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A Case Study of Al-Shifa: A Healthcare Information System in Oman

Khamis Al-Gharbi, Said M. Gattoufi, Ali H. Al-Badi, Ali Al-Hashmi

***Abstract*—**The case study presents the progression of a project management of Al-Shifa, a healthcare information system in Oman. The case study describes the evolution of the implementation of a healthcare information system tailored to meet the needs of the healthcare units under the supervision of the Ministry of Health (MOH) in Oman. A focus group methodology was used for collecting the relevant information from the main project's stakeholders. In addition reports about the project made available for the researchers. The case analysis is made based on the Project Management approach developed by the Project Management Institute (PMI). The main finding that there was no formal project management approach adopted by the MOH for the development and implementation of the herewith mentioned healthcare information system project. Furthermore, the project had suffered a scope creep in terms of features, cost and time-schedule. The recommendations of the authors, for the rescue of the project from its current dilemma, consist of technological, administrative and human resources development actions.

***Keywords*—**Al-Shifa, Information system, Healthcare, Oman, Project Management.

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I. Introduction

A healthcare information system (HIS) can be defined as a comprehensive integrated information system designed to manage the operations of a hospital or a network of healthcare units, such as medical, administrative, financial, legal and the corresponding services processing.

The implementation of such a sophisticated system is usually costly in terms of resources and time. The HIS systems require, due to their critical role and the sensitivity of information they handle, fast, secure, reliable, data integrity, and a very limited down time locally and over all the network of units interconnected by the system and exchanging data instantaneously in a way to make them fully integrated.

HIS management is meant to improve the quality of hospital administration and patient healthcare and reducing the cost of delivering these services to their customers, in addition of being a patients and diseases data warehouse where it can be utilized for statistical and decision making by researchers and administrators. This study analyses the process of the gradual implementation of a healthcare system developed by the Ministry of Health in Oman toward a national unified healthcare system management in the country.

Khamis Al-Gharbi is Assistant Dean with the Information Systems Department, Sultan Qaboos University, Oman (e-mail:algharbi@squ.edu.om).

Said M. Gattoufi is with the College of Economics and Political Science, Sultan Qaboos University, Oman (e-mail: algattoufi@gmail.com).

Ali H. Al-Badi is the HOD of the Information Systems Department, Sultan Qaboos University, Oman (email: aalbadi@squ.edu.om).

Ali Al-Hashmi is with the Sultan Qaboos University Hospital, Oman (e-mail: hashmi@squ.edu.om).

II. Information Systems in Healthcare: A Literature Survey

Healthcare systems were among the early adopter of ICT in general and particularly MIS. The claimed success encouraged decision makers and application developers to go even further in suggesting more advanced approaches to handle the healthcare activities benefiting from the spectacular developments in ICT. The international Telecommunications Union already published guidance and principles for e-Health in developing countries [1]. The Social, ethical and legal barriers to E-health were discussed in [2]. Many countries are developing their national-wide interconnected healthcare units network and Oman is planning for its national healthcare centralized information system, an e-health depository, serving different parts involved in the healthcare affairs in the country. The existing literature is echoing this success which is registered mainly in developed countries.

The existing literature underlines the main elements contributing to the debatable successes in implementing healthcare information systems. Recognizing that the realization of Health Information Systems (HIS) requires rigorous evaluation that addresses technology, human and organization issues, Yusof et al. [3] provides a framework for such an evaluation method for different of HIS. Their main findings show that having the right user attitude and skills together with good leadership, IT-friendly environment and good communication can have positive influence on the system adoption and the success of its implementation.

However, though this adoption registered some success in reducing the time for accessing the files and organizing the healthcare activities in healthcare units in many countries helping in eradicating many diseases, there is still a debate and doubt about this success in developing countries mainly due to the cost and the lack of adequate infrastructure. The successes or failures are themselves debatable since their definition varies in the literature. Berg [4] discusses the meanings of success and failure in HIS implementation and identifies the success factors as well as the failure factors of such an implementation, presenting alternative insights illustrated with concrete examples.

Oak [5] claims that, at the present, the infrastructure of health information remain inadequate to meet the increasing demand of rising population. Poverty and technological implementations are major barriers in the lesser-developed countries. Healthcare can be transformed and health status of population improved by eliminating barriers and

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implementing health informatics in developing countries. Discussing the challenges of health information systems in developing countries, Kimaro and Nhampossa [6] stressed the scarcity of funds needed for the implementation of sustainable HIS in developing countries because they are mainly funded by foreign donations. The doubtful issue of such projects is due to the fact that inadequate donor support often contributes to weakening rather than strengthening human resource capacity and effective system design, since it emphasizes the technology itself in the expense of the needs of the users. These factors contribute to the design and implementation of unsustainable health information systems (HIS) in developing countries. Berg [4] emphasizes that successfully implementing patient care information systems (PCIS) in healthcare organizations appears to be a difficult task.

From another perspective, it is important to mention as stated by Southon [7] that Organizational issues are key factors in the effective use of information technology (IT) in healthcare and particularly in complex organizations. The author analyses the failure of a large IT system selected by a major state public health service for state-wide implementation in Australia, confirming that the implementation of a healthcare system is not just a technical issue. The system selected was well proven overseas, was implemented through a pilot process, and yet was withdrawn because it did not meet requirements. The issues which are dealt-with include the nature of the organization and its interaction with the implementation strategy, the nature of decision-making, the contrast between the incentives and perspectives at different levels, ownership of the program, management of skills and the impact of instability and complexity. The paper demonstrates that the environment of large complex distributed organizations introduces a complex of issues that are not normally considered in implementation strategy Bush et al. [8] outlined that the alignment of information systems with organizational objectives and strategies is a key, contemporary challenge to organizations in general and the healthcare industry in particular. Their study contributes by confirming that alignment is a significant issue in healthcare organizations, and that such organizations make deliberate efforts to achieve it. The study further contributes by providing tables of actions and characteristics that managers might use as checklists in current and future alignment efforts as well as in generally cultivating broad support for alignment. Finally, it contributes by suggesting future study of alignment's predictors and effects in healthcare organizations.

In addition to the strategic considerations that may ruin the implementation, a well-studied and defined technical approach is crucial for the success of the implementation of a HIS. Aarts et al. [9] present a model that describes the stages of the implementation of an information system in a healthcare organization. The model offers no explanation of the implementation process but rather describes in a cyclic order the domains that are relevant when implementing a system. The model offers thus an opportunity to identify gaps in our knowledge and understanding of implementation processes and provides also the conceptual basis for a higher education course of health informatics that is focusing on organizational change and the pivotal role of information and communication technology.

The existing literature is unanimous about the difficulties and challenges that face the adoption and implementation of a HIS. The many failure cases exemplify the challenges faced in this regards. The existing literature analyses the reasons and factors of success and failure of the implementation extensively.

This study presents a genuine framework in analyzing the implementation of a HIS in the Sultanate of Oman by discussing the managerial approach adopted for the management of this implementation as a "project", by considering the project management approach suggested by the Project Management Institute (PMI) as a reference for the project management. To the best of the authors' knowledge there is no similar work in the literature related to HIS and its implementation.

III. Methodology

The case study is often associated with descriptive and exploratory researches, in order to understand a phenomenon and possibly for theory building by generalizing the results and conclusion made out of the case study. Robson [10] defines a case study as an empirical investigation of a particular phenomenon within its real life context using multiple sources of evidences. Case study has the ability to answer the "Why", "How", and "What" questions, as stated by Saunders et al. [11].

For this case study, the focus group methodology is adopted. The basic principles of focus group methodology have been suggested and are subsequently refined in [12]-[16]. The participants in the focus group are a homogeneous group of people who are asked to reflect on a series of questions posed by the interviewers. The interviewed participants hear other people's responses about which they make their personal comments, in addition to their personal point of view based on their knowledge about the issue or subject analyzed. The aim of the focus group method is to obtain accurate data on a specific issue within a social context. The methodology is particularly useful in a cross-cultural work, as claimed by Hughes and Dumont [17] and Naish et al. [18]. The healthcare system in Oman, with a much diversified staff, is a multi-cultural system and hence the focus group methodology is appropriate. Furthermore, due to the fact that the project was lasting for over Ten years, many of the early contributors are not anymore involved; the authors were constrained to rely mainly on the documents available and the interviewees who are among the rare experts involved in the project from its inception. The authors summarize, analyze and comment the information gathered from the officials (interviewees) and the provided documents. In addition, one of the researchers is an expert in HIS as he is working as head of SQU HIS for many years and recently promoted to SQU HIS specialist.

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IV. Information System in Healthcare in Oman

A. Case Background

The healthcare system in the Sultanate of Oman witnessed an impressive development during the last thirty years benefiting from the strategic orientation giving high priority to the development of the healthcare and the education sectors as well as the infrastructure, considered as the main pillars for a sustainable development boosted by the increasingly important national incomes generated by the continuous amelioration of oil and gas prices.

The Ministry of Health (MOH) is the main provider of healthcare services in Oman, in addition to a private healthcare system witnessing an impressive growth and development in size and quality of services provided. Our focus will be on the National healthcare system, which remains the major healthcare services provider in the Sultanate.

The interviewees confirm that the first initiative toward the adoption of information technology in public healthcare goes back to 1987, encouraged by a pioneering initiative undertaken by Royal Hospital, while Sultan Qaboos University built their system later. Believing in the benefits of the adoption of Information Technology (IT), and in line with the general global and local trends toward benefiting from the spectacular technological developments in IT, the MOH initiated a project for shifting toward an IT based healthcare information system management. However, there was neither clear vision for the project, nor a predefined strategy with well-defined objectives. This led to a long incubation period for the project, worsened by a debate about whether to adopt an existing system and work on its transformation to fit the needs of the ministry or develop a dedicated original system tailored for the needs of the MOH.

MOH adopted the option of developing their own tailored system for healthcare management, despite the advices of the International Health Organization, owning its already real world proven system by that time, recommending to implement their system instead and avoid 'reinventing the wheel'. The project was initiated in 1994 with the development of a pilot standalone system for the management of healthcare services at a primary healthcare center of Wadi Al-Jahawer, Wilayat Al-Suwaiq. The choice of a small and remote healthcare center for the pilot project was justified by the minimization of resistance to change, according our interviewees. Three years were needed to develop a system judged suitable to be implemented at a larger scale. The pilot project has led to the development of a standalone primary healthcare services management system tailored for those centers under the supervision of MOH. The adoption of the system became mandatory for all new centers created after 1999 and a decision was made to equip all existing centers for the adoption of the computerized healthcare services management system.

A decision was also made in 1997 to implement the secondary level in Nizwa and Sohar hospitals in 1998 followed by implementations two system at the tertiary level in Khawla and Royal hospitals in 2006. Unlike the implementation at the primary level that was a duplication of the pilot implementation, these were crucial steps in the project in the sense that they exposed the system at a large scale to the different parts involved in and by this pioneering computerized healthcare services management system, including patients, medical staff and IT technical support staff working on the development and the management of the system. Moreover, it was a divergence point in the sense that subsequent developments required by each unit was not synchronized with the others due to deep differences in characteristics partly dictated by the differences in clinical specializations.

Subsequent developments benefited from the feedback provided by different stakeholders of the project among the public healthcare services management decision makers, initially resistant to the shift toward a computerized management system, claiming that it is just a drift generated by the fashionable blind adoption of IT in management. This was in part supported by the relatively high cost of the adoption and implementation of the new system.

By 2004, an initial vision for the project was finally stated and a well-defined strategy with clear objectives was developed. The project was for the first time labelled Al-Shifa and it was stated that it consists in developing a national unified management information system for the public healthcare services provided by the units under the supervision of MOH, at their different levels, complying with technical and quality international standards. There was at that time two separate standalone systems implemented. The first one, implemented at the primary level, was the standard pilot system running at primary healthcare units. The second system, implemented at secondary and tertiary levels, was having a unified core module with additional specific modules developed based on specific requests of the healthcare units dictated by their different specific clinical specialization.

The project output was ripe in 2008 to produce a unified system, called Al-Shifa 3plus, as a result of the merger of the two formerly described implemented systems. The interviewees claim that this ultimate development was a revamp for the system. Technically, the system is fully integrated allowing the data transfer between the units, cutting with the clustering nature of the previous versions, according to our interviewees. However, to date, the full integration is not activated due to many considerations discussed in the following section.

B. Current Status of the System

MOH claims that it has a comprehensive healthcare services management system (Al-Shifa 3plus) automating most processes of healthcare delivery in MOH hospitals and health centers to the extent of almost making them paperless. There are currently 200+ public healthcare institutes adopting this system across the Sultanate, making around 85% of public healthcare seekers in Oman benefiting from the system services. This “large success” encouraged the decision makers at the non-MOH, governmental healthcare providers to adopt

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the system.

V. Case Analysis and Discussion

The framework the authors uses for the discussion and analysis is the one defined by the PMI as standard approach for the project management in general and for the IT project management in particular. According to these standards, the project management has five phases and uses 9 knowledge areas for a proper project management. The five phases are introduced in Marchewka [19] as an Information Technology Project Methodology (ITPM) and are inspired from the PMBOK standards published by the PMI [20]. These phases are conceptualize and initialize the project; develop the project plan and charter; execute; control the project and finally close and evaluate the project. The output of the first phase is the clear definition of the project goals. According to Marchewka [19] the project goal determines and influences the other phases throughout the project life cycle. The project scope (the work that has to be done) as well as the success of the project at completion. Furthermore, the goal of the project must be verifiable and measurable and must be aligned with the organization's mission, vision, strategy and goals [19].

A. Comments on the Initiating Processes

The initiating process consists of the main tasks of preparing a business case to convince the stakeholders, mainly those involved in funding the project, about the feasibility as well as its viability and profitability. Once the stakeholders are identified and convinced and the stakeholder analysis matrix is developed, the next step is to create the project charter, the document that proves the commitment of the stakeholders and their engagement to fund the project. One the project charter is signed, a kick-off meeting is organized to give the formal starting of the project. The set of documents produced by the initiating process defines the project and its constraints, identifies its stakeholders and assesses their importance, in terms of power and interest, for the project and documents the formal engagement for the project funding by its sponsors.

As explained by the interviewees, the idea of adopting IT in the management of public healthcare was rather echoing the general global trend prevailing in the early eighties of the last century. There were no preliminary studies about the readiness of the current system for the changer neither a predefined plan for it. It was just an automation of the manual system without any restructuring or processes reengineering. There was no formal business case to explain the project and justify the need for it. There was in fact no clear definition for the project.

It was just an initiative with unknown scope and without well-defined stakeholders. Hence, the authors believe that there was no formal initiating process as defined by the PMI approach for project management.

B. Comments on the Planning Processes

As explained in Schwalbe [21], planning is often the most difficult and unappreciated process in project management. Often, people do not want to take the time to plan well, but theory and practice show that good planning is crucial to good execution. The outputs produced by the planning processes consists of those related with the scope management, the time management, cost management, quality management, human resource management, communications management, risk management, and finally those related with procurement management. The details about these outputs are documented in the PMBOK [20], considered for the formal certifications offered by the PMI starting July 2013.

Though some of tasks defined by the PMI approach were made by the team managing the project of the creation of an information system for public healthcare in Oman, there was no formal and documented approach serving as reference for the management team. The interviewees recognized that there was no clear vision about the project. The initiative was undertaken without predefined specific goals or objectives. Hence the project was vaguely defined without any information about the three constraints, namely time, scope and cost.

However, there was a specific task with a specific objective, without limitations in time or cost: developing a prototype. The task consists of producing an information system able to automate the manual system at a primary healthcare centre in a remote region. The authors believe that this was a dramatic simplification of what was really needed for the public healthcare in Oman. The interviewees recognize that the decision makers at the MOH were aware about the system developed by the World Health Organization (WHO), but they declined their offer to implement their system for the MOH. The decision was made to develop an in-house system, claiming that it will be able to incorporate the specific features of the Omani public healthcare system.

As final comments, the authors understand that there was no formal planning as advised by the PMI approach for project management since there was no predefined time frame for the project, no clear scope and no well-defined cost for the project. Hence, the main elements of a proper planning for a viable and successful project were missing, as the authors conclude from the discussion with the interviewees.

C. Comments on the Executing Processes

Project execution is the most noticed group of processes in the project management. Schwalbe [21] reports researches showing that the main reason CEOs failed was poor execution; the same is true for project managers. Moreover, the majority of a project's time and budget is spent on project execution in general. Though many of the tasks and outputs created in the other process groups are fairly similar from project to project, but no two projects are ever executed in the exact same way due to uncertainties and unique challenges.

The documents available for the authors and the discussion with the interviewees did not provide much information about the technical details of the executing processes. However, it provides details about the different phases into which the project undergone.

The authors consider that the executing process was triggered by ordering an in-house prototype of a healthcare information system meant to automate the operations at a

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remote healthcare centre with a very limited number of activities and only outpatients. The ongoing executing process lasted for thirteen years so far.

Based on the information provided by interviewees (verbally) and the documents they provided, the authors noticed the long period needed to develop the prototype and its approval for implementation. However, the authors understand that the delay might be due to bureaucratic matters. This was worsened by the absence of an empowered dedicated body in charge of IT at the MOH. Moreover, the resistance to change and the lack of skilled professionals as well as the absence of a clear vision about the future of IT has certainly contributed to delaying the development and the implementation of the pilot project.

As a matter of fact, the milestone decision of generalizing the pilot project was made in 1997 without any study about the readiness of the healthcare information system to shift from manual to an automated management system. This has certainly affected the executing process since there was no clear assessment about the required resources. Hence, the executing process was triggered without a clear estimation neither of the cost nor the time frame. It was rather managed with the "kick the ball ahead" like strategy. That's why, its scope kept expanding showing a chronic scope creep.

D. Comments on the Monitoring and Controlling Processes

Monitoring and controlling involves regularly measuring progress to ensure that the project is meeting its objectives and addressing current business needs. The project manager and other staff monitor progress against plans and take corrective actions when necessary.

The authors had no access to the details about the monitoring and controlling processes documentation. However, they understood from the interviewees that the approach adopted by the project management supervision team was purely technical dealing with fuzzy goals and scope that were continuously changing. Even if the existence of a defined scope is admitted, it is obvious that the project suffers from scope creep, that is the tendency for the project scope to grow bigger and bigger. However, there was a net amelioration starting 2006 date at which the vision and the strategy for IT at the MOH were developed. The monitoring became easier, since the objectives were clearly defined.

E. Comments on the Closing Processes

Closing activities for phases and projects involves gaining stakeholder and customer acceptance of the final products and services, and bringing the phase or project to an orderly end.

The closing outputs related to integration management include final products, services, or result transition and updates to organizational process assets. It is also good practice to hold a close-out meeting and hold some type of celebration. The closing outputs related to procurement management include closed procurements and updates to organizational process assets. Helpful advice for closing projects includes planning for closure, documenting lessons learned and other important information as soon as possible, and celebrating project closure.

The authors had no access to the details about the closing processes during the elapsed phases of the project. However, they understood that there was no clear systematic approach to deal with the closing of any phases. The nature of the project, the many overlapping phases and the absence of clear vision and well defined objectives had certainly a large negative effect on the intermediate closing processes. As for the overall project, it is still an open end project.

VI. Challenges and Future Directions

A major challenge is the full integration of the healthcare information system. This full integration is characterized by the full ability of data transfer between the different units adopting Al-Shifa system, a feature currently not enabled, though technically possible, according to the interviewees. The transfer of a patient from one healthcare unit to another for further treatment/specialization and emergency cases is not uncommon between the 200+ healthcare units currently adopting Al-Shifa. However transferring a patient without his/her previous records may generate many risks to the transferred patient. These risks include prolonging the patient cure, worsening the patient illness and duplicating tests which generate unnecessary additional costs, among many other risks.

Several causes are hindering seamless electronic transfer of patients' medical records history between the interlinked 200+ healthcare-units were identified by the authors. The most important among them in their opinions are of three types, one related to the technology used, the second is related to data itself and the third is related to the human resources.

As for the technology, the ‘Client-Server’ technology, around which Al-shifa was built, has become nowadays an obsolete technology compared to the web-based more recent technology. This new technology has proved to be more efficient in information system related applications and particularly for data transfer, though the security issue is a major concern for its adopters. Moreover, the reliability and the speed of ICT infrastructure, especially in the remote areas in the country, is subject of severe concerns. It is not yet ready to properly support the data transfer. Finally, the data transfer security is a burning issue. Al-Hamadani et al. [22] claims that Oman needs to develop the required legislation governing access and use of patient’s data where legal and ethical obligations should be applied in case of violation.

The lack of common standards for the exchange of patients’ data between different health institutions with the MOH and the absence of the use of unique identifications for patients in all health institutions in the MOH constitutes the major administrative barrier toward an efficient integration of the healthcare system in the Sultanate. Moreover, healthcare institutions have worked independently and autonomously as standalone units, having changed over years their own rules, procedures and patient's identification. This led to the fact that different health institutions have different versions of Al-Shifa. Hence, an absence of a national standardization for medical terminology, classification, services, providers, drugs,

patient unique identifications will constitute a major challenge for the e-health system targeted by MOH for the healthcare system in the country.

MOH's vision to overcome the current challenges and to satisfy the future needs of the country through the creation of a National wide e-Health Repository. In order for such vision to be implemented successfully the MOH needs the collaboration of the stakeholders of the project, yet to be clearly identified.

VII. Conclusions and Recommendations

The Case Study describes the progression and the evolution of Al-Shifa, a healthcare information system, tailored to meet the needs of the healthcare units under the supervision of the Ministry of Health (MOH) in Oman. The authors believe that the dilemma the decision makers are facing resides in choosing between keeping Al-Shifa that MOH has invested heavily in the development and implementation, though with an obsolete technology, or shifting to a newer technology based system and sacrifice the very costly developed system. The authors believe that a wise decision would be to immediately stop the very costly ongoing project, and shift to a web based interconnected and integrated system. The current system may continue during the transition period, and what was achieved with this system and the problems it faced will certainly help in reengineering the healthcare management process and redesigning the healthcare information system in the Sultanate.

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