

Factors influencing successful implementations of health information systems in public healthcare organisations in sub-Saharan countries

Yasser Buchana¹, Lisa Seymour²

University of Cape Town, Cape Town, South Africa

ybuchana@gmail.com

lisa.seymour@uct.ac.za

Abstract

Health Information Systems (HIS) are information systems designed to improve effectiveness and efficiency of patient health services through better management of patient information. The benefits associated with HIS include, amongst others monitoring of diseases, monitoring of drug supplies, performance evaluations, reporting and billing as well as management of patient information. Despite a recent increase in adoption and implementation of HIS in sub-Saharan countries, the factors influencing successful implementations of HIS in sub-Saharan countries are largely disjointed and not well explained. This is since, many different studies in the region have employed multiple approaches in their own contexts with variations in purpose and scope. As a result, this paper develops a taxonomy for the implementation of HIS in sub-Saharan countries. The findings are based on an extensive literature review of research papers with a focus on health information systems implementation in developing countries published between the year 2000 and 2014. A discussion of the identified factors is presented as well as a number of practical implications for sub-Saharan countries. The identified CSFs can bring a results-oriented approach to health systems implementation projects, overall project planning, performance management, better patient healthcare and ultimately resulting in an improved public healthcare sector.

Keywords: Health Information Systems, implementation, Success factors, Sub-Sahara, Developing countries, Africa

1. Introduction

Health Information Systems (HIS) are types of information systems designed to improve effectiveness and efficiency of patient health services through better management of patient information (Haux, 2006, 2010; Heeks, 2006). Depending on the level of sophistication, these systems are conceived to achieve a number of benefits. These include for example better management of patient information, monitoring of diseases, monitoring of drug supplies, performance evaluations, reporting, billing, and assisting with decision-making. Examples of HIS used in healthcare units in most sub-Saharan African (SSA) countries include amongst others electronic patient records systems, emergency medical systems, decision support systems, tele-medicine systems, drug monitoring and control systems, mobile health technologies.

Over the last decade, public institutions in developing countries have been adopting information technologies to enhance and support delivery of services to the public (Braa et al., 2004; Blaya et al., 2010; Fraser et al., 2005; Tomasi et al., 2004). With respect to the public healthcare sector, the overall value added by Information Technology (IT) to public healthcare organisations in developed countries is now a well-established fact (Bekkers, 2003; Danziger & Andersen, 2002; Kirkman et al., 2002). However, in developing countries this is not the case. There are a number of IS/IT problems and challenges still facing public sector institutions, especially in healthcare (Ammenwerth et al., 2003).

Recent research indicates that, despite increased investments in IT implementation projects in the public healthcare sector in developing countries, many implementation outcomes of health systems have resulted in mixed results (Blaya et al., 2010; Fraser et al., 2005). There are sporadic documented cases of IS success (e.g. Blaya et al., (2010)) and extensively documented repetitive failure cases.

According to Beynon-Davies & Lloyd-Williams (1999), IS failure is the cancellation of an IS project due to increased accumulation of various kinds of problems or the inability to meet the project's objectives as well as failure to meet stakeholders expectations.

Heeks (2002), classifies IS failures into two different types. First is "*Complete failure*". This is a case where the IS never gets implemented or immediately abandoned. The second type of IS failure is referred to as "*Partial failure*". This is when major project objectives are not met with only very few initial objectives achieved, as well as, when the project yields unwanted results. As a result, public service institutions in developing countries have been looking for ways to achieve success with respect to implementation projects of healthcare related technologies, and to minimise associated failure risks (Avgerou, 2008; Wootton, 2001).

One of the widely cited fundamental causes of IS failures in developing countries is the transfer of HIS and IS models from developed to developing countries in hopes of generating similar IS success achieved in developed countries (Heeks, 2002). This is mostly done without consideration of the different contexts and gaps between developed and developing countries. These include, for example, technological infrastructure, skills, financial resources, processes and culture. For these reasons, many authors have attempted to adapt systems development methodologies to accommodate analyses of the socio-organisational conditions of developing countries (Korpela et al., 2000; Wood-Harper et al., 1990).

Literature on the phenomenon suggests a strong need to investigate and validate implementation of healthcare systems and their corresponding implications on public health organisations in SSA developing countries (Swinfen & Swinfen, 2002; Wootton, 2001). This study is mainly motivated by this persistent need and aims to develop a taxonomy for classifying the factors influencing successful implementation of HIS in SSA.

2. Problem statement

In recent years, the information technology implementation problem has gained significant popularity amongst scholars who have studied the phenomenon from multiple perspectives (Cooper & Zmud, 1990; De Lancer, 2008; Hauswald & Yeoh, 1997; Kwon & Zmud, 1987). These studies have produced and contributed to a number of theoretical understandings and practice in the field.

Unfortunately, in an attempt to classify the implementation success factors of health information systems in SSA countries, the analysis of literature demonstrated a lack of a cohesive taxonomy. This is partly because there are many studies on IS implementation in healthcare in the region employing multiple approaches in their own contexts. The lack of taxonomy of health information systems implementation in the SSA region therefore suggests that there is a need to cohesively organise the success factors relative to the HIS implementation outcomes.

The rationale behind this research study is motivated by the need to identify the most important factors public healthcare organisations in SSA region should focus on during various implementation phases and to cohesively organise these factors in a taxonomic framework.

3. Relevance and importance of HIS success factors research in sub-Saharan developing countries context

Critical Success Factors (CSFs) are commonly defined as the most important factors that ensure the successful implementation of a project (Rockart, 1979; 1982). Fundamentally, implementation success is a multidimensional concept, which consists of different levels. Implementation success may vary given the uniqueness of a project. These variations are dependent on the organisations involved as well as the context. As a result of its multi-dimensional nature and its constant evolvement, this makes the concept of 'success' difficult to define collectively. Success therefore is, significantly dependent on the context (Ballantine et al., 1996; Seddon et al., 1999). For the purpose of this paper,

success is defined as the factors deemed critical during implementation of information systems which may help to avoid implementation failure. To reiterate, IS failure is defined in the context of this study, as the termination of an IS project as a result of accumulation of many different problems or the failure to meet the objectives of the project as well as the inability to meet stakeholders expectations.

In the context of health systems implementation in SSA countries, a CSF taxonomy for HIS implementation has several important implications (Leonard, 2004; Rockart, 1979). For example, given that most sub-Saharan African countries are characterised by lack of adequate IS/IT infrastructure, skills, services and resources, identifying and analysing the CSFs can provide implementation stakeholders with a listing of factors that bring a results-oriented approach not just to health systems implementation projects, but overall project planning, systems design, reporting, performance management, better patient healthcare and ultimately an improved public healthcare sector. Moreover, according to Rockart (1979) CSFs allow management to identify and pay careful attention to a number of factors deemed critical during a project implementation so as to minimise failure risks and subsequently maximise chances of success.

4. Research objective and research question

The main objective of this study is to develop a taxonomy for the implementation of HIS in sub-Saharan developing countries. The purpose is to identify the necessary factors influencing a successful implementation of health information and classify them in a coherent taxonomy. The main objective of the study informs the research question guiding this study. This is formulated as:

What are the factors influencing successful implementations of health information systems in sub-Saharan countries?

5. Literature review and identification of factors

To identify the relevant literature, an inclusive selection criterion was used. Peer reviewed articles from leading journals in the field were consulted. A series of searches from the year 2000 to year 2014, with special focus on health implementation projects in developing countries were searched. Some of the databases and journals consulted included amongst others PubMed, Information Systems Research, International Journal of Medical Informatics, Communications of the ACM, MIS Quarterly and Periodic Abstracts. Further articles were obtained from references from key articles. However, it emerged that there were very few studies that were published on the subject in leading journals, especially on the subject as well as in the sub-Sahara region. The contemporary nature of the phenomenon in the sub-Saharan region mostly contributed to this outcome. There were a number of studies that addressed implementation of information systems in healthcare in general, and very few studies addressed specialised types of health information systems such as, tele-medicine, hospital information systems and emergency medical systems.

The review also critiqued the research design and approach taken by such studies, as well as, the level and focus of the analysis. Analysis of the literature found a number of studies have taken multiple socio-theoretical perspectives. The majority of studies reviewed in this paper were found to have been guided by some form of theoretical assumption. Amongst the popular theory used by studies investigating health systems implementations include Complexity theory, Actor Network Theory, Diffusion of Innovation, Structuration theory and Institutional theory.

A total of 46 Studies were identified with a focus on CSFs in developing countries context, of these 23 studies were identified as most relevant. The analysis of these studies indicated a number of factors and sub-factors. However the most critical factors influencing implementation success of HIS in sub-Saharan countries were found to be: (1) Stakeholder engagement, (2) Top management support, (3)

Technological infrastructure, (4) Appropriate implementation plan, 5) User involvement and training, (6) Culture, (7) Sustainability, (8) Project review and monitoring. The section to follow will provide a discussion of each factor. Table 1 provides a cross reference between the 8 factors and the relevant corresponding authors. In the subsequent sections, a summary of each identified success factor in question is provided.

5.1 Stakeholder engagement

The success of HIS implementations in sub-Saharan countries requires a harmonious balance of all stakeholders' relationships, as well as, an engagement of all their concerns and contributions (Clifford et al., 2008; Wootton, 2001). Stakeholders are defined as all the relevant people or organisations that have a direct or indirect influence on the system requirements and will be affected by the implemented system (Achterkamp & Vos, 2007; Vos & Achterkamp, 2006). These include for example, implementation consultants, developers, managers, governments, direct users and their managers. The ability to manage stakeholder engagement has previously been found to be strongly associated with the success of systems implementations in public institutions elsewhere in the world (Elpez & Fink, 2006; Leonard, 2004). In the sub-Saharan context, engagement of all stakeholders involved is critical especially since the implementation of a new health system may raise fears of people losing their jobs.

5.2 Top management support

A large number of the studies analysed emphasised the importance of top management support as an integral factor in the successful implementation of healthcare related information systems, particularly in African countries (Namakula & Kituyi, 2014; Tetteh, 2014). The function of top managers in healthcare systems implementation is classified into two primary functions: (a) to provide the necessary leadership and (b) to provide the required resources. With regards to provision of necessary leadership, top management have an important role to play in engaging all the relevant stakeholders and to make sure the vision and perceived benefits of the implemented HIS are well understood across the different stakeholder groups (Braa et al., 2007). This in turn helps avoid user-resistance to change when HIS is implemented.

5.3 Technological infrastructure

Technological infrastructure is a critical factor that influences the success of HIS implementation in sub-Saharan Africa (Berg, 2001). There are a number of sub-factors, including for example, high costs of hardware, software and network connectivity. In particular, the problem of software content and the language used, lack relevance to the local context. This problem stems from the transferring of HIS developed in first world countries to developing countries (Heeks, 2002). Chetley et al., (2006) argue that appropriate language is frequently neglected in ICT programmes and little content is available in local languages for health programmes.

In addition, sub-Saharan Africa is well known to having unstable and unreliable electricity and power supply. As a result, a number of projects have failed (Braa & Hedberg, 2002; Littlejohns et al., 2003; Igira et al., 2007). To deal with such unreliable electricity and power supply problems, alternative sources of power must be provisioned in advance.

5.4 Appropriate implementation plan

Having an appropriate implementation plan allows organisations to outline a feasible course of action for the possible utilisation of the implemented HIS (Furuholt & Ørvik, 2006). However, literature a number of authors argue for the need to optimise and re-engineer some of the manual core healthcare business processes (Castelnuovo et al., 2012; Cline & Luiz, 2013). The nature of healthcare processes in sub-Saharan Africa involves highly structured and knowledge-intensive operations, which is characterised by a high degree of unpredictability (Tetteh, 2014). Therefore, appropriate planning, would ensure proper standardisation where re-engineering of business processes is required (Fraser et al., 2005).

Table 1 Factors identified from empirical studies

Study	Stakeholder engagement	Top management support	Tech. Infrastructure	Appropriate Implementation plan	User involvement	Culture	Sustainability	Review monitoring
Clifford et al. (2008)	X		X	X	X			
Leonard (2004)	X	X						
Wootton (2001)	X							
Tetteh (2014)		X	X	X	X	X		
Braa et al. (2007)	X	X				X		
Berg (2001)			X					
Igira et al. (2007)			X					
Castelnuovo et al. (2012)			X					
Furuholt & Ørvik (2006)		X		X	X	X		
Fraser et al. (2005)			X	X		X		
Cline & Luiz (2013)	X	X		X	X			
Heeks (2006)		X	X		X		X	
Wisborg et al. (2008)					X			
Bano & Zowghi (2013, 2015)				X	X			
Blaya et al. (2010)	X					X		
Avgerou (2008)								
Walsham et al. (2007)						X	X	
Jacucci et al. (2006)	X			X	X		X	
Isabalija et al. (2011)		X		X			X	
Braa et al. (2004)	X						X	
Kimaro & Nhampossa (2005)			X	X		X	X	
Mengiste (2010)		X			X			X
Braa & Hedberg (2002)					X			X
Ammenwerth et al. (2003)	X	X	X	X			X	X

5.5 User involvement and Training

Seminal work by Olson & Ives (1981) and Ives & Olson (1984) define user involvement as the “participation in the development by a member or members of the target user group”. A review of literature on systems implementation revealed the need for user involvement (Heeks, 2006). This is also supported by empirical evidence from numerous system implementations in sub-Saharan countries (Wisborg et al., 2008). However, user involvement is often regarded as one of the most complex and challenging factors. This is given the various types of and degrees of involvement. Poor user involvement has been identified in the literature as a one of the fundamental causes of information systems failure.

Furthermore, user involvement theories suggest that it is generally expected that user involvement increase user satisfaction and system usage (Bano & Zowghi, 2013, 2015). End users in particular, should be involved to ensure that the implemented HIS is culturally appropriate and relevant to their needs. In HIS implementation, user involvement can be considered as a corollary of both an appropriate implementation plan and stakeholder engagement. Through stakeholders’ engagement and an appropriate implementation plan, the different types and extent of user involvement can be defined. User training follows logically from end user involvement. This is to ensure that users understand the various changes in workflow and business processes and to make sure users understand how to use the new system.

5.6 Culture

Leidner & Kayworth (2006) argue that understanding the concept of culture (including national, organisational and group) is of vital importance and can influence the successful implementation of an information technology. Cultural norms and societal practices are important to people in sub-Saharan countries. This suggests that during implementation of HIS, cultural issues should be contextually and appropriately addressed in terms of relevant strategies to deal with people’s concerns and sensitivities (Avgerou, 2008; Blaya et al., 2010). In this regard, the relevant stakeholders at the top management level, have an important role to play in developing strategies to ensure such cultural issues and societal practices that may inhibit people from accepting and using the information technology are addressed (Tetteh, 2014; Walsham et al., 2007).

5.7 Sustainability

Most countries in sub-Sahara Africa heavily depend on a combination of several health funding options. These include for example, governmental budgetary allocation, health insurance programmes, funding from external private donors and user fees. Research indicates that approximately 52% of financial resources come from user fees (World health organisation, 2010). Governmental expenditure on health care in the region is still far behind the WHO set targets (World health organisation, 2010).

A number of research studies in IS literature focusing on explaining the problem of sustainability failure throughout multiple developing countries revealed a wide range of sustainability issues. In particular, there are issues of resource sustainability. According to Avgerou (2008) many IS projects in most developing countries are often deprived of resources, poorly maintained and as direct consequence, become technologically as well as functionally degraded. This makes sustainability an important factor to the success of HIS in sub-Saharan developing countries (Jacucci et al., 2006; Braa et al., 2004). Thus, to avoid such systems degradations, top management should outline strategies to sustain the implemented, HIS which include financial, human, environmental, technological sustainability.

The capability for long-term sustainability of the implemented system, especially financial, is an important factor that may determine the long-term success of the HIS (Isabalija et al., 2011; Kimaro & Nhampossa, 2005). Long and short-term sustainability plans ought to be clearly defined to ensure appropriate investments and costs are determined in advance as well as the capacity to maintain the IT infrastructure needs. Gladwin et al, (2003) suggest that promoting public and private partnerships

between stakeholders at different levels (local, national, regional and international level) can help to encourage socioeconomic sustainability of healthcare IT projects.

5.8 Project review and monitoring

Monitoring and evaluation is an important factor that influences the success HIS implementation. In the context of sub-Saharan Africa developing countries, the lack of resources necessitates the use of monitoring and evaluation strategies during and after implementation of HIS projects (Ammenwerth et al., 2003). Monitoring at different phases of the implementation allows top management to identify and to take necessary actions to deal with any implementation challenges as well as other potential issues that may arise during and after HIS implementation (Mengiste, 2010). Conversely, evaluation of HIS implementation in different phases of implementation allows top management to assess the efficiency and effectiveness of the project and whether the initial defined objectives are being achieved. Through the development of rigorous metrics to measure the project's progress, top management promote accountability and transparency and to fight corruption.

6. Classification of factors influencing HIS implementation in sub-Saharan Africa

As previously discussed in the paper, the importance of identifying and classifying the implementation success factors cannot be overstated. Unfortunately, in an attempt to classify the implementation success factors of health information systems in sub-Saharan countries, the analysis of literature demonstrated a lack of a cohesive taxonomy. This is partly because there are many studies on IS implementation in healthcare in the region employing multiple approaches in their own contexts. The lack of taxonomy of health information systems implementation in the sub-Saharan region therefore suggests the need to cohesively organise the success factors relative to the HIS implementation outcomes.

A critique of the literature on the implementation of information technology in healthcare institutions in SSA countries revealed a number of critical factors affecting successful implementations of information technologies in healthcare. Table 2 summarises the identified CSFs and groups them in four categories namely: 1) Strategic, 2) Tactical 3) Organisational and 4) Technological.

Previously, a number of studies have tried to identify the factors that lead to implementation success of different IT projects, however, Esteves and Pastor's unified critical success factor model was able to coherently organise these factors in the four mentioned classifications. The Esteves & Pastor (2000) model is appropriate in this context, because it unifies the most important elements of a systems implementation success.

Furthermore, the Esteves & Pastor (2000) model has been used by numerous other studies to classify different success factors. According to Esteves (2004) strategic factors strive to establish the implementation goals to be achieved while tactical factors aim to identify suitable alternatives with respect to how to achieve the goals. The author further argues that, strategic factors usually consist of high levels of risk, thus, involve long term planning mainly performed by senior management. In contrast, tactical factors involve the resources necessary to achieve the goals defined at the strategic level and generally involve a short or medium term planning effort, carried out by the middle managers.

In addition, Esteves & Pastor (2000) note that, tactical category involves the operational activities required to achieve short-term the project's intended goals and objectives of the implementation projects at different phases. The technological category focuses on factors related to technological infrastructure issues implementers must take into consideration prior implementing HIS in sub-Saharan countries. These relate to the technical capacity, such as hardware, software and network capabilities. The organisational category focuses on aspects related to organisations within which the system will be implemented. Fig.1 presents a taxonomy illustrating the inter-connections between

the different critical success factors as well as how these factors are organised into strategic, tactical, technological and organisational groups.

Table 2 Factors influencing HIS implementation in Sub-Saharan developing countries

Critical Success Factors	Category	Authors
Stakeholder engagement	Strategic	Clifford et al. (2008) Leonard (2004) Wootton (2001)
Top management support	Strategic	Leonard (2004) Tetteh (2014) Braa et al. (2007)
Technological infrastructure	Technological	Berg (2001) Igira et al. (2007) Clifford et al. (2008) Castelnuovo et al. (2012)
Appropriate implementation plan	Tactical	Furuholt & Ørvik (2006) Fraser et al. (2005) Cline & Luiz (2013)
User involvement and Training	Tactical	Heeks (2006) Wisborg et al. (2008) Bano & Zowghi (2013, 2015)
Culture	Organisational	Blaya et al. (2010) Tetteh (2014) Avgerou (2008) Walsham et al. (2007)
Sustainability	Organisational	Jacucci et al. (2006) Isabalija et al. (2011) Braa et al. (2004) Kimaro & Nhampossa (2005)
Project review and monitoring	Tactical	Mengiste (2010) Braa & Hedberg (2002) Ammenwerth et al. (2003)

7. Discussion

Public HIS implementations in most developing countries are often unique to the context where they are implemented. Occasionally, these health systems implementations may involve national/macro level mandates from governments. Such mandates are often external the organisational context. For example, these mandates may include among others, organisational power struggles and politics as well as socio-cultural issues of users both internal and external to organisations where the HIS is implemented. Although these factors maybe outside of the organisation, they may nevertheless, have positive or negative influences on HIS implementation success (Shankardass et al., 2014).

Governments often develop micro-plans and policies which may involve institutionalised processes and value across units in public health institutions to address power struggles before embarking on the implementation programme. According to Shankardass et al., (2014), HIS in public health institutions

depend on cross-sectoral structures and relationships to foster successful implementation outcomes. These outcomes assist senior management and implementation stakeholders to incorporate sensitivities of healthcare policies, well-being and equity during the development, implementation and evaluation of policies and services pertaining to the health of the citizens (Shankardass et al., 2014).

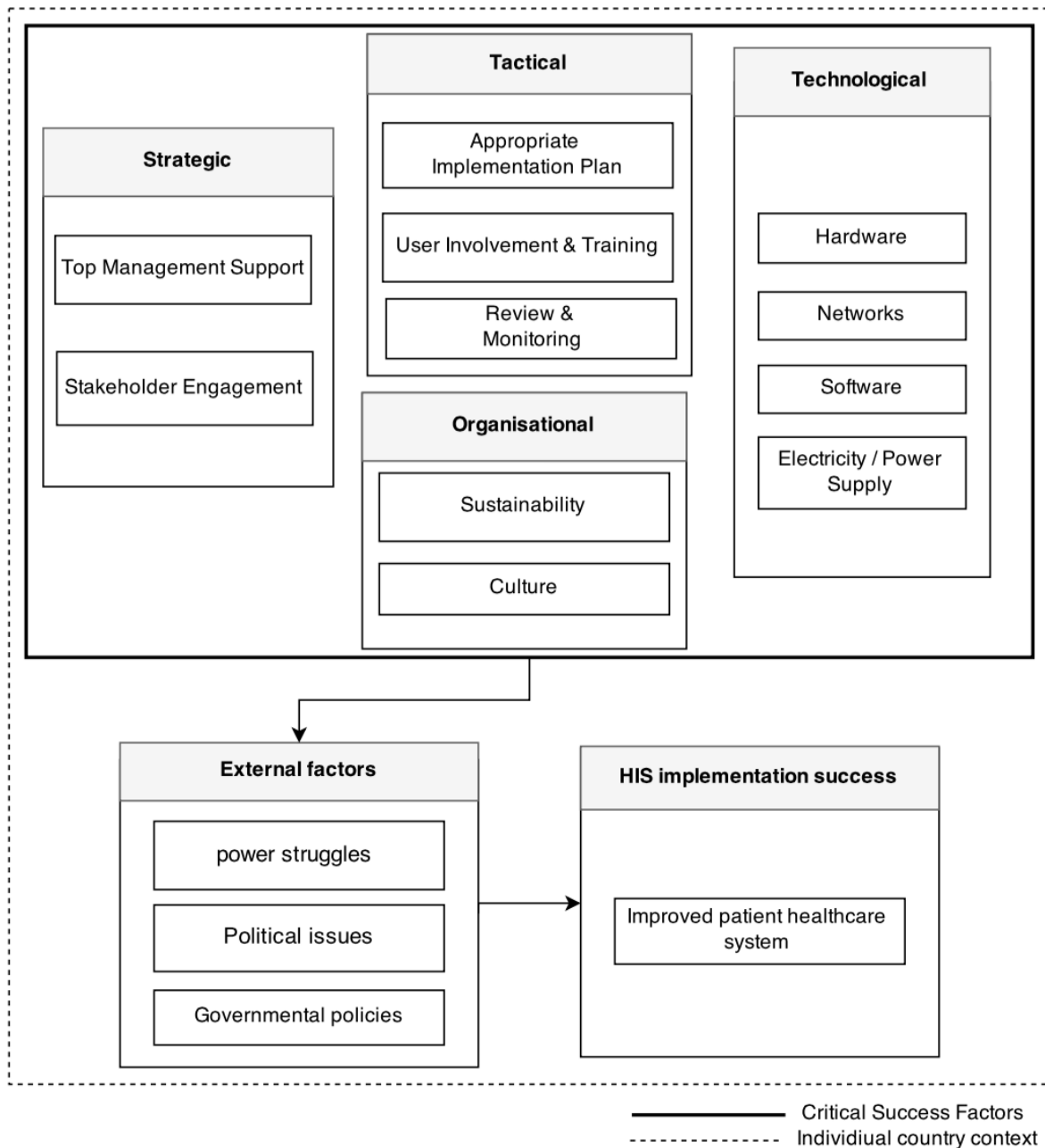


Figure 1 Taxonomy of HIS implementation success factors

Having discussed the CSF influencing HIS implementation in SSA, it is worth noting that, these factors are specific to the context where the HISs are implemented. This is because the diversity existing in the sub-sahara region, HIS implementations may be driven by different policies external to the organisation where the HIS are implemented. However, from a national or macro level perspective, the identified success factors may be used in conjunctions with context specific health plans to further increase the chances of implementations success as illustrated in Fig 1. Hence, from a macro level perspective, the identified factors in this study are flexible enough to be adapted and transferred to all sub-Saharan countries with similar socio-economic conditions. Each country may use

the taxonomy to guide the HIS implementations in conjunction with its own health plans and budgetary capabilities to suit in its own context.

8. Conclusion

The aim of this research paper was to develop a taxonomy for the implementation of HIS in sub-Saharan developing countries. The importance and relevance of studying the critical success factors were discussed in section 3 of this paper. A total of 23 papers were found to be relevant and were used to develop the framework. A discussion of the identified success factors in the literature was presented. The research question and objectives were addressed by the developer model which consisted of 8 factors, namely, (1) Stakeholder engagement, (2) Top management support, (3) Technological infrastructure, (4) Appropriate implementation plan, 5) User involvement and training, (6) Culture, (7) Sustainability, (8) Project review and monitoring. In addition, Fig.1 presented a taxonomy demonstrating the different critical success factors influencing the successful implementation of HIS. The CSFs can be considered practically independent of regional or country biases. However, more work is required to contextualise the factors in individual SSA countries contexts.

9. Implications for future research

The findings generated by the research study were based on a wider perspective on the factors influencing successful implementations of HIS in sub-Saharan countries. Therefore, as a recommendation of further research, this study recommends: (1) a narrow perspective to either extend the model further by analysing these factors individually. For example, it might be useful to identify and analyse the critical stakeholders, their roles and responsibilities in the implementation of HIS in sub-Saharan developing countries. (2) By conducting multiple case studies in different sub-Saharan countries and then comparing the implementation outcomes as well as the overall impact on the health system. This study is part of an ongoing research investigation, which aims to analyse the identified CSFs from a South African perspective.

10. References

- Achterkamp, M. C., & Vos, J. F. (2007). Critically identifying stakeholders. *Systems Research and Behavioral Science*, 24, 3–14.
- Ammenwerth, E., Gräber, S., Herrmann, G., Bürkle, T., & König, J. (2003). Evaluation of health information systems problems and challenges. *International Journal of Medical Informatics*, 71, 125–135.
- Avgerou, C. (2008). Information systems in developing countries: a critical research review. *Journal of Information Technology*, 23, 133–146.
- Bakar, A., Sheikh, Y., & Sultan, B. (2012). Opportunities and challenges of open source software integration in developing countries: Case of Zanzibar health sector. *Journal of Health Informatics in Developing Countries*, 6.
- Ballantine, J., Bonner, M., Levy, M., Martin, A., Munro, I., & Powell, P. L. (1996). The 3-D model of information systems success: the search for the dependent variable continues. *Information Resources Management Journal (IRMJ)*, 9(4), 5-15.
- Bano, M., & Zowghi, D. (2013). User involvement in software development and system success: a systematic literature review. In *Proceedings of the 17th International Conference on Evaluation and Assessment in Software Engineering* (pp. 125–130). ACM.
- Bano, M., & Zowghi, D. (2015). A systematic review on the relationship between user involvement and system success. *Information and Software Technology*, 58, 148–169.

- Bekkers, V. (2003). Reinventing government in the information age. International practice in IT-enabled public sector reform. *Public Management Review*, 5, 133–139.
- Berg, M. (2001). Implementing information systems in health care organizations: myths and challenges. *International Journal of Medical Informatics*, 64, 143–156.
- Beynon-Davies, P., & Lloyd-Williams, M. (1999). When health information systems fail. *Topics in health information management*, 20, 66–79.
- Blaya, J. A., Fraser, H. S., & Holt, B. (2010). E-health technologies show promise in developing countries. *Health Affairs*, 29, 244–251.
- Braa, J., Hanseth, O., Heywood, A., Mohammed, W., & Shaw, V. (2007). Developing health information systems in developing countries: the flexible standards strategy. *MIS Quarterly*, (pp. 381–402).
- Braa, J., & Hedberg, C. (2002). The struggle for district-based health information systems in South Africa. *The information society*, 18, 113–127.
- Braa, J., Kanter, A. S., Lesh, N., Crichton, R., Jolliffe, B., Sæbø, J., Kossi, E., & Seebregts, C. J. (2010). Comprehensive yet scalable health information systems for low resource settings: a collaborative effort in Sierra Leone. In *AMIA Annual Symposium Proceedings* (p. 372). American Medical Informatics Association volume 2010.
- Braa, J., Monteiro, E., & Sahay, S. (2004). Networks of action: sustainable health information systems across developing countries. *MIS Quarterly*, (pp.337–362).
- Castelnuovo, B., Kiragga, A., Afayo, V., Ncube, M., Orama, R., Magero, S., Okwi, P., Manabe, Y. C., & Kambugu, A. (2012). Implementation of provider-based electronic medical records and improvement of the quality of data in a large HIV program in sub-saharan Africa. *PloS one*, 7, e51631.
- Chetley, A., Davies, J., Trude, B., McConnell, H., & Ramirez, R. (2006). Improving health-connecting people: the role of ICTs in the health sector of developing countries.
- Clifford, G. D., Blaya, J. A., Hall-Clifford, R., & Fraser, H. S. (2008). Medical information systems: A foundation for healthcare technologies in developing countries. *BioMedical Engineering OnLine*, 7, 18.
- Cline, G. B., & Luiz, J. M. (2013). Information technology systems in public sector health facilities in developing countries: the case of South Africa. *BMC medical informatics and decision making*, 13, 13.
- Cooper, R. B., & Zmud, R. W. (1990). Information technology implementation research: a technological diffusion approach. *Management science*, 36, 123–139.
- Danziger, J. N., & Andersen, K. V. (2002). The impacts of information technology on public administration: an analysis of empirical research from the golden age of transformation [1]. *International Journal of Public Administration*, 25, 591–627.
- De Lancer, P. (2008). An empirical study of factors affecting adoption and implementation. *Performance Measurement: Building Theory, Improving Practice*, and 61, 166.
- DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information systems research*, 3(1), 60-95.
- Elpez, I., & Fink, D. (2006). Information systems success in the public sector: Stakeholders perspectives and emerging alignment model. *Issues in Informing Science and Information Technology*, 3, 219–231.
- Esteves, J. M. d. S. (2004). *Definition and analysis of critical success factors for ERP implementation projects*. Doctoral dissertation, Universitat Politècnica de Catalunya, Barcelona, Spain.
- Esteves, J., & Pastor, J. (2000). Towards the unification of critical success factors for ERP implementations. In 10th Annual BIT Conference, Manchester, UK (p. 44).
- Fraser, H. S., Biondich, P., Moodley, D., Choi, S., Mamlin, B. W., & Szolovits, P. (2005). Implementing electronic medical record systems in developing countries. *Informatics in primary care*, 13, 83–96.

- Furuholt, B., & Ørvik, T. U. (2006). Implementation of information technology in Africa: Understanding and explaining the results of ten years of implementation effort in a Tanzanian organization. *Information Technology for Development, 12*, 45–62.
- Hauswald, M., & Yeoh, E. (1997). Designing a pre-hospital system for a developing country: estimated cost and benefits. *The American Journal of Emergency Medicine, 15*, 600–603.
- Haux, R. (2006). Health information systems—past, present, future. *International Journal of Medical Informatics, 75*, 268–281.
- Haux, R. (2010). Medical informatics: past, present, future. *International Journal of Medical Informatics, 79*, 599–610.
- Heeks, R. (2002). Information systems and developing countries: Failure, success, and local improvisations. *The information society, 18*, 101–112.
- Heeks, R. (2006). Health information systems: Failure, success and improvisation. *International Journal of Medical Informatics, 75*, 125–137.
- Igira, F. T., Titlestad, O. H., Lungo, J. H., Makungu, A., Khamis, M. M., Sheikh, Y., Mahundi, M., Ngeni, M. J., Suleiman, O., & Braa, J. (2007). Designing and implementing hospital management information systems in developing countries: case studies from Tanzania-Zanzibar. *Health Informatics in Africa (HELINA)*.
- Isabalija, S. R., Mayoka, K. G., Rwashana, A. S., & Mbarika, V. W. (2011). Factors affecting adoption, implementation and sustainability of telemedicine information systems in Uganda. *Journal of Health Informatics in Developing Countries, 5*.
- Ives, B., & Olson, M. H. (1984). User involvement and mis success: a review of research. *Management science, 30*, 586–603.
- Jacucci, E., Shaw, V., & Braa, J. (2006). Standardization of health information systems in South Africa: The challenge of local sustainability. *Information Technology for Development, 12*, 225–239.
- Kaplan, B., & Harris-Salamone, K. D. (2009). Health IT success and failure: recommendations from literature and an amia workshop. *Journal of the American Medical Informatics Association, 16*, 291–299.
- Kimaro, H. C., & Nhampossa, J. L. (2005). Analyzing the problem of unsustainable health information systems in less-developed economies: case studies from Tanzania and Mozambique. *Information Technology for Development, 11*, 273–298.
- Kirigia, J. M., & Wambebe, C. (2006). Status of national health research systems in ten countries of the who African region. *BMC Health Services Research, 6*, 135.
- Kirkman, G., Cornelius, P., Sachs, J., & Schwab, K. (2002). The global information technology report 2001-2002. *New York: Oxford*, (p. 4).
- Korpela, M., Soriyan, H., Olufokunbi, K., & Mursu, A. (2000). Made-in-Nigeria systems development methodologies: An action research project in the health sector. *Information Technology in Context: Studies from the perspective of developing countries*, (pp. 134–152).
- Krishna, S., & Walsham, G. (2005). Implementing public information systems in developing countries: Learning from a success story. *Information Technology for Development, 11*, 123–140.
- Kwon, T. H., & Zmud, R. W. (1987). Unifying the fragmented models of information systems implementation. In *Critical issues in information systems research* (pp. 227–251). John Wiley & Sons, Inc.
- Leidner, D. E., & Kayworth, T. (2006). Review: a review of culture in information systems research: toward a theory of information technology culture conflict. *MIS quarterly, 30*, 357–399.
- Leonard, K. J. (2004). Critical success factors relating to healthcare's adoption of new technology: a guide to increasing the likelihood of successful implementation. *Electronic Healthcare, 2*, 72–81.
- Littlejohns, P., Wyatt, J. C., Garvican, L. et al. (2003). Evaluating computerised health information systems: hard lessons still to be learnt. *Bmj, 326*, 860–863.

- London, L. (2008). What is a human-rights based approach to health and does it matter?. *health and human rights*, 65-80.
- Lucas, H. (2008). Information and communications technology for future health systems in developing countries. *Social Science & Medicine*, 66, 2122–2132.
- Ludwick, D. A., & Doucette, J. (2009). Adopting electronic medical records in primary care: lessons learned from health information systems implementation experience in seven countries. *International Journal of Medical Informatics*, 78, 22–31.
- Luís Mosse, E., & Byrne, E. (2005). The role of identity in health information systems development: A case analysis from Mozambique. *Information Technology for Development*, 11, 227–243.
- Lungo, J. H., & Iqbal, F. (2008). Development of health information system in Zanzibar: practical implications. *Journal of Health Informatics in Developing Countries*, 2.
- Malik, M. A., & Khan, H. R. (2009). Understanding the implementation of an electronic hospital information system in a developing country: a case study from Pakistan. In *Proceedings of the Third Australasian Workshop on Health Informatics and Knowledge Management-Volume 97* (pp. 31–36). Australian Computer Society, Inc.
- Mbarika, V., & Meso, P. (2008). Editorial: Information systems research for Africa: A renewed focus. *The African Journal of Information Systems*, 1, 1.
- Mengiste, S. A. (2010). Analysing the challenges of is implementation in public health institutions of a developing country: the need for flexible strategies. *Journal of Health Informatics in Developing Countries*, 4.
- Namakula, S., & Kituyi, G. (2014). Examining health information systems success factors in Uganda's healthcare system. *The Journal of Global Health Care Systems*, 4.
- Nguyen, L., Bellucci, E., & Nguyen, L. T. (2014). Electronic health records implementation: An evaluation of information system impact and contingency factors. *International Journal of Medical Informatics*, 83, 779–796.
- Nielsen, K., Mock, C., Joshipura, M., Rubiano, A. M., Zakariah, A., & Rivara, F. (2012). Assessment of the status of pre-hospital care in 13 low-and middle- income countries. *Prehospital Emergency Care*, 16, 381–389.
- Nyella, E. (2009). Challenges in health information systems integration: Zanzibar experience. In *Information and Communication Technologies and Development (ICTD), 2009 International Conference on* (pp. 243–251). IEEE.
- Olson, M. H., & Ives, B. (1981). User involvement in system design: an empirical test of alternative approaches. *Information & Management*, 4, 183–195.
- Razzak, J. A., & Kellermann, A. L. (2002). Emergency medical care in developing countries: is it worthwhile? *Bulletin of the World Health Organization*, 80, 900–905.
- Rockart, J. F. (1979). Chief executives define their own data needs. *Harvard business review*, 57, 81–93.
- Rockart, J. F. (1982). The changing role of the information systems executive: a critical success factors perspective. Boston: Massachusetts Institute of Technology.
- Sabherwal, R., & Robey, D. (1993). An empirical taxonomy of implementation processes based on sequences of events in information system development. *Organization Science*, 4, 548–576.
- Saunders, C. (2007). Editor's comments: information systems in developing countries. *MIS Quarterly*, 31, iii–VI.
- Shankardass, K., Renahy, E., Muntaner, C., & O'Campo, P. (2014). Strengthening the implementation of Health in All Policies: a methodology for realist explanatory case studies. *Health policy and planning*, czu021.
- Seddon, P. B., Staples, S., Patnayakuni, R., & Bowtell, M. (1999). Dimensions of information systems success. *Communications of the AIS*, 2(3es), 5.

- Sheikh, M. (2014). Digital health information system in Africa resource poor countries: current challenges and opportunities. *Journal of Health Informatics in Developing Countries*, 8.
- Spiegel, J. M., Lockhart, K., Dyck, C., Wilson, A., OHara, L., & Yassi, A. (2012). Tool, weapon, or white elephant? A realist analysis of the five phases of a twenty-year programme of occupational health information system implementation in the health sector. *BMC medical informatics and decision making*, 12, 84.
- Swinfen, R., & Swinfen, P. (2002). Low-cost telemedicine in the developing world. *Journal of Telemedicine and telecare*, 8, 63–65.
- Tetteh, G. K. (2014). State-of-the-art: Research theoretical framework of information systems implementation research in the health sector in sub-Saharan Africa. *Journal of Health Informatics in Developing Countries*, 8.
- Tomasi, E., Facchini, L. A., & Maia, M. d. F. S. (2004). Health information technology in primary health care in developing countries: a literature review. *Bulletin of the World Health Organization*, 82, 867–874.
- VanRooyen, M. J. (2002). Development of prehospital emergency medical services: strategies for system assessment and planning. *Pacific health dialog*, 9, 86–92.
- Vos, J. F., & Achterkamp, M. C. (2006). Stakeholder identification in innovation projects: Going beyond classification. *European Journal of Innovation Management*, 9, 161–178.
- Walsham, G., Robey, D., & Sahay, S. (2007). Foreword: special issue on information systems in developing countries. *Management Information Systems Quarterly*, 31, 6.
- Waseem, H., Naseer, R., & Razzak, J. A. (2010). Establishing a successful pre-hospital emergency service in a developing country: experience from rescue 1122 service in Pakistan. *Emergency Medicine Journal*, (pp. Emj–2010).
- Williams, F., & Boren, S. A. (2008). The role of electronic medical record in care delivery in developing countries. *International Journal of Information Management*, 28, 503–507.
- Wisborg, T., Murad, M. K., Edvardsen, O., & Husum, H. (2008). Pre-hospital trauma system in a low-income country: system maturation and adaptation during 8 years. *Journal of Trauma-Injury, Infection, and Critical Care*, 64, 1342–1348.
- World health organisation, W.H.O. (2010). Who.int. Retrieved 7 May, 2015, from http://www.who.int/workforcealliance/members_partners/member_list/aphra/en/
- Wood-Harper, T., Bell, S., Bhatnagar, S., & Bjorn-Andersen, N. (1990). Information systems development for developing countries. *Information Technology in Developing Countries*, in: Bhatnagar, SC and Bjørn-Andersen, N. (Eds.), (pp. 23–39).
- Wootton, R. (2001). Telemedicine and developing countries — successful implementation will require a shared approach. *Journal of Telemedicine and Telecare*, 7, 1–6.