

# IMPACT OF USER REQUIREMENTS ON HEALTH INFORMATION SYSTEMS (HIS) AND ADOPTION OF HIS IN DEVELOPING COUNTRIES

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## ABSTRACT

This study aims to explicate the strategic utilization of Information Systems (IS) in health sector of utmost significance as Health Information System (HIS). There is a fundamental role in improvement of IS and knowledge transfer, especially in developing countries and following of Millennium Development Goals (MDGs). HIS, despite of its importance for a secure access to patients' vital medical information among doctors, nurses, pharmacists, other healthcare providers, and the patients themselves, is still in its infancy in the developing countries. A number of barriers have been identified as the root cause of the problem, the most challenging of which is the lack of user requirements. Generally, the previous studies on HIS have not taken into account the factor of user requirements. Furthermore, to date, there is no comprehensive model available for the success of HIS, which takes the impact of user requirements factor in the developing countries into consideration. Thus, the present study addresses this gap by exploring the influence of user requirements factor on HIS in Yemen. Rapidly evolving technology transforms IS and information transfer significantly without the rapid pace of IS in the healthcare sector that leaves no support choice for service providers if they want to remain competitive. Human capital, an important element in the context of relationships with contemporary employees, is the most important competitive advantage in healthcare systems. Therefore, healthcare professionals need a new strategy for the public health sector and the training of their employees. Besides, the knowledge and skills of health professionals are not only vital components, but also essential for the quality of care and health of society. Therefore, these motivations mean that today's health care providers are embracing IS in the health sector.

**Keywords:** health Information system quality; user requirements; health information system; information system; developing countries;

## 1. INTRODUCTION

There is widespread belief that most of the national and sub-national Health Information Systems (HIS) are not able to provide information support necessary for evidence based health planning and intervention area [1]. Moreover, the role of information in lending support to the HIS in Yemen it started with a basic statistical reporting system through an ICT-enabled Health Information Management System (HIMS) [2].

Furthermore, the role of information in supporting of HIS in Yemen has started from a basic statistical reporting system through to an ICT enabled HIMS. The building blocks to facilitate the implementation of such system are through the development of Health Informatics standards and a mechanism for the adoption of such standards. The legislative support required to enable a wider adoption by all stakeholders is vital for successful implementation. Health Information Technology (HIT) has the potential to improve the quality, efficiency, outcomes, patient safety and reduce the cost of healthcare. However, accordingly [3] Problems identified lack of availability of these systems especially in developing countries, insufficient works on end user acceptance of HIT systems. These limitations can be overcome when researchers study the factors that will affect the user acceptance of these systems, and then consider the factors while developing the systems. It further contributes by identifying their dimensions and providing an instrument for their measurement in future research- It validates an instrument for measuring project success. It provides support for expectations that more outcome-based contracts, more monitoring, less shirking, and less misrepresentation of privately held information lead to project success. Finally, it contributes by contradicting expectations that more goal conflict and more task programmability lead to more outcome-based contracts and that more outcome-based contracts lead to less monitoring. These findings should help IS project managers better manage projects.

Information Technology is widely utilized in private as well as public sector organizations, as evidenced by a great margin of financial resources allocated to Information Technology (IT). IT sector is an important contributor to the national economy and an active generator of new projects, jobs, and investments [4]. Information plays an essential part in our life and the way to react with the external environment. It is essential that IS projects are properly scoped and implemented successfully. IS as technological tools are widely used in organizations, each according to its field requirements. It is rare to find an organization without an information system or some form of technology to perform its daily routine activities [5]. In order to take advantage of the vast potentials of Information Technology most countries of the world have developed national IT project policies to serve as a framework for IT integration in all aspects of the society [6].

Organizations are increasingly delivering their products and services in project specific environments with emphasis placed on the success of the various projects. As projects are increasingly used as a way to organize work towards achievement of organizational objectives, there is simultaneous pressure on firms to achieve their objectives through projects, thereby forcing them to view success as a combination of both project and project management success[7]. The investment in information technology (IT) projects is a challenging task with many projects failing to achieve their intended objectives. Furthermore, the institutions across the IT projects have high failure rates because of the nature of domain and the rapid technology changes. Therefore, it is important to understand the factors causing IT project success or failure[8].

Thus, success and failure are difficult to define and measure since they mean different things to different people. However, success is a concept that is critical when we are trying to foretell the future of our projects. Although, IT project failure is considered widespread there is no commonly agreed definition of success and failure[9]. The success is not always easily to define and measure due to the different meanings it may carry for different people [7]. Traditionally, project success has been defined in terms of the “iron-triangle”, i.e. time, cost and quality, as suggested by [10] argued that, various factors are perceived to contribute to project success or failure and different criteria have also been put forward as contributing towards success and failure.

Many IT projects fail through many reasons such as; these projects maybe not within budget, or not on time or do not deliver what was promised. Failures in IT projects are more common than failures in any other aspects of the modern businesses. Whereas there are large number of projects is obvious failure. Other factors have been identified such as poor project management, poor monitoring and control by the project manager and lack of incentives for: developers may contribute to project failure [6].

These factors may leads to project success if it addressed well. There is no single cause of IT project failure, no simple solution but if the various influencing issues are understood and managed, chances of success will increase. Moreover, many earlier studies strived to identify factors leading to delays, lost productivity particularly in construction projects [6]. According to [11], understanding early warning signs in the project can improve the project`s chances of not being considered as a failure. Based on the above discussion , further research are needed to go beyond the conventional performance measurement frameworks of IT Projects implementation to look at the Failure reasons and factors that influence IT.

Many researchers assumed that if a project`s did not fulfil a company`s predetermined performance measures, the project was assumed to fail [6]. Identification IT projects fail and main top factors that influence these failures are very important to organization top management, project management teams and organization stakeholders. Therefore, many organizations do not critically examine the causes for project failure and this prevents them from learning from their mistakes [12].

Yemen has come out with a number of strategies such as National Information Technology Center, Universal Services Provider, Rural Internet Center and Rural Info Center to strengthen and encourage ICT usage among the rural community [13]. The benefit of adopting ICT in healthcare is even more significant where the Yemen population growth rate will remain high in the next 20 years comparatively to the slow economic growth resulting in Yemen population being young but poor Thus, it can be foreseen that increased government pressure to provide major healthcare services to the society in the future will become a more pressing issue [14]. Studies related to healthcare ICT integration in Yemen are relatively little [14]. Users requirements can be calcified into two categories include functional and non-functional requirements.

Understanding user requirements is an integral part of information systems design and is critical to the success of interactive systems. However specifying these requirements is not so simple to achieve. It is now widely understood that successful systems and products begin with an understanding of the needs and requirements of the users. Therefore, User requirements which reflects the focus on user needs and perceptions is a vitally important factor for user interaction design for the personalized goal to gain. User requirements for personalized and adaptive services in Integrated Service Creation. However, User requirements reflect the focus on user's needs and perceptions, user requirements should be adequately captured to increase the success for personalized service.

Non-functional requirements mean to capture some preferred behaviours among those captured by functional requirements[15]. However, the term 'non-functional requirement' emerged way back in nineteen sixties and lot of research has been done but still, till date we have no standards of specifying, measuring and validating the non-functional requirements, often termed as NFRs are these days considered to play a pivotal role in a successful development of a software product. Although a debate is there to consider few Non-functional Requirements as Functional Requirements[16]. Therefore, Non-functional Requirements which leads to the discovery of new Functional Requirements. Non-functional requirements (NFRs) are imposed by the environment in which the system is to operate. These kind of environments include timing constraints, quality properties, standard adherence, programming language to be used, and so on[17]

Functional requirements describe the service the system should provide and how the system will react to its inputs. In addition, the functional requirements need to state explicitly certain behaviours that the system should not do (more on this later). functional requirements can be high and general (in which case they are user requirements in the sense that was explained previously) or they can be detailed expressing inputs outputs exceptions and so on ( in which can they are system requirements , from natural language (in our case , the English language ), visual model and the more rigorous formal methods. [17]

Furthermore, the vision statement as pointed out in the national Failure reasons and factors that influence IT Projects policy of the public sector of Yemen influence IT Projects performance. Influence information system Projects is contributing to the deployment of information and communication technology. This initially implies long term visioning for improving the performance of the IT teams and staff in public health unit in Yemen. Yemen has set of problems has been identified from and relating to the lack of best practices implementation organizations implementing international process improvement standards such as Capability Maturity Model Integration are able to identify their strength and weaknesses in a systematic manner. On the other hand, organizations lacking in the implementation will not be able to assess their strength and weaknesses effectively and this will affect the process effectiveness in the long run [18].

There is also an issue of involvement the end user for project development and success which is identified as a hindrance factor [19]. The term end user is used to distinguish the person for whom a hardware or software product is designed from the developers, installers, and service of the product. Therefore, "end" part of the term probably derives from the fact that most information technologies involve a chain of interconnected product components at the end of which is the "user." Frequently, complex products require the involvement of other-than-end users such as installers, administrators, and system operators. The term end user thus distinguishes the user for which the product is designed from other users who are making the products possible for the end-user needs determines what to build and therefore has a significant influence on the success of a software project.

## **2. PROBLEM STATEMENTS**

IS in health sector are complex. While the potential health and financial benefits from the use of technological innovation in health are large, the risks are also substantial [20]. According to the authors, the majority of public sector IT applications in developed countries were either partial or total failures. Frequently, technology companies coming into the health domain underestimate its complexity and proceed on the assumption that if something has worked in another domain then it should be possible to achieve the same in health. Given the high failure rate and the very visible and often politically embarrassing failure of many health ICT projects, there has been substantial academic and industry research on the factors that cause such projects to fail. It is now widely understood that successful systems and products begin with an understanding of the needs and requirements of the users [21] User requirements are an integral part of information systems design and are critical to the success of interactive systems. However specifying these requirements is not so simple to achieve.

Regarding this, there is little research being conducted to evaluate the level of satisfaction among the information system's user [22]. Teixeira, Ferreira [23] argued that, the lack of human consideration such as end user requirements issue is among other issues that causes the failure. It is important to note that the decision of whether a requirement is invariant or not is an issue for the system stakeholders, aided by the requirements engineers [24].

Therefore, based on the above discussion, further research are needed to go beyond the conventional performance measurement frameworks of IT implementation to look at the End User requirements of IT/IS in public health units in Yemen. Samah, Shaffril [13] Argued that, Village Development Committee in Yemen have a moderate level of ICT usage. Since, failure is very costly to the organizations, affecting its success and wasted time without benefits. [25], this research formulates this problem to indicate the major causes of these failures. Indicating the main factors in public organization of Yemen by addressing the user requirements elicitation as this issue is important in project success.

### **3. RESEARCH OBJECTIVE**

Based on problem statement it has become clear that not many studies have highlighted IS factors affecting End users of IT project in the public health units. The current body of knowledge is the work of a few people that still locked empirical support. There is the need for further research in order to increase our understanding on the influence of IS/IT in user interface requirement of IS/IT Projects on the public health units. That validates the proposed framework initiative adoption especially in developing countries like Yemen. Therefore, in the content of the Yemen public sector, the research attempts achieve the following:-

1. To explore the investigated factors of health information system quality on user requirements in Sana'a, Yemen.
2. To validate and proposed that examines the quality for Health information system among health information system user requirements factor in. Sana'a, Yemen.

### **4. SIGNIFICANCE OF THE RESEARCH**

The current study recognizes the need to go beyond the conventional problems has been identified the user requirements In information system in health units .The implementation organizations implementing international process improvement standards models of IT implementation by looking at Understanding user requirements is an integral part of information systems screen and is critical to the success of interactive systems. it will identify the end user requirement factors in health units in Yemen as case study for collection the actual data from the field moreover, this research will provide new insights into improving the user requirements the very improving the user in health units beginning stages influence End user IT/IS project implementation. In sedition this study will provide policy implication and recommendation for improving the performance of user requirements context of public information system in health units in Yemen.

#### **4.1 HIS highlighted by the previous studies**

According to [26], conducted a qualitative study which sought to evaluate HIS software based on user requirements. The findings showed the HIS software met user requirement in terms of entering patient and insurance data though it failed to meet their needs related to sending messages for patient and to managing dynamic medical order. More empirical investigations have been demanded to identify the diverse issues and weaknesses of the HIS to better understand the requirements for different types of the HIS users. It is believed that the HIS implementation is conducted within users despite the fact that all of the HIS software fails to meet user needs. It is believed that the HIS implementation conducted within users. Neglect of any of these parties implies to miss related expertise, skills, knowledge, requirements and expectations. Expectation and requirement arise from what users see and hear about the system and interpret the ways the system will work for them.

This is particularly true in HIS environments where health personnel may be distrustful and even reject new technologies [27]. Consequently, the HIS may be underutilized by the users. More empirical investigations are being required to identify problem and weaknesses of the HIS for better understanding of the requirements for different types of the HIS users. If they are not satisfied of the system, they will not use it, or will not use it correctly and

efficiently. The problems arise when users reluctant and having difficulties to use the system [22]. Studies indicated that addressing user expectation is a distinct element to ensure the successful adoption of the HIS [26].

It is important to measure how customers perceive their HIS and quantifies their satisfaction rather than evaluate technical aspects of the systems and to listen to the voice of customers rather than developers' voices. A "good" IS, perceived by its users as a "poor" system [27]. It is notable that a positive user attitude towards the IT can have beneficial influence on the system adoption and one of the most important barriers of its implementation is attitudinal behavioural barriers [28, 29]. Also adequate training to the end user will determine whether the implementations of a system would go smoothly or not [30].

#### **4.2 Previous literature on the adoption of IS in health sector.**

Information system in health sector can be defined as a massive and integrated system that is created to store, manipulate and retrieve information of the administrative and clinical aspects. It provides the information needed to each level of the management at the right time, in the right form and in the right place, and decisions have to be made effectively and efficiently accordingly. The role of HIS is vital in planning, initiating, organizing, and controlling the operations of the hospital sub-systems and thereby providing a synergistic organization in the process. HIS raises the quality of patient care by making a better assessment of data and recommending better care and enabling a hospital to move from a retrospective to a concurrent review quality and suitability of care [31]

Information system in health sector is the field that concerns itself with processing of information, communicative tasks of medical practice, education and research including the information science and technology that [32]. IS in healthcare organization including hospitals has several names in literature such as health record system, electronic health record, health information system, health information [33].

The aim of HIS is to obtain the best achievement possible to support patient care and administration through the electronic data processing, improve the quality and reduce the cost, deliver high quality health services efficiently and support health care services and knowledge-based systems which equip people with sound diagnostic support and intervention for patient care activities [22, 34]. The effective use of HIS seeks to reduce unnecessary costs as well as improve patient care in the healthcare industry. In a qualitative study by [34], entitled the Implementation of HIS and its user perspective, the researchers had gathered some views on the information system development and implementation in two hospitals.

The researchers in [22], carried out a qualitative study aiming to investigate the level of user satisfaction, with regard to the use of HIS. The Findings indicated that differences between the varying types of users for HIS in Developing Countries such as Malaysia in terms of the (i) HIS interface quality, (ii) quality of the HIS Function, (iii) quality of the HIS Performance and (iv) quality of the HIS (combination of HIS interface, HIS Function and HIS Performance). The Problems emerge when users feel reluctant and have difficulties using the system. Thus, HIS is just an example of HIS, with a hospital being the health care environment.

The research in [35], conducted a study on seven public and five private hospitals using the Kuala Lumpur Computer-based clinical decision support systems (CDSS) as a key element in the decision-making process in healthcare environments with the aim of enhancing the medical care delivery quality. The aim of this research was to decide on the factors that affect adoption and therefore, the use of clinical decision support systems by hospital physicians. Notably, a positive user attitude towards the IT can have a strong influence on the system adoption [28], and one of the most important barriers of its implementation appears to be the attitudinal behavioral barriers [29].

The research in [36], designed a comprehensive, complete information system to administer the administrative, financial and clinical aspects of a hospital. Their study elaborated those aspects of the implementation of HIS in the public health care in Developing Countries such as Malaysia. A quantitative approach was used to get some views on information system development and implementation in the Malaysian hospitals to for ranking the factors that influence the implementation of HIS using the Analytical Hierarchy Process (AHP). The use of this approach in their study aimed to investigate which factors are more important in HIS implementation from the experts' perspectives. The results of performing the AHP could aid the HIS implementation success and healthcare institution to motivate their users when it comes to accepting a new technology.

#### **4.3 HIS challenges in developing countries.**

Developing countries is aware of the importance of IT to development service in public sector including the health units through the construction of ambitious ICT strategies. previous related empirical studies in HIS provides the historical perspective of the transformation of Health Management Information System to Health Information Management System, the challenges and the way forward in realizing a National Integrated HIS, health care system to meet issues and challenges of the future [37, 38]. One of the initiatives is bringing the Information System into Malaysian Public Hospitals. This is similar to enhance the ICT tools within such as Malaysia in achieving 2020 Vision to make Malaysia as developed country. Thus, this paper is aims to investigate the implementation of THIS, IHIS and BHIS in Malaysian Public Hospitals based on interviews. The findings were analysed by content analysis using Nvivo. From the findings, it was found that the HIS implementation phases have different Phases in each category of HIS hospitals, however their activities are similar.

Moreover, the types of HIS have faces with different issues and challenges of low satisfaction and acceptance levels [34]. THIS is for the organization's skills and capacity for change. This situation might bring challenges and stressful continuous learning experience. Moreover, it might create various HIS problems in future. However, the HIS also faced with several issues and challenges such as (1) high initial costs (2) time consuming (3) technology and technical problems such as complex system and integration problems (4) fundamental problems such as lack of computer skills, complex tasks, complex function and (5) ethical issues such as certification, security, privacy, and confidentiality. These challenges are lack of IT budget, luck of IT skills, lack of leadership , resistance to change, lack of infrastructure and the disruption of the structure of the national economy, the lack of formal social security, underdeveloped insurance products and investments, a rapidly changing operating environment including increasing expectations on the quality of healthcare and lack of quality nursing and aged care services to meet the increasing demand [39, 40].

In a study conducted by [38], the capital cost in equipping a hospital with Total Health information system (THIS), ranges from 80 to 100 million Malaysian The investment on THIS is significantly high and any failure on the project will be huge loss to the government. During the implementation of the project, there are several challenges have been identified if they were not addressed appropriately; they may contribute to the failure of the project. The challenges include culture, knowledge and skills, system quality, redundancy and data. Suggested that implementation of hospital information system has brought a new perspective in ICT applications development. He added that the complex nature of a hospital organization creates bigger challenge in the implementation compare to other organizations. Furthermore, being an organization that deals with human health and life add to more vulnerability of the ICT application implementation. Table 1 provides a summary of previous related studies on measuring the influence of the different variables or factors on the adoption of user requirements in the HIS with some indicators on the most significant factors.

**Table. 1** A Summary of Previous Studies on IS in Health Domain.

Author, year and the country	Key Findings
[22] in Malaysia	Differences between the varying types of users for HIS in Malaysia in terms of the (i) HIS interface quality, (ii) quality of the HIS Function, (iii) quality of the HIS Performance and (iv) quality of the HIS (combination of HIS interface, HIS Function and HIS Performance). The Problems emerge when users feel reluctant and have the difficulties in using the system. The HIS is just an example of HIS, with a hospital being the health care environment.
[26], in Iran	They found that all HIS software does meet user requirement in regard of entering patient and insurance data. Although all of the HIS software fails to meet user needs related to sending messages for patient and to managing dynamic medical order.
[35], in Malaysia	Perceived threat reduces the intention to use, involvement increases the intention to use, and the belief also increases the intention to use.

[41], in Malaysia	The interview results were categorized into a few themes namely the system development, human resource, scope of implementation, support system, user-friendly, training, hardware and security. Quality human resource, good support system, user-friendly and adequate training of the end-user will ascertain the success of the HIS implementation.
[42], in South Korea	The consumer requirements and degree of difficulty as well as the measure of importance in building service system are outlined using the Quality Function Deployment (QFD)
[43], in Malaysia	HIS information is essential for monitoring health, and for evaluating and improving the delivery of health-care services and programs. However there are several problem within the IS in health sector such as lack of trained personnel and Lack of investigating user requirements. Indicated user requirements are a distinct element that ascertains the successful adoption of the HIS. There are still several issues that need to be addressed.
[36], in Malaysia	Indicated that physicians have a elevated perception means for the technology and it showed that HIS would improve physicians' performance regarding the decision making. The relevant factors were prioritized and ranked using the Analytical Hierarchy Process (AHP).

## 5. METHOD AND HYPOTHESIS

A structured survey has been administered to seven Hospitals in late 2017. Demographic data Users have been found and analysed. Descriptive as a result, an analytical approach is used. However, This method approach was followed that consists of a quantitative approach to comparatively analyses user perceptions and experiences from various user groups, Structured quantitative were conducted with all respondents, using a combination of distributing the all questionnaire, with seven hospital population groups (nursing staff, doctors , professional, hospital administrators). Outcome from the seven hospitals of users requirements consolidate and recheck to provide a richer, more complete understanding of system automation inside hospitals in the health sector in the capital city of Yemen. In the current research, 250 questionnaires distributed among the organizations chosen as representative of the unconscious population. Initially, showing 200 questionnaires were returned 72% response rate. Many rate analysis that is extracted for the number of research questions has been filled with 100 to 100, as shown large city [44]. The summary of hypothesis showing in Table 2.

**Table. 2** Summary of hypothesis testes

NO	Hypothesis	Result
H1	Health information system quality will have a positive effect on user requirements among user on health information system in Yemen.	Significant
H1a	Information quality will have a positive effect on user requirements among user on health information system in Yemen.	Significant
H1b	System quality will have a positive effect on user requirements and integration among user on health information system in Yemen.	Significant
H1c	Service quality will have a positive effect on user requirements and integration among user on health information system in Yemen.	Significant

## 6. DATA ANALYSIS

This paper presents the data collected from the field survey consisting of the response of the respondents from 180 SMEs located in capital city of Yemen. The result of the analysis in this paper includes the followings: Participants

Personal Data Analysis, Measurement Framework analysis (Cronbach's alpha), Testing the Framework using regression analysis.

### 6.1 Participants personal data analysis

The respondents' personal data include area, gender, age and education. Thus, the sample size of the current study covered best hospitals which are the seven hospitals in Sana'a Province of Yemen with a frequency of 6.7% to 17.2%. Table 3 presents the sample size and the results of the respondents' personal data of public health sector employees. As described in Table 3, the male was the most of the respondents whereas they represented 67.8% compared to females which represented 32.2%. The younger who less than 40 years in age were represented over two-thirds of them, and the results revealed that those who are between 30 and 39 years represented probably the largest percentage in the current research as this particular group was nearly 37.8% of the respondents whereas the group of respondents between 20 and 29 years represented 27.8%. Participant in the age 40-49 years represent 21.1%. Those who are more than 50 years represent only 13.3% percent. The age categories were embraced from previous studies [45, 46].

**Table. 3** Participants Personal data analysis

Characteristic	Item	Frequency	Parentage	Valid Percentage
Area	48 Model Hospital	25	13.9 %	13.9 %
	Saudi German Hospital	41	22.8 %	22.8 %
	University of Science Technology Hospital	31	17.2 %	17.2 %
	Azal Hospital	35	19.4 %	19.4 %
	Modern German Hospital	16	8.9 %	8.9 %
	Yemen German Hospital	20	11.1 %	11.1 %
	Dr. Abdukader Al-Mutawakel Hospital	12	6.7 %	6.7 %
	Gender	Male	122	67.8 %
Female		58	32.2 %	32.2 %
Age	20-29 years	50	27.8 %	27.8 %
	30-39 years	68	37.8 %	37.8 %
	40-49 years	38	21.1 %	21.1 %
	50 years	24	13.3 %	13.3 %
Level of education	Diploma	30	16.7 %	16.7 %
	Bachelor	76	42.2 %	42.2 %
	Master	48	26.7 %	26.7 %
	Doctorate	25	13.9 %	13.9 %
	Other	1	.6 %	.6 %

### 6.2 Measurement framework analysis

According to the author, Cronbach's alpha is the most widely used measurement for assessing internal consistency. The value of Cronbach's alpha above 0.7 is acceptable, and the value above 0.8 is preferable. The reliability test of Cronbach alpha for each construct is presented in Table 4. The reliability coefficients for all construct of the questionnaires and their values are between 0.810 and 0.869. This is an indication of the high degree of reliability and consistency of the answers of the questionnaires.



**Table. 4** Cronbach's alpha for all variables

Model constructs	No of Items	Cronbach's Alpha if Item Deleted	Result
<b>Information Quality</b>	6	.810	High Level Range Reliability
<b>System Quality</b>	6	.869	High Level Range Reliability
<b>Service Quality</b>	6	.862	High Level Range Reliability
<b>Business Role</b>	5	.825	High Level Range Reliability
<b>Authorization</b>	5	.824	High Level Range Reliability
<b>External Interface</b>	9	.818	High Level Range Reliability
<b>Security</b>	5	.817	High Level Range Reliability
<b>Information Quality</b>	6	.810	High Level Range Reliability

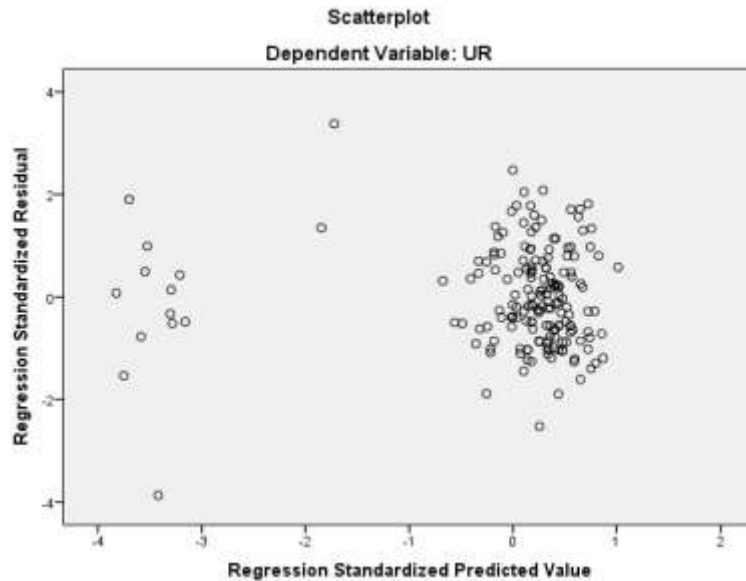
### 6.3 Regression analysis assumptions

Multiple regression analysis is to predict a dependent from a combination of several independent variables. The Correlation is a statistical technique which can show the strength and direction of the relationship between pairs of factors. In Pallant [47], other words, the aim of performing a correlation analysis is to answer the following questions: Is there a relationship between variables? What is the direction of this relationship? Is it a positive, negative or zero relationship? And how strong is the relationship between the pair variables? To answer these questions, Pearson correlation was used to explore the strength of the relationship between a pair of factors. Pearson correlation coefficients have only one value ranging from -1 to +1. A positive correlation means that increasing one variable lead to increasing the other and vice versa with the negative correlation and a correlation of zero means that there is no relationship between the two variables. In addition, a correlation of 1 or -1 means that the correlation is perfect. To interpret the correlation value, the following categories were suggested by Pallant [47], as follow, correlation coefficients ranging from 0.10 to 0.29 means small correlation, correlation coefficients ranging from 0.30 to 0.49, means medium correlation and correlation ranging from 0.50 to 1.0 means high correlation.

**Table. 5** Analysis for multicollinearity by Pearson correlation

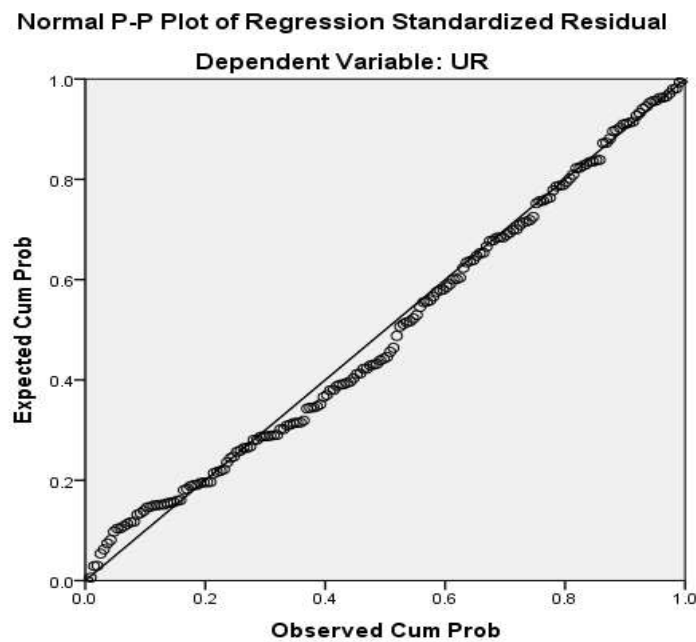
Variables	Correlations
Information Quality	.755
System Quality	.403
Service Quality	.445
Business Role	.706
Authorization	.678
External Interface	.753
Security	.753
Information Quality	.755

The assumption for the regression is the homoscedasticity of the variables. Homoscedasticity appears when the variance over a variety predictor variable seems to be constant. In other words, the values of the variance of the dependent variable concentrate in only a limited range of the independent variable [48]. Homoscedasticity assumption was examined through the scatter plot diagrams of standardized residuals. The assumption of homoscedasticity was fulfilled and there was no concern to use multiple regression analysis. Figure 1, illustrates the result of homoscedasticity test.



**Figure. 1** Homoscedasticity for user requirements

The fourth assumption for the regression is the linearity of the variables. Linearity is the degree of how the relationship between the variables can be portrayed in a straight line [49, 50]. To assess the assumption, linearity residual plots as suggested by [48] was employed. The result of testing linearity through scatter plot diagrams is shown in Figure 2, revealed the assumption of linearity was met as the figures showed the distribution scatter around the centre of the shape. The results of linearity assumption provide justification to use multiple regressions to explore the relationship between the dependent and independent variables. Figures 1 and 2 have displayed the results of homoscedasticity and linearity tests for in User requirements. Overall the results suggest that the assumptions of multicollinearity, homoscedasticity and linearity of data are met.



**Figure. 2** Linearity test for user requirements

#### 6.4 Evaluating each of the independent variable

This section aims to identify and compare the strength of prediction of the independent variables on the dependent variable. In other words, this study aims to identify which variables in the model contributed to the prediction of the dependent variable using Beta value. In this study, we are interested to compare the contribution of each independent variables in the model. The results in Table 6 show that all independent contributed significantly to the User requirements.

Information quality has the highest contribution on user requirements amongst the independents variables ( $\beta = .444$ ). Other variables also significantly and positively contributed to the user requirements as arranged in descending order: system quality ( $\beta = 3.85$ ) and service quality.

As can be seen from Table 4, the  $R^2$  was statistically significant, with  $F = 120.852$  and  $p < .001$ . As a result, the common expression of the regression equation is stated as user requirements =  $1.961 + .444$  information quality +  $.385$  system quality +  $.151$  service quality. The three independent variables were observed to have a positive correlation to the user requirements as indicated by the positive R value of  $.753$  in Table 4. A computed R square value of  $.567$  suggests that the variables explain more than 63.3 percent of the variance in the User requirements (with a standard error estimate of  $.54526$ ). In other words, almost all independent variables have magnitude effect on User requirements factors.

**Table. 6** Results of multiple regression between IS factors and user requirements model of Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.743 <sup>a</sup>	.567	.560	.54526

a. Predictors: (Constant), Service quality, System quality, and Information quality. b. Dependent Variable: UR

#### ANOVA

Model	Sum of Squares	Df	Mean square	F	Sig.
1 Regression	68.526	3	22.842	76.830	.000 <sup>b</sup>
Residual	52.326	176	.297		
Total	120.852	179			

a. Dependent Variable: UR, b. Predictors: (Constant), Service quality, System quality, and Information quality.

#### Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	Constant	1.981	.240		8.244	.000
	INFORMATION_QUALITY	.268	.049	.444	5.512	.000
	SYSTEM_QUALITY	.237	.036	.385	6.605	.000
	SERVICE_QUALITY	.095	.048	.151	1.986	.049

a. Dependent Variable: UR, \*  $p < .05$ , \*\*  $p < .001$

## 7. DISCUSSION OF THE FINDINGS FROM THE FUNDUS IMAGING SYSTEM CASE

Based on observations that took place during the immersion and pilot study, a number of emerging themes from the framework, namely Health information system quality (HISQ), and User requirements factors have been identified. These issues are presented in the next sections, which are organized in terms of the two themes.

### **7.1 Health information system quality**

This term refers to the framework of user requirements on the health information system quality (HISQ). The conceptual model of the current research encompasses: the information, system quality and also service quality of the success of HIS.

In terms IS, information quality is considered as one of the major factors that contribute to the users' perceived usefulness of such information [51]. In addition to that, how the users perceive information as useful strongly correlates to their use of the system, and this is true especially in the context of HIS [52, 53]. As reported by Ramayah, Lee [54], any IS that offers a high quality content will be more likely to contribute better to the users' intention in being actively involved in using the service. Therefore, information quality is deemed as an important factor that influences the adoption of HIS

System quality is a term used to denote to the quality of information processing of the system. This also includes the software and hardware components. It underlies how or to what extent the system quality is technically good or sound [55, 56]. The quality of a system also includes features such as stability, integration, and flexibility, which all contribute to the users' perceived ease of use of HIS [57]. As found by Li [58], system quality has more substantial impact on the achievement of EHR than information quality and service quality. Moreover, the same researcher pointed out that the role of quality of system functionality and user-friendly interface is in facilitating the physicians' processes of communication and easy access to the clinical information. It is also described as the extent to which the system is effective at offering information that satisfies and fulfils the purpose for which it is designed and developed [59].

Service quality is described as the level to which normative expectations of a service for the receivers diverge from their perceptions of the performance of the given service [55]. As defined by Petter, DeLone [60], service quality refers to the degree to which the expectations of the receivers of the service are sporadic with their perceptions of the actual service that they receive. The quality of portals and IS services due crucial for owners to satisfy their users. [61]. There are also other important elements of service quality which include training programs, maintenance, support and technical expertise of the IT personnel [62]. In the context of HIS, normally, the clinicians would assess the quality of the IT products and services to ensure that they meet the specifications and configurations based on their requirements [63].

### **7.2 User requirements**

The term user requirements (UR) refers to the needs that a certain system will fulfill for the users, and what is expected to be met by using that system. User requirements are stated in a User Requirements Document (URD) using narrative text. Since they are signed off by the user, user requirements function as the basic input for developing a certain system [64]. User requirements should be defined during the designing phase of the system since they provide a description of the tasks and functions supported and carried out by the system. They also describe how the system will be implemented. In the design phase, user requirements reflect the developer's perspective. Moreover, since they are the needs of the stakeholders who interact directly with the system, such requirements have been argued as the most difficult challenges in a system development [65-67]. As added by Juaim [64], the complexity of user requirements is partly attributed to the users' inability to express and communicate all of their needs and partly due to their incomplete, inaccurate and conflicting information. Therefore, it is important to analyse such user requirements carefully. In relation to this, the objective of this study is to explore the important factors for perspective of user requirements system by users and analyses the user requirements of the system using both the FRs and NFRs as the preliminary study in developing a HIS system based on these sub-factors; Business roles, External interfaces, Authorisation and Security.

In item business roles, the previous researches have highlighted the effect of the business process management in the success of HIS implementation. The impact of the business process management on the success of HIS implementation is crucial, and is the subject of our investigation in this study. It plays a role in changing the business process to accommodate the HIS software, thus changing the way of doing business (Often provide better service for the patients and the employees), as well as peoples' roles and responsibilities. Thus, healthcare departments often comprise of complicated processes, spanning from different groups and organisations. The implementation of HIS to manage and automate the processes are more important roles in improving the impact of healthcare enterprises [68].

In addition external interface some previous researchers, for example Sousa, Campos [69], have proposed a computer-aided and comprehensive approach to verify and specify user interface based on unit-checking technique. They pointed out that the specification of user interface for applications is more than the mere description of the graphical elements, but also includes the crucial elements of behaviour relevant to the interaction between the users and the system. Thus, a user interface is a “dialogue” which is capable of determining the communication between the operator and the system, as well as the available functions and the information that should be offered at each moment [69]. The relationship between the user and the interface has been reported in the previous studies. In addition, the user interface should be created in a manner where it evolves from iterative to evolutionary, so that it can support the user interface development life cycle in a more flexible way. Task analysis is beneficial for the effective design of user interface because the problems that exist in the task analysis during the user interface design can be beneficial in both directions [70]. User interface is intuitive and enhances exploratory learning, it must not lead us user fear of making irreversible errors because this will lead to their stress and anxiety.

Meanwhile, authentication is defined as ensuring that the entity requesting access to the system or who is using it and allowed to access it, which means the entity's identity. In HIS, not any one can access the information. In the healthcare system, not all users are allowed to access all of the information. Therefore, there are several models of authorisation which restrict the users' access to certain information at a certain time. However, the growing number of users and the increasing amount of information render user authorisation to be more challenging. This critical issue also restricts the spread of HIS. Majority of HIS are designed independently, and they still lack certification and authorisation mechanisms. As a result of this, the sharing of the healthcare service has become more challenging from the viewpoint of the business user, requirements of the system include the roles of users and related to security authorizations [71].

In terms of the security non-functional requirements (NFRs) of the security in HIS are those requirements regarding the users' security which include generic, authentication, integrity, confidentiality nonrepudiation, privacy and availability [72, 73]. It is pointed out that all systems offer the users with security and data protection as a priority. This is usually offered in the form of IDs and passwords for the users or employees in HIS and others [36]. It is very crucial to ensure that the security of the data is stored in the device since such data would be valuable and confidential. In an earlier study, it is recommended that security should be achieved through back-ups for every information of the patients, the audit trails used for monitoring the usage and access of the data and the use of log-in identification code with a password since unsecured data may be subjected to violation and abuse [30]. One of the major challenging issues faced by patient information is the issue of security.

## **8. CONCLUSION**

The aim of the study was to investigate the impact of Information system health sector factors for HISs in developing countries. Based on the literature review of previous studies, the present study identified Seven (8) factors as its primary contribution (1) : System Quality : (2) Information Quality, (3) : Service Quality, (4) Business role (5) : Authorization, (6): External Interface , (7) : Security . Awareness towards the importance of HIS as important factors which impact the users' attitude towards the adoption of HIS in developing countries. These factors are the common shared factors investigated in studies related to Information system health sector and HIS adoption in developing countries. Besides that, such study opens further opportunities for the formulation of framework that outlines the Information system health sector factors and adoption of HIS in developing countries.

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