Organization Current Knowledge Design (OCKD): A Knowledge Management Framework for Healthcare Institutions

A.N.Dwivedi[1], R.K. Bali[1], R.N G. Naguib[1]
[1]Biomedical Computing Research Group (BIOCORE), Coventry University, UK

Abstract - **The objective of this paper is to contribute to the existing body of knowledge on the linkages between three multidisciplinary research themes - Healthcare management concepts, Information and Communication Technology (ICT) and Knowledge Management (KM). We introduce Organization Current Knowledge Design (OCKD), a KM framework for Healthcare Institutions (HIs). The OCKD framework is likely to be the first holistic KM framework for HIs which would assist HIs to discover and create new knowledge. We review relevant literature on the need for knowledge management in healthcare and develop theoretical propositions, validated by a pilot case study, to build a conceptual KM Health framework. The conceptual KM Health framework is then validated via sub case analysis and two additional cases, and a final version of the KM framework is presented.**

Keywords – **Knowledge Management, E-healthcare, Information Technology.**

I. INTRODUCTION

Today an average physician spends about 25 percent of his/her time managing information and has to learn 2 million clinical specifics [1]. This is further compounded by the fact that biomedical literature is doubling every 19 years. In the UK, each physician receives about 15 kg of clinical guidelines per annum [2]. The above indicators illustrate how difficult it is for HIs and Healthcare stakeholders (HSs) to successfully meet the healthcare information needs that are growing at an exponential rate.

The impact of the above particularly from a societal perspective is enormous. Up to 98000 patients die every year as a result of preventable medical errors [3]. The financial cost of these preventable medical errors cost from "US $37.6 billion to $50 billion" and, in numerical terms, account for more deaths than from "car accidents, breast cancer or AIDS" [3]. A study has pointed out adverse drug reactions result in more than 770000 injuries and deaths each year [4].

Another study reported in the Harvard Business Review noted that, as early as 1995, there were indications that "more than 5% of patients had adverse reactions to drugs while under medical care; 43% of those inpatient reactions were serious, life threatening, or fatal" [5].

A. IT solutions for Healthcare

Until recently, the focus of IT solutions for healthcare such as data warehousing was on the storage of data in an electronic medium, the prime objective of which was to allow exploitation of this data at a later point in time.

As such, most of the IT applications in healthcare were built to provide support for retrospective information retrieval needs and, in some cases, to analyze the decisions undertaken. In the past, HIs were using IT in a very static manner (i.e. clinical data was traditionally used in a supportive capacity). Due to the problem of information overload HIs are seeking to tackle clinical problems before they arise. Consequently, healthcare industry had been predominantly focused on the technology aspect of healthcare.

Since the 1980's, there has been an emphasis on codified knowledge, i.e. to discover new ways of effectively representing healthcare-related information. Studies have shown that one of the major reasons for Artificial Intelligence (AI) to live up to its expectations was because, as a discipline, AI has totally neglected its philosophical origins. AI has also influenced a significant part of the Bioinformatics and Cybernetics revolution and, as such, it too runs the risk of suffering from the same limitations as AI i.e. 'emphasis on the modellability of knowledge structures, on physical artefacts as representations of knowledge etc' [6].

It is therefore important that clinical knowledge management related research learns from the problems faced by previous technologies (e.g. AI) that occupied the pride of place from funding sponsors thirty years ago.

It has been argued that the key to success of the healthcare sector in the twenty first century is an effective integration of technology with the human based clinical decision-making process [7]. This would allow HIs to decide how best to disseminate the knowledge acquired in a manner that ensures that it is available to other healthcare stakeholders for preventative and operative medical diagnosis and treatment as and when required. This work has considerable utility as healthcare management grows to become a priority area.

B. Knowledge Conversion Methodologies.

There are two separate domains: (1) the Knowledge Engineering (KE) and (2) Knowledge Management (KM) domains, that offer knowledge conversion methodologies [8]. Knowledge Engineering is led by knowledge engineers who support the use of techniques such as Knowledge Discovery in Databases concept (KDD).

The second domain (Knowledge Management) offers knowledge conversion methodologies like Socialization, Externalization, Combination and Internalization (SECI) that are more applicable at offering insights at an abstract level of functioning in organizations [8].

It could be stated that the KE domain focuses on a computing perspective, whilst the KM domain concentrates on the organizational context. What emerges is that knowledge engineers are looking at the knowledge paradigm from a computing angle, and developing frameworks for building knowledge based system development, i.e. a technology based perspective. On the other hand, organizational theorists are looking at this from a behavioral viewpoint (i.e. - a people-based perspective).

This prevailing situation had led to the necessity for the formulation of a new KM Healthcare framework that can combine these two perspectives. It is therefore important to develop a conceptual KM healthcare management framework that encompasses technological, organizational, and managerial perspectives. The unique contribution of this paper is that it outlines the philosophical background as well as a practical case on how to incorporate KM in healthcare by introducing the OCKD KM Healthcare framework.

II. Methodology

This section is a discussion of the research design, process, methodology, and methods for data collection (and their relationship to the aims and objectives) of the research. This methodology used to develop and validate a conceptual KM Healthcare framework is described and justification for its selection is provided. The section also discusses the rationale for selection of the case study protocol.

The research design, guided by a qualitative philosophy, was inductive in nature and used the case study methodology for accomplishing the research objectives (see Fig. 1). A schematic representation of the research process adopted can be seen in Fig. 2. Empirical data was gathered via a main case. The findings from this case, in conjunction with inputs from the literature review, formed an iterative process. The analysis of the collated data resulted in a first level conceptual KM framework for Healthcare organizations. Data was then gathered from sub-cases (24 National Health Service Trusts) that supported the main case study (see Fig. 2). The analysis of this additional data validated the findings obtained. The data obtained from the sub cases lead to a revision of the first conceptual KM framework, leading to a second conceptual KM framework. Data was also collected from two additional case studies to carry out a cross-case analysis (see Fig. 2). This ultimately resulted in a revised (and final) KM-Healthcare framework, complemented by a User Guide which included a structured "walk-through" for Healthcare institutions (see Fig. 2).

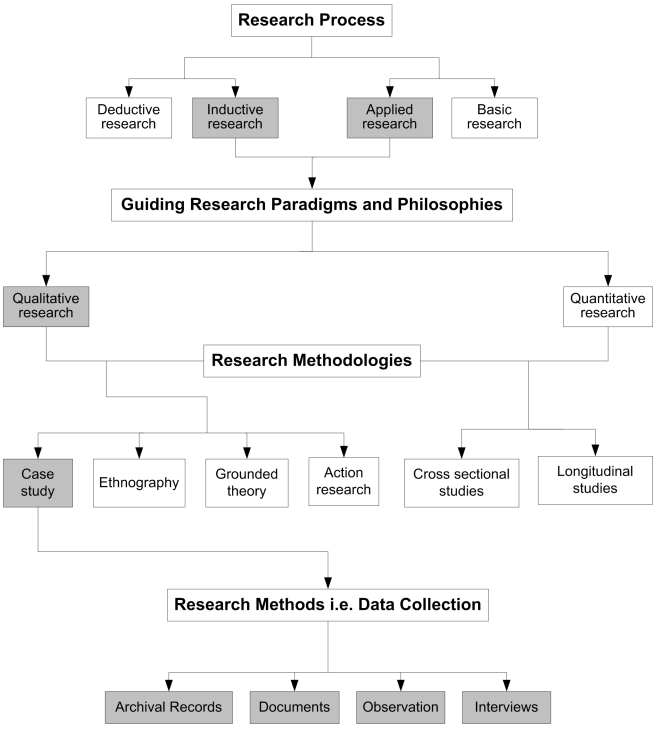

Fig.1 The research design

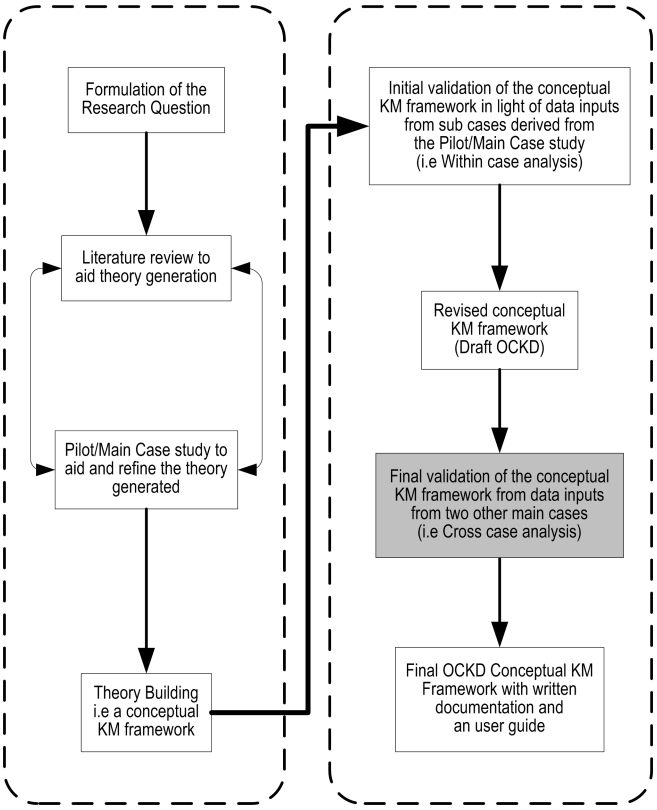

Fig.2 Schematic description of the research process

A. Data Collection Methodology

The research methodology adopted 'triangulated' research methods (i.e. data was gathered from multiple sources so as to ensure adequate exploitation of both quantitative and qualitative data). Both primary and secondary data - relevant and applicable to the collaborating institutions and industry was analyzed to provide empirical evidence in order to create and validate the KM framework.

The case study methodology supported collection of empirical data from multiple sources of data such as documents, archival analysis, observations, and interviews (see Fig. 1). The research, due to its nature focused on the gathering of empirical data that was qualitative in nature. Different data collection methods were adopted, for example secondary data was gathered from literature reviews, existing company documents and data from other researchers formed the theoretical propositions for the main case (see Fig. 1).

The primary data for the main case was collected using semi-structured and unstructured interviews, combined with observation and documents analysis i.e. secondary data within the company such as documents, reports, presentations etc (see Fig. 1 and 2). The data collected from the main case was primarily in the form of company documents and semi-structured interviews. Weekly contact was maintained.

The later stages of the research process (relating to the validation of the conceptual framework) used a combination of primary and secondary empirical data - obtained from the main case and other supporting cases (see Fig. 2). Due caution was exercised whilst gathering empirical data and appropriate case study research tactics were adopted in order to reinforce validity.

III. Results: OCKD-A Novel Healthcare KM Framework

Based upon empirical data from the case studies, the final version of a four layered KM Healthcare framework (OCKD model) could serve as a generic toolkit for HIs who are interested in developing an understanding on how to develop a KM strategy (see Fig. 3 and 4). As one "peels" away one layer, another layer emerges, finally revealing the organizational core competencies.

The first step (Layer 1 in Fig. 3) in formulating a KM strategy involves the identification of the core competencies of an HI. This process will enable an HI to be clear about its MOST (mission, objectives, strategy, and tactics). It would also allow it to notice how its MOST in context to its EIC (economic, industry and company) outlook is aligned with its organizational core competencies.

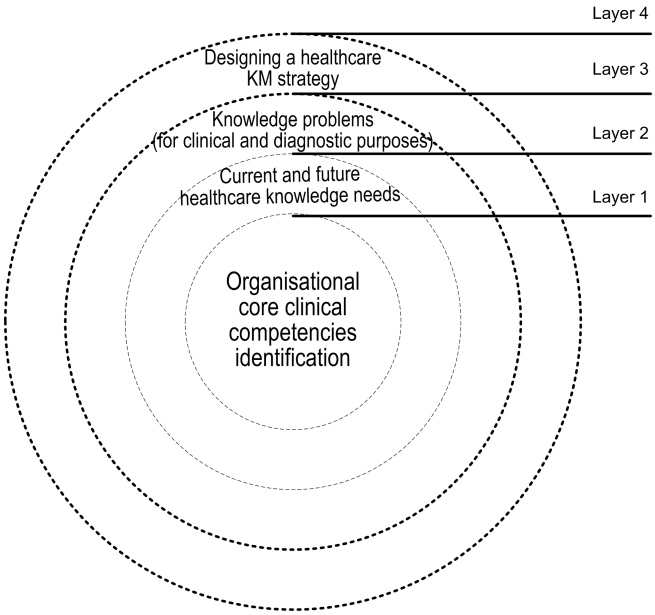

Fig 3 Multiple-layered perspective of the OCKD Framework

The next step would be a study to identify the HI's current and future knowledge needs (Layer 2 in Fig. 3). This would call for an analysis of the current technological infrastructure (i.e. support for m-health applications) in place for supporting knowledge transfer. After this process, an HI will need to assess how much knowledge should and could be codified (see Layer 3 in Fig. 3 and Fig. 4).

This stage will result in the decision to adopt a KM strategy with emphasis on either personalization or codification. Irrespective of the strategy adopted, HIs would have to be clear upon what constitutes best clinical innovative practices. This to some extent will help in capturing the tacit knowledge of clinical specialists. At the top layer (Layer 4 in Fig. 3), an HI has a KM strategy. Each HI can either adopt a KM strategy which has emphasis either on the tacit knowledge that resides in its resources or on a KM strategy that emphasis the organizational processes (the codification strategy). If a decision is taken to adopt a codification-led KM strategy, decisions regarding taxonomy have to be taken (e.g. whether to adopt Natural Language Processing, Artificial Intelligence and/or Neural Networks).

This leads to the identification of relationships that exist between different types of knowledge (tacit or explicit) being transferred and to dissemination practices. This then results in a spiral transfer between the processes marked with the broken arrow signs (see Fig. 4). Finally the findings (knowledge identified/created) are then modelled in a knowledge repository and disseminated via an appropriate KM delivery platform (e.g. Lotus-Notes).

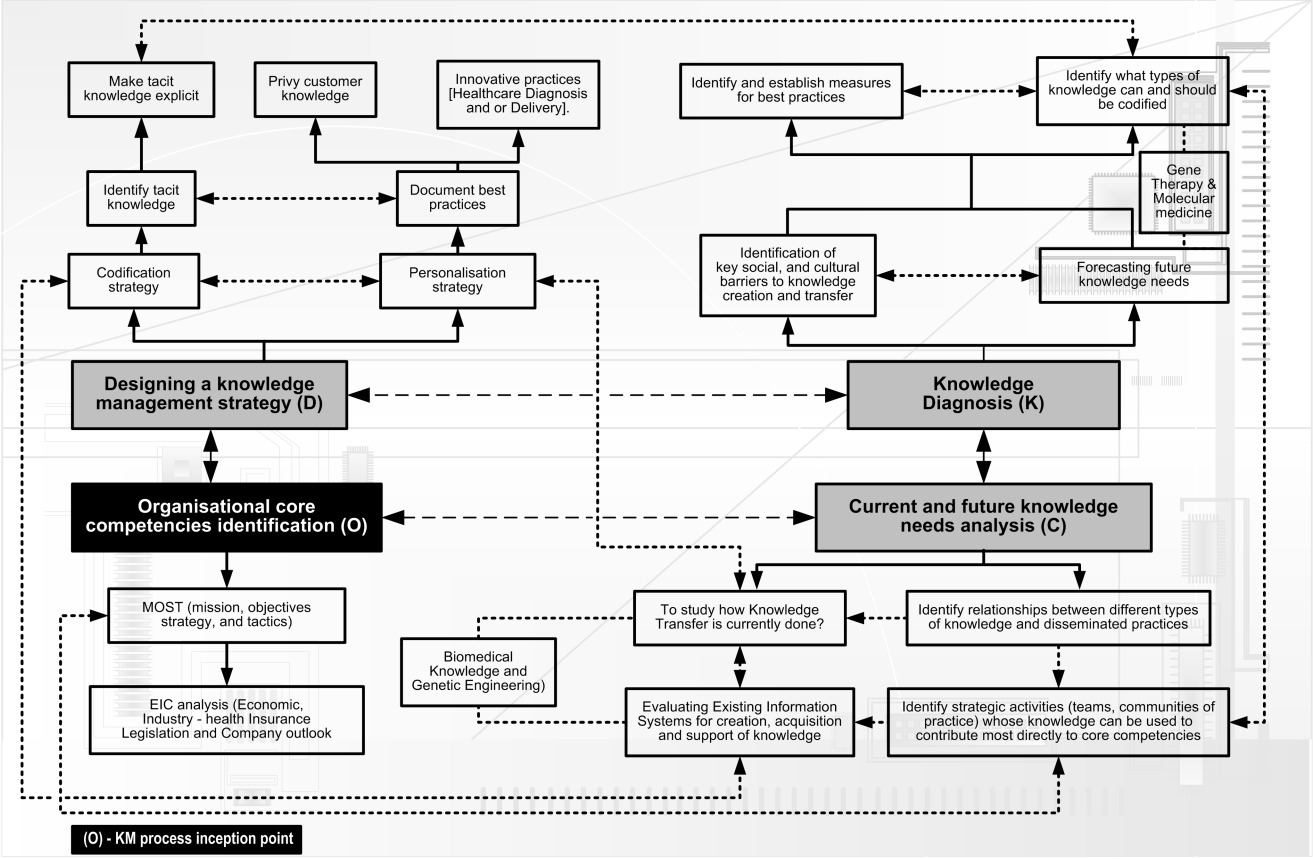

Fig 4. Final version of the OCKD KM-Healthcare framework is presented

IV. Conclusion

This research provides the healthcare industry with its first ever practical KM Healthcare framework that transforms the conceptual ideas of KM into a customizable working program with defined objectives, using existing industry techniques. The OCKD framework also supports the designing, building, and maintenance of a knowledge-sharing platform both from an IT and organizational perspective.

The primary benefits that HIs can realize from the adoption of the OCKD KM-Healthcare framework include: (1) formulation of knowledge sharing platforms that allows retention of critical knowledge such as background knowledge of the overall healthcare process, (2) creation of a knowledge-sharing culture and (3) identification and improvement of knowledge relationships between different stakeholders and key systems involved in the healthcare process.

Since the findings shown here are based on cases of HIs within the UK, the future directions include generalization of the findings by studying additional HIs in the US and Australia.

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