on socialization platform. In order to ensure the success of bringing in knowledge management, it is crucial to be able to acquire and utilize key enablers (that is, ICT) so as to make it possible to effectively utilize an organization's limited resources, reduce the use of manpower, material, and time, and still be able to achieve the expected results (Yeh et al. 2006).

Knowledge Transfer and Storage of Information Regarding ICT and e-health Application Usage

The interviewees indicated that knowledge on how to use ICT facilities and e-health tools are transferred from individual person to the other. There is no repository where expert individuals are encouraged to store their knowledge for future use of employees of the hospital.

One doctor stated “we learn how to use these ICT and e-health tools from our friends and we need a regulated system to do this”

Ashok (2011) states that an active strategy for creating and managing knowledge is, where individuals strive to explicitly encode their knowledge into a shared knowledge repository, such as a database, as well as retrieving knowledge they need that other individuals have provided to the repository. Yu et al. (2007) state that people are the main enabler for executing knowledge management, and then argue that information technology is the fundamental tool for knowledge management due to its role in the transference of experiences within an organization.

From the interviews with the interviewees it was also evident that the doctors do not have the required knowledge to use the ICT and e-health application. Moreover, the few individuals who know how to use the application are

unable to store or share their knowledge in explicit form.

It is therefore recommended that hospitals place much emphasis on empowering the doctors through knowledge acquisition, storage and transfer on how to use ICT facilities and e-health applications rather than equipping the hospitals with ICT and e-health infrastructure. As indicated by Bordoloi and Islam (2012) the ICT infrastructure needs to be used to improve knowledge management as it has been regarded as a key factor in enhancing organizational performance in organizations across the globe

The Need for a Knowledge Based Migration Framework (KBMF)

The KBMF is based on the research findings obtained from the doctors. The framework proposes a strategic way of migrating from resource based view to knowledge based view to improve the usage of e-health applications in the hospitals. Figure 1 illustrates the processes of the KBMF

The KBMF starts with identifying key staff members within the hospital who may use e-health application. A need analysis based on the research findings become the key needs of the doctors which are then tackled through a knowledge management strategy. Supplement

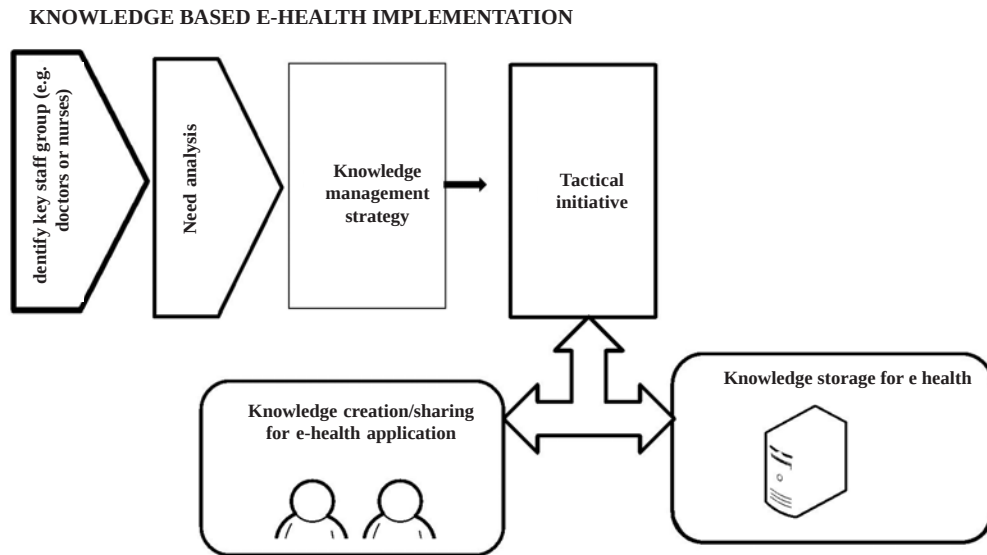


Fig. 1. Knowledge Based Migration Framework (KBMF)

these research findings with input from senior management and organizational strategy documents from the department of health, to determine an overall strategic focus.

The strategic focus will then pave the way to tactical initiatives which specifies the exact knowledge management activities which needs to be implemented. In this instance a knowledge creation and sharing activities for e-health application is required by the doctors. Again knowledge storage for e-health activities is needed.

Knowledge Creation /Sharing Activities

Knowledge is created through a continuous dialogue between tacit and explicit knowledge via four patterns of interactions, socialization, combination, internalization and externalization (Nonaka and von Krogh 2009). Explicit knowledge is codified knowledge transmittable in formal, systematic language whereas tacit knowledge is personalized knowledge that is hard to formalize and communicate and deeply rooted in action, commitment and involvement in context (Halawi et al. 2006) The hospital knowledge creation can takes place when all modes of knowledge conversion form a continual cycle triggered by actions as team interactions, dialogue, metaphors, coordination, documentation, experimentation, and learning by doing. All the modes according to Nonaka and von Krogh (2009) are:

- ♦ Tacit to tacit. Knowledge is passed on through practice, guidance, imitation, and observation.
- ♦ Tacit to explicit. This is deemed as a particularly difficult and often particularly important conversion mechanism. Tacit knowledge is codified into documents, manuals, etc. so that it can spread more easily through the organization. Since tacit knowledge can be virtually impossible to codify, the extent of this knowledge conversion mechanism is debatable. The use of metaphor is cited as an important externalization mechanism.
- ♦ Explicit to explicit. This is the simplest form. Codified knowledge sources (for example, documents) are combined to create new knowledge.
- ♦ Explicit to tacit. As explicit sources are used and learned, the knowledge is internalized, modifying the user's existing tacit knowledge.

Knowledge Storage Tools for e-health

The knowledge created can be stored for new doctors who are deployed to the hospital and can also be used by other health workers in the hospital. The storage process can be done through the use of data warehouse, knowledge warehouse, databases and repositories hosted inside or outside the hospitals.

Data warehouses are the main component of Knowledge management (KM) infrastructure. Hospitals can store data in a number of databases. The data warehousing process extracts and data captured by multiple e-health applications and organize in a way that provides meaningful knowledge to the doctors, which can be accessed for future reference. For example, data warehouses could act as a central storage area for hospitals transaction data.

Knowledge warehouses are another type of data warehouse but which are aimed more at providing qualitative data than the kind of quantitative data which is typical of data warehouses. Knowledge warehouses store the knowledge generated from a wide range of databases including: data warehouses, work processes, news articles, external databases, web pages and people (documents, etc.). Thus, knowledge warehouses are likely to be virtual warehouses where knowledge is dispersed across a number of servers.

Databases and Knowledge bases can be distinguished by the type and characteristics of the data stored. While data in a database has to be represented in explicit form (generally speaking the information can only be extracted as it is stored in the system), the knowledge-based systems *support* generation of knowledge that does not explicitly exist in the database. In this way, the data in knowledge bases can be incomplete, fuzzy, and include a factor of uncertainty.

Data repository is a database used primarily as an information storage facility, with minimal analysis or querying functionality.

CONCLUSION

Having reviewed the ICT and e-health infrastructure resources in South Africa hospital, unpacked the concept of resource based view and knowledge based views, investigated the usage of ICT and e-health applications in the hospitals, it was revealed that much ICT and e-health

infrastructure have been procured for these hospitals but usage of these infrastructure by doctors is very low due to lack of knowledge on how to use the facilities. It was also observed that the hospitals have no knowledge management system in place to support the doctors to use the ICT and e-health facilities.

The research further revealed that ICT and e-health knowledge and skills acquired by doctors and other health workers was tacit knowledge in nature and it is transferred from friend to friend by means of verbal communication. Based on these findings, Knowledge based Migration framework (KBMF) was proposed to move the hospitals from resource based concept to knowledge based concept to assist the doctors use e-health facilities which are in the hospitals. The proposed framework would again provide a systematic creation, transfer, and storage of tacit knowledge to explicit knowledge to improve the usage of ICT and e-health infrastructure resources found in these hospitals hence improving the delivery of health care services by the hospitals.

RECOMMENDATIONS

Based on the findings it is recommended that the proposed KBMF framework be implemented on a pilot scale in the North West Province of South Africa. The pilot implementation should take into account the installation of a broader internet bandwidth to improve internet connectivity and speed.

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