

The Adoption of Information System Technology in Piloting the Current State of Health Institution in Tier Three Nations

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Abstract

This article is a pragmatic approach on the evaluation and implementation of the health information system as directed in assisting medical institutions to store patients' health record in an electronic based method. In order to manage lots of information, the health information system comes in handy to sort data, processes and people. The system which consists of a set of interrelated components gathers, stores, and disseminates health or organizational related information of individuals working in the same health sector. All around the world the applications of digital health technology have become vital tools of modern information technology which has aided in the smooth and efficient delivery of quality healthcare. Studies have shown that the success of the electronic health information system implementation in developing countries is still low, and various reasons have however been identified as the cause of this poor outcome. This article is a pragmatic approach on the evaluation of information system technology adoption in the Nigerian health sector. The work focuses on factors that will determine the successful implementation of the health information system in health institutions in Nigeria, and how these factors can be enhanced using the Information System Quality Dimensions (Service Quality, System Quality, and Information Quality) as findings from this study show that attention should be on updating and upgrading the Information System quality dimensions (service Quality, Information Quality, and System Quality) since it reveals that there is a high dependence on these dimensions to bridge the research gap; as results show that there is an overall correlation between the analyzed variables.

Keywords: Health information system, IS success model, Information system technology, electronic health, Service Quality, System Quality, and Information Quality, Information System Quality Dimensions, patients' health record.

1. Introduction

Health information system is introduced to move from the paper-based method of data collection to a more systemic way of organizing and sharing of the data. The implementation of the HIS is aimed at aiding health practitioners as well as administrative staff to secure patients' health record in an electronic based manner. To manage a lot of information, the health information system is needed to sort and arrange data, processes and people. The information system collects, stores, and shares health information or

organizational activities of individuals working in the same health sphere (Mohamadali & Aziz, 2017). Technology is being adopted worldwide to provide and deliver healthcare and E-health is deemed as essential for solving problems facing healthcare systems of increasing demand due to an ageing population and improved treatments as well as limited resources (Ross et al., 2016). Electronic health applications refer to the set of software applications that deliver tools, processes and communication systems to support electronic healthcare practices. These applications enable the transmission and management of healthcare related information and hence contribute towards patient's health improvement and the medical practitioners' performance (Chauhan & Jaiswal, 2017). The HIS applications are developed to provide a channel for the various vital departments in a hospital such as human resource finance and etc. to communicate with one another (Mohamadali & Zahari, 2017).

Although, according to what studies have shown, the adoption of e-health technologies has been inconsistent within the healthcare practice and has been sluggish. Summarily, the outcome of e-health technology does not correspond with the proposed benefits (de Grood et al., 2016). The implementation of ICT in the healthcare division is considered as the pushing force in the unravelling healthcare reforms in developing and developed countries. There is an assumption behind the developmental policies that investing in ICT is the pavement towards social and economic development (Boore et al., 2017). Electronic health comprises of different applications that support the care and management of patients, and they include: Health Knowledge Management, Consumer Health Informatics, electronic Medical Records, M-Health, Healthcare Information Systems and Telemedicine (Boore et al., 2017). In response to countries emerging e-health initiatives, organizations such as the world health organization, international telecommunication union and the organization for standardization embraced the role of disseminating knowledge, sponsoring discussion forums, facilitating collaboration, and developing tools and other guiding documents that would enable policy makers and public servants understand the power of e-health and its complexity. Countries and stakeholders were urged to direct their efforts towards i) creating a consistent e-health vision that would adhere to the country's needs and resources ii) developing an action plan to deliver the proposed vision and iii) creating a framework for monitoring and evaluating e-health implementation and progress (World Health Organization, 2019).

Health care institutions in Nigeria have failed to adhere to the world trend of information systems nor implement the right policies that can ensure the proper storage and easy retrieval of patients' health information as well as an efficient health care administration (SULEIMAN, 2023). Various studies have revealed that a lot of large-scale information system projects are experiencing failure for several reasons. A particular study by Fowler reveals that just 28% of IS have successful performance. This failure has a negative outcome on health staff and health care. To realise a successful outcome, it is very vital that this system is successfully implemented and consistently utilized (Wijayati & Achadi, 2023). Furusa & Coleman, (2018) agree that the implementation of e-health has been low in a lot of developing countries because they are faced with barriers ranging from a lack of resources to equip their health institutions with new technologies to limited budgets allocated to the health sector, poor policies that fail to address short term and long term needs as well as a lack of information communication technology knowledge and skills. The state of e-health system globally is not the same as there is no general approach in its implementation; countries use various approaches towards e-health implementation. Even though the progression to mobile learning in the medical education sphere for example, is on the increase in the developing countries, they may encounter notable challenges in adopting this new structure, particularly in Sub-Saharan Africa (Mbada, 2020).

Previous studies have stated that the implementation of electronic health information systems in the developing countries have yielded negative success outcomes due to some factors that are not taken into consideration prior to implementation (Muhaise & Kareeyo, 2017). To adopt a new technological innovation like e-health, there is a need to carry out a readiness assessment of medical care institutions by medical staff and managers at the beginning stage of development and at intervals after implementation to produce guidelines that can address the likely obstacles after implementation and assess the successes of the system. However, there is a gap between planning to adopt e-health technology and the sustainable adoption of the technology to achieve the expected goals. However, a developing country like Nigeria is yet to bridge this gap (Zayyad & Toycan, 2018). According to the National Electronic Health Records Survey National Centre for Health Statistics; in the United States the percentage of physicians using any EHR system varied depending on the state. For example, it ranged from 54% in New Jersey to 89% in Massachusetts. The adoption of e-health systems and the success of e-health adoption have been low in both developed and developing countries respectively. The developing countries are faced with the challenges of lack of technical expertise, insufficient e-health infrastructure and computer skills of staff. Therefore, it should be notable that the global state of e-health is not reliant on the availability of technology alone but other factors as well (Furusa, S. S., & Coleman, A. 2018). (Omotosho & Ayegba, 2019) stated that despite the fact that electronic mode of healthcare delivery is progressively known and utilized even in developing nations; they are still faced with a bulk of challenges during implementation and utilization of e-health services in small and large measures. (Yosser, 2020) affirms that there is plentiful evidence among the developing nations that several pilot e-health projects couldn't transition to implementation in full scale.

This article focuses on assessing the current state of affairs on the adoption of the information system technology in the health sector of Nigeria by evaluating the impact of Information system quality dimensions and the relationship with other variables within an information system success model.

2. Literature Review

The materializing of digital and clinical technologies are tweaking health services. The rise of e-health technology is improving patient centered care and is about the improvement of electronic data management, storage and capacity while at the same time providing patients, clinicians and providers with accessible information. Aligned to the developments in e-health capacities, new clinical technologies, monitoring and diagnostic capabilities and accompanying treatment options are growing speedily. The authors from a study conducted on a series of case studies in a book written by key policymakers, scholars and experts looking at health systems and their projected successes to 2030; derived from ten chapters, the ways in which clinical technology and information technology can be used to improve the orderliness and timeliness of care delivery and patients' access to services and information. Examples of such 14 technological initiatives are: m-health in Lebanon, the electronic national health information system in Papua New Guinea, the establishment of Italy's national health technology assessment program, e-consultation services in Estonia, the United Arab Emirates implementation of unified medical records and the learning health system in Sweden (Braithwaite et al., 2018).

The field of medicine practice necessitates the use of ICT to support record keeping, decision making and the processing of information (Taiwo Adeleke et al. 2015). The implementation of e-health in Nigeria is still at the preliminary stage and while the government has made attempts to develop and exploit the application of e-health technology in hospitals to enhance the quality of healthcare, the healthcare staff

complained that they were not kept abreast during the planning stage (Zayyad & Toygan, 2018). According to a reported survey, African countries like Ghana, Kenya and South Africa, (with Kenya having the lead in the digital health market) have the majority health and e-health informatics strategies implemented. Also in Africa, patients' account of their medical histories is usually disintegrated, disconnected and shared out amongst several healthcare givers platforms that could either be private or public and this constitutes a problem that limits sharing, accessibility and completeness of information, specifically with public hospitals that are not Ict accommodating. This claim supports the report that in developing countries, the private health organizations are more Ict compliant than the public health organizations (Omotosho & Ayegba, 2019).

To probe consumer's current level of knowledge and understanding on the usage of Ict in healthcare, (Hossain, 2019) asked the respondents if they had an inkling that ICT (mobile gadgets, devices and the internet) can be used to get e-health services. The author also asked respondents to mention possible uses of Ict in getting healthcare services in order to ascertain consumer's perception on the possible utilization of ICT in getting healthcare services. The health information system is a 13 computerized system that can help hospitals to derive value for the health care system and the administration system also. Reasons for the adoption of HIS in hospitals vary and include registration, appointments, admission, clinical data documentation management, discharge and etc. The success of a Health Information System implementation is dependent on how well the technology is implemented and adopted to enhance clinical performance and yield the positive required results. In contrast to the paper-based method of documentation, the electronic method of documentation provides more quality, originality and integrity of stored information where those who can have access to patients' data are only the authorized personnel, which strengthens the integrity of stored data in the system (Mohamadali & Zahari, 2017). Regardless of adjustments in hardware and software, a technology with the capability to be maintained over a long time is a sustainable one (Mohamadali & Mohammed, 2019).

3. E-Health Card framework

Adebayo & Ofoegbu, (2014) define the e-health card as a small smart ID card combining integrated circuits that is portable and can fit into a wallet easily. This card can process data and provide secure services to organizations to support identity-based applications and authorization management. It is designed to contain medical history and doctors' prescriptions for their patients. Furthermore, it will provide patients with secure copies of their personal electronic health records. In the financial sector this has been used largely, with examples such as ATM cards, credit cards, etc. A prototype of the e-health card system has been made by Mohammed and Palash for the developing countries. Some authors have also implemented electronic medical records for the third world economies. The goal however is to determine people's disposition to the adoption and use of a system that is similar to the proposed one's benefits of adopting the e-health card system. The benefits of the e-health card system are as follow:

1. Patient information portability.
2. Easier and faster access to patient's records.
3. Efficient storage of patient data.
4. Better diagnosis and faster administration.
5. Easy accessibility to healthcare and cheap services.
6. Patient's data confidentiality.
7. Availability of patient data upon requirement.



Figure 1 Awareness distribution Chart of E-health system (Adebayo & Ofoegbu,2014)

Going by survey conducted by the authors with focus on medical practitioners, the results from the chart above show that 42% of the respondents have heard about, have an idea, and understand the concept concerning the proposed system, 56% have no idea about it but understand the concept while 2% do not have any idea nor have no understanding as well about the concept.

4. Research model

The research model adopted for this research is an integration of the DeLone and McLean IS success model. The DeLone and McLean information systems success model which was first set forth in 1992 and modified in 2003 has been classified into six major groups namely: system quality, information quality, service quality, (intention to) use, user satisfaction, and net benefits. Various researchers have utilized this model in their IS studies, some of which are: assessing the success of knowledge management systems, e-commerce systems and a lot more. The model has also been tested and applied in several health information systems studies in developing and developed nations hence it was noted that it serves as a good framework for the evaluation of health information systems. In Ethiopia for instance, in modelling the precursory of electronic medical records system implementation success in their hospitals, findings reveal that the constructs and relationships represented in the DeLone & McLean model are relevant in the success of a system's assessment. Another study of an emergency response medical information system validated the usefulness of the DeLone and McLean model in the evaluation of health information systems. Findings revealed that the quality dimensions represented in the model influences user satisfaction and intention to use which thus affected the individuals' perception of the system's impact. Other findings from a conducted study that evaluated the performance of newly developed information systems in three government hospitals located in Korea, reported that the quality dimensions which

includes system quality, information quality, and service quality relevantly related to user satisfaction and net benefits (Ojo, 2017). Due to the complexity and challenges in the information systems field, practitioners and scholars are enthusiastic to upgrade the functionality and quality of new systems in order to tap into its prospective growth. The overall quality construct which includes system quality, service quality, and information quality has been studied. The result in unanimity finds that there is a positive relationship in existence between quality and satisfaction as well as actual usage. The overall quality influences the user satisfaction while quality in the technological context influences affects the actual usage. System quality has been defined as the extent to which system users have a belief that the system is easy to use, learn, connect and enjoyable to use, and user friendly. Service quality is addressed through these characteristics, namely: reliability, assurance, functionality, tangibles, responsiveness, interactivity and empathy. Service quality affects user satisfaction and actual usage. Information quality is defined as the extent to which system users think that online learning information is accurate, relevant, up to date organized and comprehensive; and is a critical factor that determines satisfaction and actual usage. Actual usage is defined as the extent to which a person utilizes the capabilities of an IS in respect to the nature, duration, and frequency of use. Although there is a mixed bag of results, it's determined that there is a vital relationship between actual usage, satisfaction, and performance. However other studies state that this relationship is insignificant. Some other studies explored the effects of satisfaction on actual usage, but this study explores the effects of actual usage on satisfaction. User satisfaction is defined as the degree to which a user perceives a system useful and intends to use it again (Aldholay, 2018). (Ighe, 2019) mentions that the value of an online health information is determined by the quality of information users have access to and there are proofs that some online health information portals produce poor quality of information as a result of the exclusion of information quality needs in the beginning stages of the system creation process. Results reveal that most frameworks pay more attention to the technical aspect instead of the human aspect that is the actual usage of the information by users, during the capture of the information quality needs.

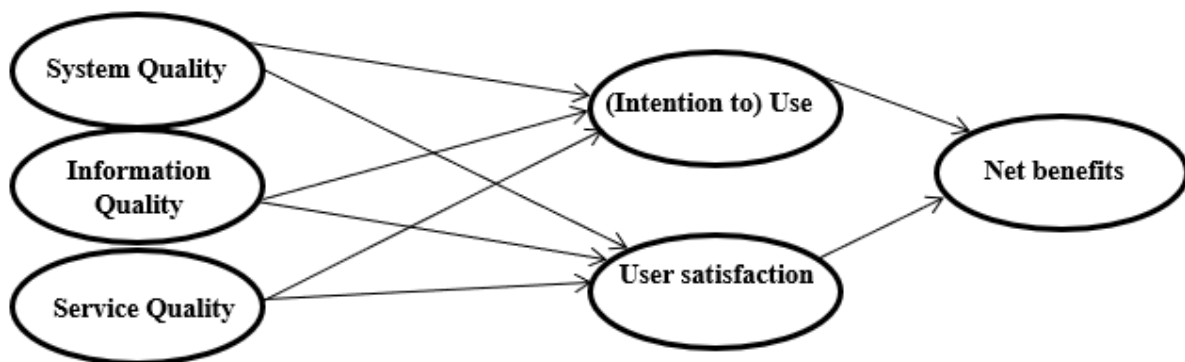


Figure 2: Proposed Research Model

The above model results in the below hypotheses:

H1: The quality dimensions (system quality, information quality, and service quality) of the HIS has an impact on the intention to use and actual use of the HIS

H2: The quality dimensions (system quality, information quality, and service quality) of the HIS positively relate with the user satisfaction in using the HIS

H3: The quality dimensions (system quality, information quality, and service quality) of the HIS relate with the net benefits in using the HIS

(Jaafreh, 2017) Defines the constructs thus:

- **Systems quality:** As defined by DeLone and McLean system quality is “the desired characteristics of the information system itself, which produces the information”. These desired characteristics include system flexibility, response time, intuitiveness, reliability, sophistication, ease of use, and ease of learning.
- **Information quality:** This includes desirable characteristics such as accuracy, completeness, timeliness, relevance, usability, understand-ability, currency, and conciseness and hence is defined as “the desirable characteristics of the system outputs”.
- **Service quality:** This quality consists of characteristics such as technical competence, responsiveness, accuracy, and reliability. Service quality is “the quality of service that the system users receive from the IS organization or IT support personnel”.
- **System use and Intention to use:** The intention to use is an attitude while Use is an action by the user to operate and learn the information system. System use is “the degree and manner in which staff and customers utilize the capabilities of an IS. E.g. frequency of use, appropriateness of use, purpose of use, amount of use, nature of use, and extent of use.
- **User satisfaction:** As defined by DeLone and McLean, it is “the recipient’s response to the utilization of the output of an IS”. Also, it can be defined as a user’s height of satisfaction with using the information system.
- **Net benefits:** Two dimensions namely: individual impact and organization impact were grouped into one by DeLone and McLean and named Net benefit.
Net benefits are defined as “the extent to which information system are contributing to the success of groups, individuals, industries, organizations, and nations”. Examples are: increased sales, improved decision making, improved profits, improved decision making, consumer welfare, economic development, improved productivity and etc.

5. Research method

This article meets its objectives via a quantitative research method. The aim of the quantitative method is to seek precise measurement and analysis of aimed concepts for example using surveys, questionnaires and etc. The sampling method utilized in this study is the stratified sampling method which is a type of probabilistic sampling. (Mweshi & Sakyi, 2020) Support this process by explaining that the stratified sampling method is appropriate when a population has mixed qualities where the need is to make sure that every quality is represented proportionally in the sample. (Elfaki, Musa & Deji 2023).

5.1 Population sample and data collection

The data collection took place in 19 hospitals across 4 states in Nigeria utilizing a questionnaire that consisted of six variables and four demographics. The demography of the questionnaire was based on Gender, Profession, Age and IT knowledge level. The population of this study consisted of medical employees of the health care institutions of Nigeria. The units of analysis utilized for this study are the hospitals utilizing an information system. The sample size decided so as to get a decision model is 377 health employees. The survey method used was deemed the most appropriate for the study in order to measure the factors being explored. A five-point Likert-scale was used to represent the responses of the

respondents from 5 (strongly agree) to 1 (strongly disagree). An online calculator was utilized to calculate the sample size. However, since the total population size was not known, an estimated population of 20,000 was used for the calculation with a 95% confidence level and a 5% margin of error which resulted in a 377-sample size but 228 was used for the analysis from the total questionnaires due to incomplete responses from few of the respondents. The model constructs: service quality, system quality, information quality, intention to (use), and net benefits each had four measurement items while user satisfaction had three measurement items.

5.2 Demographic Analysis

This is a descriptive measure analysis that is utilized to describe the characteristics of the study sample.

Table 1: Statistical value of demographic analysis

		Sex	Pro	Age	Knowledge
N	Valid	228	228	228	228
	Missing	0	0	0	0
Skewness		-.142	.067	.281	-.119
Std. Error of Skewness		.161	.161	.161	.161
Kurtosis		-1.998	-1.613	-.630	-.508
Std. Error of Kurtosis		.321	.321	.321	.321
Sum		350	448	390	490

Table 2: A Frequency table for Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	106	46.5	46.5	46.5
	Male	122	53.5	53.5	100.0
	Total	228	100.0	100.0	

Table 3: A frequency table for Profession

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Doctor	86	37.7	37.7	37.7
	Nurse	64	28.1	28.1	65.8
	Other profession	78	34.2	34.2	100.0
	Total	228	100.0	100.0	

Table 4: A Frequency table for Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	25-39	86	37.7	37.7	37.7
	40-50	122	53.5	53.5	91.2
	50 and above	20	8.8	8.8	100.0
	Total	228	100.0	100.0	

Table 5 : A Frequency table for IT Knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low IT knowledge	30	13.2	13.2	13.2
	Average IT knowledge	134	58.8	58.8	71.9
	High IT knowledge	64	28.1	28.1	100.0
	Total	228	100.0	100.0	

The tables above display the statistics of the valid number of samples which totals a number of 228 with 0 missing. Tables (2, 3, 4, and 5) show the distribution of the samples received based on gender just about (Female 47% and Male 54%). The profession (doctor, nurse and other profession) represents just about 38%, 28.1% and 34.2% respectively. The age range from 25 to 39 years represents just about 38%, 40 to 50 years 56% and 50 above 9%. The IT knowledge levels (Low IT, Average IT and High IT) respectively represent 13.2%, 59% and 28.1%.

5.3 Reliability Coefficients

The alpha test used to evaluate the reliability is carried out utilizing all questions in the questionnaire. The purpose of this test is to assess the consistency of the instrument. The result of this test is thus shown below:

Scale: All Variables

Table 6: Case Processing Summary

		N	%
Cases	Valid	228	100.0
	Excluded	0	.0
Total		228	100.0

a. Listwise deletion based on all variables in the procedure.

Table 7: Reliability Statistics

Cronbach's Alpha	N of Items
.901	31

The results from the tables above shows that the reliability coefficient for the dimensions of IS success overall is 0.901 which is deemed acceptable for this study.

5.4 Correlation Analysis

The Pearson’s correlation model is used in this study to test the statistics that measure statistical relationship between two set of continuous variables. It shows whether the direct associations between the variables of the model are significant or insignificant as well as the strength of the relationships.

6. Data Analysis Result and Findings

A descriptive measure analysis was utilized to describe the characteristics of the study sample.

The IS quality variables have an overall significant correlation with (intention) Use, user satisfaction and net benefits. Therefore, all tested relationships showed significant correlations.

1. The impact of information system quality (service quality, information quality and system quality) on (intention) Use overall was significant, but with each measurement item showing either positive/negative/significant/insignificant relationships, moderate or weak strength however with the exception of one information quality measurement item which showed no relationship with another measurement item under (intention)Use. Overall correlation results indicate that the IS quality affects the user’s intention to use, and actual use of the system in hospitals. However, based on the correlations that were weak and insignificant, the IS quality should be further analysed and enhanced to get more significant results with stronger strength in the context of the subject’s objective.
2. The impact of the information system quality (service quality, information quality and system quality) on user satisfaction and net benefits overall was 93 significant, but with each measurement item showing either positive/negative/significant/insignificant relationships, moderate or weak strength. Overall correlation results show that the IS quality affects the users satisfaction of the system and the value they get from the system. However, based on the relationships that were weak, the IS quality should be further analysed and enhanced to achieve better satisfaction and more value from the system.

Table 8: Research Findings Summary

HIS Success Factors with Relationships	Significance level	Non-existent Relationships
The Information system quality dimensions (service quality, information quality and system quality) has an impact on the (Intention) Use and hence	The service quality has an overall significant correlation with the (intention) use at the 0.01 level (2-tailed).	The information quality has the least impact on the (Intention) Use

are success factors for the adoption of HIS in Nigerian hospitals.	The information quality has an overall significant correlation with the (intention) Use at the 0.01 and 0.05 levels (2-tailed).	because one of the measurement items has no relationship with another measurement item under the (Intention) Use. Hence, information quality is the least success factor for the adoption of HIS in Nigerian hospitals.
	The system quality has an overall significant correlation with the (intention) use at the 0.01 level (2-tailed).	

The Information system quality dimensions (service quality, information quality and system quality) has an impact on user satisfaction and net benefits and hence are success factors for the adoption of HIS in Nigerian hospitals.	The service quality has an overall significant correlation with user satisfaction at the 0.01 and 0.05 levels (2-tailed).	
	The service quality has an overall significant correlation with net benefits at the 0.01 and 0.05 levels (2-tailed).	
	The information quality has an overall significant correlation with user satisfaction at the 0.01 level (2-tailed).	
	The information quality has an overall significant correlation with net benefits at the 0.01 level (2-tailed).	

	The system quality has an overall significant correlation with user satisfaction at the 0.01 and 0.05 levels (2-tailed).	
	The system quality has an overall significant correlation with net benefits at the 0.01 and 0.05 levels (2-tailed).	

<p>Summarily, the highest HIS adoption success factors in Nigerian hospitals are the: Quality of service provided by the information system, the quality of the system’s output itself, the Satisfaction the medical personnel derive from utilizing the system, and the benefits they gain from using the system (Net benefits); because these factors all show relationships, while the Information Quality is the least success factor.</p>		
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7. Conclusion

The results and findings will be very relevant to not just health practitioners but other researchers as well, as they can expand on the IS success model and apply it to carry out similar research in other environment or settings. This study reveals that there is a high dependence on the IS quality dimensions to bridge the research gap. Health practitioners on the other hand can benefit from the result of this study by utilizing it to enhance the quality of IS in order to produce better outputs in relation to health care delivery.

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