THE GENERIC QUALITY ASSURANCE MODEL (GQAM) FOR SUCCESSFUL E-HEALTH ACQUISITION IN RURAL HOSPITALS

Nkqubela Ruxwana, PhD[1], Marlien Herselman, PhD[2] and Dalenca Pottas, PhD[1]

[1]*Nelson Mandela Metropolitan University, South Africa*
[2]*Nelson Mandela Metropolitan University & Mareka Institute, CSIR, South Africa*

ABSTRACT

The e-health evolution has the potential to aid management of scarce resources and improve quality of services within healthcare. However, their implementation continues to fail. Amongst other reasons, the lack of project quality management is found as a key contributor to the failure of e-health solutions implementation projects in rural hospitals. Hence, a Generic Quality Assurance Model developed in this study for the successful acquisition of e-health solutions in rural hospitals to enable improved quality of care and service delivery. The study used triangulation of qualitative and quantitative research approaches, in terms of which a case study approach was adopted.

KEYWORDS

Quality, Quality Assurance, e-Health Solutions, ICT4D, Healthcare, Project Quality Management.

1. INTRODUCTION

In the recent past, we have seen major advances in ICTs driven by the increasing need to develop and organize efficient ways of providing healthcare services. Consequently, there have been rapid increases in the adoption of ICTs in healthcare, collectively known as "e-health", which promises to have an enormous impact on all healthcare elements. According to Chu (2007), the key drivers for e-health are the quality, safety, effectiveness and efficiency of healthcare services.

In South Africa, we have seen an increase in e-health developments that have the potential to improve healthcare services. These include innovations that have reduced healthcare costs, improved quality, increased accessibility and enhanced the delivery of healthcare services (Braa & Hedberg, 2002:113–127; Seebregts & Singh, 2007).

These e-health developments are also viewed as a vehicle that can bridge the digital divide between rural and urban healthcare centres (Ruxwana, Herselman & Conradie, 2010). They promise to facilitate the capability to find solutions for the challenges that the rural healthcare sector is faced with (Ruxwana et al., 2010) and to extensively transform healthcare services delivery and patient care, as well as to facilitate the management of the healthcare system throughout the world (Louw & Hanmer, 2002).

E-health developments are, however, faced with several challenges that appear to be hindering their implementation. Some of these challenges are associated with the legal and regulatory environment, the limitations of the technology and the patients' trust, and majorly those associated with the failure of information technology (IT) projects (Mbananga, Madale & Becker, 2002; Heeks, 2002; Braa & Hedberg, 2002; Standish Group, 2004). Over a decade, several scholars have investigated the success and failures of IT projects, where they identified several factors of success (DeLone & McLearn, 2003; Gable, Sedera & Chan, 2008; Standish Group, 2001) and failure (Standish Group, 2004; Jones, 2004; Matta & Ashkenas, 2005:3). Interestingly, most of these factors associate to those that can positively effected by appropriate adoption of project quality management, through element of quality assurance. Hence, a question worth investigation is whether the adoption of quality assurance models can add value and ensure success of IT projects, especially in rural context?

This study is such a research initiative. The aim of this study was to develop a Generic Quality Assurance Model (GQAM) that can be used to add value and ensure successful acquisition of e-health solutions in rural hospitals in the Eastern Cape Province in order to improve the quality of care and service delivery. This study is of the view that the lack of emphasis on quality assurance (QA) as a subset of project quality management when implementing IT solutions is one of the major contributors to implementation challenges and failure.

1.1 Problem Statement

The ICT revolution has affected the healthcare sector tremendously by providing solutions that enhance information access, storage, retrieval and analysis, as well as the dissemination of accurate patient medical history. However, the critical implementation of these e-health solutions essentially transpires in the developed world with a limited scope in the developing world. As stated by various researchers, this is due to many challenges linked to the digital divide, which compromise the implementation of ICTs, including, lack of infrastructure, services and know-how, limited resources, low literacy levels and professional isolation (Herselman & Jacobs, 2003; Littlejohns et al., 2003).

Conversely, the lagging implementation may be due to the higher failure rate of IT project implementation, as reported in the Standish Group's CHAOS reports (Standish Group, 2004). South African healthcare ICT initiatives are no exception, although there is limited literature on their success or failure. The few studies conducted on healthcare projects in South Africa show that the failure rate is projected to be higher than that of developed countries owing to the challenges and limitations the country is faced with (Mbananga, Madale & Becker, 2002; Heeks, 2002; Braa & Hedberg, 2002). Heeks (2002) and Matthews (2007) further mentions that most information system projects in developing countries fail either totally or partially.

Conversely, other scholars, driven by the continuous confusion on the IS success and their value to organizations, are of the view that there needs to be an understanding for IS success in order to combat its failures, thus researched at IS success measurement models. An important contributions come from those IS success models developed by scholars such as DeLone and McLean (2003), and Gable et al. (2008), which identified that the IS success is multi-dimensional.

However these models have focused on the quality of the product- the solution, and have not particularly addressed the aspects of quality from the project management context, which includes all the processes and activities of the performing organization that determine quality policies, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken (PMBOK, 2004). The project quality management also enforce quality processes of the actual products, which are stated by IS success models.

Though there are several studies conducted in the context of project quality management, with methods and models developed, the ICT projects continues failure. In particular, these studies on project quality management, not carefully addresses the element of QA and its adoption in rural context, thus making this study novel as it further investigates the adoption of QA in rural hospital context which has never been done before.

Evidently the introduction of project quality management has increased project success. In support of this, Jones (2004) states that the six most common problems identified when observing failed projects include poor project planning, poor cost estimating, poor measurements, poor milestone tracking, poor change control, and poor quality control, which could all be identified and mitigated through QA. As a result, successful IT projects generally exhibit higher expertise in all of these six areas. Remarkably, these six problem areas are related to project management rather than to technical expertise. It thus becomes evident that inadequate project quality management, especially the lack of QA, is a contributing factor to the failure of projects.

1.2 The Present Study

The present paper focuses on essential elements for a generic quality assurance model that can aid successful implementations of e-health in rural hospitals in South Africa. The aim of the study was to determine the essential components for QA model and to develop a GQAM that will aid successful implementation of e-health solutions in rural hospitals. The following general question and sub-questions were posed:

What are the components of a generic quality assurance model (GQAM) to assist rural hospitals in the Eastern Cape Province in South Africa with the successful acquisition of e-health solutions?

- *Sub-question 1: what are the QA methodologies used in e-health acquisition for rural hospitals?*
- *Sub-question 2: how do these methodologies aid successful e-health acquisition in these rural hospitals?*
- *Sub-question 3: what are the challenges experienced when applying these methodologies in rural hospitals?*
- *Sub-question 4: what sensible model can be adopted to overcome these challenges and to improve the quality assurance processes used in e-health acquisitions in rural hospitals?*

2. METHODS

A multiple-case study methodology was applied. This is a type of qualitative research design whereby the researcher investigates a chain of single entities, phenomena or cases confined by time and activity and collects detailed information by using a variety of data collection procedures during a sustained period of time (Creswell 2003:12). According to Yin (2002), a case study of this nature is an empirical investigation of an existing event within its environment. It is mainly used when the boundaries between the event and its environment are not clearly evident.

The overall purpose of adopting a qualitative research approach for this study was to gather non-numerical data to help explain and develop a GQAM for e-health acquisition. Accordingly, the methods used to obtain qualitative information included questionnaires and interviews. The information derived from these instruments was combined into a GQAM that depicts the activities that should be included to ensure quality in e-health acquisition in order to be successful in implementing such solutions in rural hospitals.

2.1 Sampling

Purposive sampling was applied in this study to sample the various hospitals and participants. According to Babbie (2005: 189) purposive sampling involves the selection of the units to be observed on the basis of one's own judgment about which ones will be the most useful or representative. Thus, hospitals surveyed were those serving rural communities and using the five e-health solution implemented by the Eastern Cape Department of Health (ECDoH). Only hospitals providing primary care and that are generally the point of first entry for patients in the different regions (the former Transkei and Ciskei) were selected.

2.2 Participants

As indicated in the above, purposive sampling was adopted to select the participants for this study. Participants from the five cases included senior management, project managers and coordinators, the IT directorate and e-health team representatives from the ECDoH. Representatives from the vendors of the solutions; and the solution user community (doctors, nurses, radiographers and other hospital staff). In addition, experts in the project quality management fields, both in industry and academia, were also involved. In total, there were 35 participants from, from which the data were collected over a period of 18 months.

2.3 Ethics Approval

Ethics approval from the Eastern Cape Department of Health and the Nelson Mandela Metropolitan University was obtained before any information was gathered from any of the healthcare centres concerned. Furthermore, informed concern was signed with participants before interviews were conducted.

3. RESULTS

In order to develop a the GQAM several research sub-questions were answered, of which key findings are presented in the following subsections, starting with the first sub-question

3.1 QA Methodologies used in e-health Acquisition for Rural Hospitals

Generally, the respondents agreed that there was a general quality management strategy in place, and these strategies were developed in terms of a quality management system and standards. However the implementation of these strategies and their use on a project implementation level seems to only be prevalent in the vendors that supply the e-heath solutions. On the other hand, the participants were not as confident about the level of detail of the strategies and their applicability to the project implementation level in ensuring quality. This was further supported by the participants, showing no awareness of any quality manual in place for projects to follow. Throughout the organizations there were common limitations: all participants revealed the non-existence of a "lessons leant" knowledge base, which is an integral part of QA and a key for improved quality and continuous improvement in organizations and projects.

Furthermore, the findings revealed that there is a need for improvements in the existing methods covering the areas of traceability, accountability, quality upfront, customer involvement, independent QA and the use of modern tools and techniques in e-health acquisition in the Eastern Cape.

It can therefore be concluded that QA methodologies exist in the participating organizations. However, there is much to be done to promote awareness of these methodologies for guiding QA at project level, such as the development of a quality manual or policy with detailed QA principles and standards that have to be followed. It would also be useful to have a "lessons leant" knowledge base, where all the lessons leant from projects can be stored to aid success and provide points of reference in future projects.

3.2 The Perceived Value of Methodologies to Aid Successful e-health Acquisition in these Rural Hospitals

The findings reveal that greater value is added by adopting QA methodologies in projects. The findings collected using the various instruments reveal a consensus that, although QA does not guarantee project success, it does aid the project team in achieving its project objectives, evaluating progress and identifying risks, changes and actions to mitigate those risks identified earlier in the project lifecycle. The findings do, however, show that there are limitations in the current methodology and if these are addressed earlier on in the project lifecycle, greater value can be added throughout the project process, as depicted on the questionnaire findings below:

- *67% of the participants agreed that QA activities adopted have assisted in achieving project goals, while 33% strongly agreed*
- *56% of participants agreed that there were existing shortcomings and weaknesses in their current QA activities, while 44% strongly agreed*
- *All the participants perceive QA as being an integral part of project success, as 78% disagreed and 22% strongly disagreed when asked if the system implementation process would have been successful without the QA activities.*

The above findings reveal positive feedback on the value added by QA in e-health solutions and in project success. However, there is room for improvement in this regard, as the participants indicated that there are weaknesses in QA activities. The participants were also probed with regard to the key elements of existing models or based on their experiences of QA that they view as being essential and that they believe are required. The purpose of this was to find out the existing gaps in current project models.

3.3 Challenges Experienced when applying these Methodologies in Rural Hospitals

Although some of the challenges experienced result from other factors, an effective QA methodology would have helped to identify and mitigate possible risks earlier on in projects. All the data collection instruments used have highlighted the weaknesses in existing QA methodology, especially in the key principles such as quality upfront, user involvement, clear accountability, independent QA evaluations, the use of QA tools and techniques, qualified staff, traceability and continuous improvement. It is however clear that most of these challenges are related to and are the results of the adopted QA methodology weaknesses. All participants indicated that there are existing challenges with the adopted methods; when asked on specific QA problems experienced during the project, the following are the interviews abstractions:

- *"The lacking user involvement and user requirements leads to deployment of un-required solutions" (Respondent 1).*
- *"The sites do not take ownership and accountability of the solutions" (Respondent 2).*
- *"Limited QA activities in general is the problem, roles and responsibilities, communication, involvement, reviews, evaluations, testing and training" (Respondent 3).*

3.4 The Sensible Model for e-health Acquisitions in Rural Hospitals

In literature, there are several models, methods and standards relating to QA. The literature reveals that, in order to have an impact on project success, there is a need for standardized methodologies. It is also evident that QA activities include several elements that have some form of review, inspection, approval and testing; which are an integral part of the methodology for solution implementation (Standish Group, 2001; ISO, 2007; Ruxwana et al., 2010).

Most factors contributing to the success of IT projects includes most, if not all, the factors can be achieved with QA adoption within a project. Indeed, the existing standards and models do not provide context-relevant guidelines on quality, but a generic view of quality management. Hence it is key to consider the different complexities of rural areas in South Africa and to have a model that is relevant to the context and developed within the culture. In addition to the literature study, it was important to collect primary data on the burning issues and key factors relating to QA in solution development within the e-health sector in South Africa. Hence, the expert's reviews were conducted to reflect on experiences of the challenges inherent in implementing existing quality methods, standards and models in South African organizations; as summarized below:

- *"The challenge to implementation of QA methodologies is the lacking understanding of their intent and benefits; which then results to resistance from the project team, especially if it changes their norm of doing things. Therefore the elements of the most sensible model include awareness and change preparation for those who are involved" (Respondent 1).*
- *"The challenge is education, knowledge, understanding, and implementation of these methodologies in organizations. As a results people are resistant to use them, as they don't know their intent, benefits, and they don't understand how they can implement them within their processes" (Respondent 2).*
- *"The most sensible model for QA is the one that enforce standardization of the project activities to a certain degree; with the aim to support continuity and maintenance of such solution" (Respondent 3).*

There was consensus on the fact that models or methods that are customized to fit a certain environment can enforce standards and quality in solution design processes, and these models should be used in a way that fits the culture of the environment and can only be successful when driven by its users.

4. DISCUSSION

The findings obtained from the data collection instruments, such as the interviews, questionnaires, expert reviews and literature study, revealed that there are QA methodologies for e-health solution acquisition in rural hospitals in the Eastern Cape Province. It is also important to note the critical support of these findings for literature relating to the importance of QA in solution design and implementation. The findings reveal the

perceived critical role played by QA in ensuring project success. However, there are challenges and weaknesses in implementing QA methodologies.

It was clear that there was no standardized methodology for implementing e-health solutions in the selected hospitals. Although the contracted vendors adopted their own methodologies, these seemed to focus more on product development, thus the quality aspects were those that focused on solution functionality as per specifications. This therefore highlights that project management and QA that ensure the generic quality from a project process perspective was found to be lacking; hence, the challenges were experienced at the end, with most solutions.

Evidently, most problems that exist could have been identified and resolved earlier if QA had been adopted in the process of acquiring these solutions. However, there was no defined process for the solutions to follow, so each solution followed its own different methodology which led to several challenges such as those linked to: traceability; accountability, sustainability, support and maintenance; training; awareness and involvement; compliance and standardization; requirement analysis and readiness assessment; continuous improvement; independent QA, evaluation and knowledge base; quality upfront; qualified staff; and, QA tools and techniques

The findings also reveal that the most sensible QA model is one that puts the solution's stakeholders first, defines quality from their perspective and develops a means to ensure that the specified expectations are met. From these findings the key elements of such a model should be: user awareness and involvement; training and support; standardization; clear accountability through roles and responsibility and stakeholder maps; promoting and enforcing the management of a knowledge base; traceability of expectations through continuous reviews; relevant and customized to fit the environment in which it is used; providing support for meeting technical and human expectations; and, facilitating continuous improvement. Based on these findings, the proposed GQAM was developed.

5. PROPOSED SENSIBLE QA MODEL

According to Arsham (2006), a model is an external and explicit representation of a part of reality as an individual sees it; who wishes to use the model to understand, change, manage and control that part of reality. The purpose was to develop a GQAM for successful acquisition (i.e. development and implementation) of e-health solutions in rural hospitals in the Eastern Cape Province for improved quality of care and service delivery. In order to develop and test this model it was necessary to identify the QA methodologies that are currently used in rural hospitals for e-health solutions acquisition (sub-question 1); to further evaluate the adopted QA methodologies to determine if they were the most sensible methodologies for successful acquisition and to determine their role in ensuring the acquisition success, their shortcomings and adoption challenges in system acquisition (sub-questions 2-4).

In order to develop such a model in a manner that is relevant and fits the context of its implementation, a user involvement approach was adopted where the e-health team and other relevant stakeholders were involved. To further ensure that the model was within the general practice and can fit any typical Solution Development Life Cycle (SDLC), experts' reviews were also considered. This representative involvement was adopted in a series of cycles to formulate the model elements, designs and testing. The study process happened through the four phases followed. The first two phases focused on case studies where the data were collected to answer the research questions using data triangulation to provide findings and conclusions. The findings obtained from the case studies were then used in phase 3 to develop the first draft of the QA model in layers. The layers continued through to phase 4 where the draft QA model developed from the case study findings evolved until the final GQAM was produced. In phase 4, the GQAM was used as input to the cycles for developing a QA value chain (excluded in this paper), which provides the implementation guidelines.

5.1 GQAM Layers

The purpose of GQAM is to aid the successful acquisition, that is, development and implementation, of e-health solutions for rural hospitals. This can be achieved by using the GQAM as a blueprint for the fundamental elements and project quality management processes that need to be followed to ensure that quality will be met in the end, irrespective of who is implementing the solution. This model is referred to as

"generic" as it can be used for any e-health solution acquisition project, for any adopted systems development method, and for any given context for ensuring quality within project management processes. This model encompasses five layers and each layer or stage comprises functions or processes to be executed that have different interlinking deliverables, as depicted in Figure 1 below:
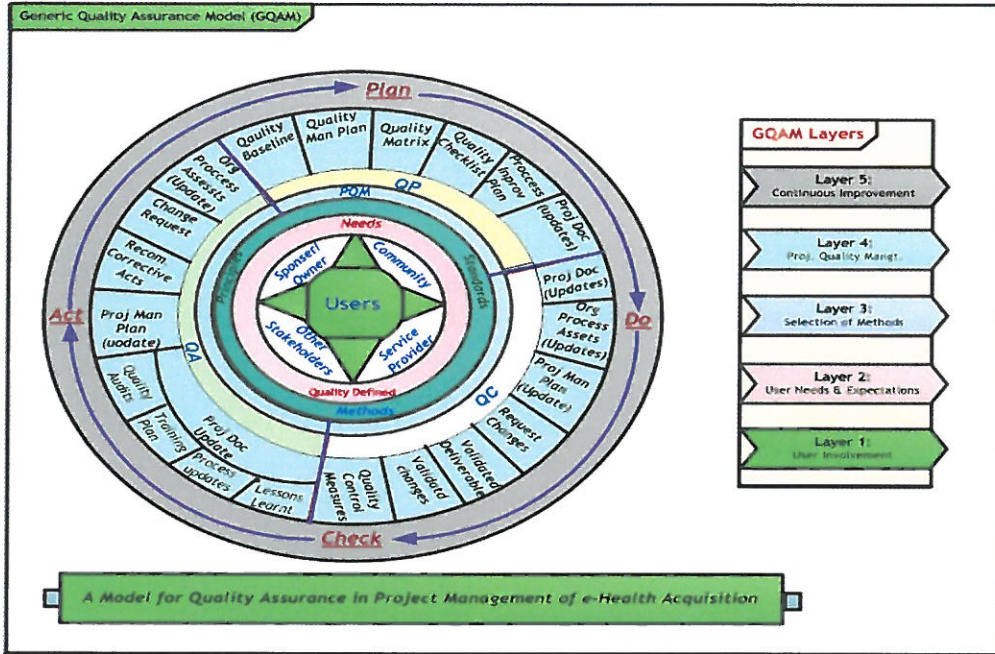

Figure 1. GQAM for e-health acquisition in rural healthcare

This model was built from the inside out, with users forming the central point of departure, with other stakeholders being considered through to the outer layer of continuous improvement of the processes adopted inside and the implementation of the model. The table 1 below summarizes the layers and their core focus.

Table 1. Method layer summary

Layers	Description
1	Identification of each project stakeholder and understanding their different roles and influence in the project and its success becomes critical.
2	This layer focused on user involvement, user needs and expectations as quality drivers
3	This is about considering the existing organizational methods, principles and standards for projects. This includes adoption or adaptation of methods and principles.
4	This layer fosters QA as a subset of project quality management
5	This layer recognizes QA as an integral part of continuous improvement in project processes, activities, knowledge base, deliverables and methods.

6. CONCLUSION

The purpose of this study was to develop a GQAM for the successful acquisition (of e-health solutions in rural hospitals in the Eastern Cape Province for improved quality of care and service delivery. In order to develop this model it was necessary to identify the QA methodologies that are currently used in rural hospitals for e-health solution acquisition in order to further evaluate the QA methodologies adopted and to determine whether they are the most sensible methodologies for successful acquisition. In addition, to

determine their role in ensuring acquisition success, their shortcomings and the adoption challenges in system acquisition were also outlined.

The findings presented show that there are QA methodologies which are used, although there is no formalization or standardization of the processes of applying these methodologies. It was found that, although this is the case, the QA methods had a great impact on project success. These methods were found to have several weaknesses which if considered could add more value when corrected. This study has indeed developed the GQAM which can be used to ensure e-health solution success in rural hospitals by overcoming the challenges and further introducing standards that will support sustainability and future maintenance of these solutions, while facilitating user buy-in and ownership through increased user involvement levels.

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