Towards Development a Novel Framework of Web-Based Systems Quality Engineering by the Integration between Information Systems and Software Engineering Theories: Context of Higher Education

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Abstract. Nowadays systems failure is the dominant of current research in the fields of information systems and software engineering. The rate of systems fails, and dissatisfying users are high with a lack of appropriate framework that can be used as a success measure in the context. With mix of the results in systems success measure. The organization is in need for a well-defined engineered framework to assist in the success measure of web-based systems. Yemeni south region's universities are facing the problem (dissatisfying users, justifying the cost of implementing systems and measuring its success). This study aims to propose the characteristics of a quality framework suitable for such a purpose and context of developing a novel systems quality framework based on adapting Delone & Maclean 2003, ISO 25010 and Tam to measure the success and quality of these web-based systems. Researchers validated the framework and instrument via 8 academic specialized lecturers in systems and software engineering from (Malaysia, Yemen and India). Researchers then confirmed the translated questionnaire (English to Arabic and back to back translation) with an authorized translation company. Before starting the pilot study, pre-test has been conducted with nine respondents to see if there is any doubts or unclear syntax, everything was OK. Pilot results showed an excellent result.

1. Introduction

Authors over the past 60 years of systems introduction and implementation, organizations in the different fields are still needs to ensure the success of their systems (Petter, DeLone, & McLean, 2012). Measuring information systems success based on its users is important value especially with new developed systems, today's it became a general phenomenon of systems fail to satisfy users and to provide outcomes successfully (Scott & Fruhling, 2013). According to Wu, Guo, Choi, & Chang (2017) system implementation constitutes a huge financial undertaking for businesses. financial losses because of systems fail can accrue even with intensive development management and watchful plan (Sykes, 2015).

Software quality engineering is an emerging field that is concerned with improving the approach to quality of the software (desktops systems, web systems and mobile systems). It is imperative that field of software quality engineering be firmly rooted in a quality framework satisfying its needs. To define the needs of software quality engineering filed, the meaning of quality is broadly defined by reviewing the literature on the subject. Quality of software engineering needs a quality framework that is working efficiently and meets context requirement and that it embraces all the viewpoints of quality (Côté, Suryn, & Georgiadou, 2007).

From research conducted in several disciplines, tracking of how important and vital the measure of any software and/or any information system has been achieved (Fadhel, 2015). It is worth taking note of that measures for the success of software and assessment of information system has become more important. This has led to challenges being experienced regarding the measurement (DeLone & McLean, 2016). For this reason, the importance of underlining the challenges and demands that are related to systems that diminishes the measurement's success and effectiveness is evident (DeLone & McLean, 2016). This study aims to develop a higher education web-based systems novel framework for the higher education domain in the country. To examine the relationships between the antecedents of the higher education web-based systems towards satisfaction in the framework. To determine the factors that significantly affect students' satisfaction to the higher education web-based systems. To assess the satisfaction, loyalty and benefit of the higher education web-based systems. To examine the relationship of students' satisfaction of the higher education web-based systems towards loyalty and towards benefit in non-commercial system.

2. Literature Review

Accessing and testing the success of a given system or software, not forgetting its context of use, is quite essential nowadays (DeLone & McLean, 2016). Hence the reason why scholars in this field are facing challenges when conducting an examination for the success of a system. The understanding of taking customer on the central position in examining how responsive and effective a system can be, is very important (DeLone & McLean, 2016). With respect to this, a strong role is being played by culture as the prospects for success varies when considering different cultures. This is resultant from the fact that different cultures are grounded on certain values, norms and codes of conduct. In turn, these values and norms have a way of influencing the insights towards systems and the way they are used (Mohammadi, 2015). Considering Arab economies, Yemen falls within the ranks of the poorest of these economies, while also being at the 160th position in the human development index (HDI) (Nations, 2015). Although, within the past ten years, the country has been putting a lot of efforts towards progress by the acceleration of its educational system (Rakels, 2013). However, is quite disheartening to discover that this propagation has brought about an increase in challenges encountered by the economy. These challenges include resources wastage, poor systems, duplication of materials and an increase in the number of users and organizations dissatisfied about the state of the system (AbdulMonsif, 2015; Baheshwan, 2016; Fadhel, 2015; Rakels, 2013). Whilst still considering these Arab economies, it has been observed that research conducted on the success of systems are limited. In addition, taking a critical review of literature in this regard, no study has considered highlighting or taking into consideration the country of Yemen (Baheshwan, 2016; Fadhel, 2015; Khred, 2017). At present, rapid advancements have been recorded by the global economy about information systems and information technology (IT). The current economic and socially tempestuous

situation has enlarged the challenges academic leaders face when it is time to find the right management tools to meet their prioritization requirements (R. L. Lee & Blouin, 2017). Web-based systems are becoming the tools of our modern digital time of life (Hasan, 2014; Hasan & Abuelrub, 2008). The report showcases academic institutions, specifically universities, being the forerunners in the early development of web-based information system (WIS), with the aim of attracting target audience (Hasan, 2014; Hasan & Abuelrub, 2008). Bear in mind that the least developed countries are being challenged by low-level economies which translates to a negative effect on all aspects of life in these countries. For this reason, the positive effect of scientific research and higher education are seldom noticed, thus resulting in negligence of the entire research process (Baheshwan, 2016; Fadhel, 2015; Khred, 2017).

Evidently, many the web assessments and engineered frameworks available, are not strong enough in assessment of systems' quality. Hence, the understanding of the systems' quality in Yemen as a country, is essentially important. This will aid the development of a framework for success quality being observed from a user's perspective (Mebrate, 2010; Mwangi, 2016; Singh & Kumar, 2014). This affirms a previous finding that the examination of success measure from the users' perspective is quite important in outlining the exact worth of the systems (Galliers & Leidner, 2014). Organizations use web systems to share information and present to public (Lee & Blouin, 2017). The assessment of the success of systems is very important in outlining the performance rate of the system, identification of any issues, resolution of problems experienced by users and procuring recommendations on how to meet the user's requirements (DeLone & McLean, 2016; Fadhel, 2015; Galliers & Leidner, 2014; Irani Zahir, 2000; Mebrate, 2010; Mwangi, 2016; Sugiyanto et al., 2016; Suwawi, Darwiyanto, & Rochmani, 2015; Urbach & Müller, 2012; Zahran et al., 2014). The satisfaction of the students together with the systems' quality should be given utmost consideration as this is the most important element. In that regards, the development of WIS should be conducted to achieve student satisfaction by meeting the expectations of the students (Lee, Huh, & Jones, 2016). In recent times, researchers have come to the agreement that the satisfaction of the user is a more accessible measure in comparison to the others, and the success of WIS depends completely on the satisfaction of the users. Notably, the satisfaction of users is adaptable in specific contexts (Almahamid, Tweiqat, & Almanaseer, 2016; Bairamzadeh & Bolhari, 2010; Hasan & Abuelrub, 2008; Lee et al., 2016; Vaezi et al., 2016).

The usage of early frameworks for the identification of the major factors and sub-factors, with the potential of enhancing users' satisfaction and elimination of aspects of computer anxiety, have failed (Cheok & Wong, 2015). Because of this, in future studies, there should be an inclusion of quality characteristics which will serve as the fundamental components for accessing the success of systems. This will help in the refinement of the items of measurement in a new context (Forsgren, Durcikova, Clay, & Wang, 2016). There has been a confirmation that the net benefit must be defined within the context of system under consideration and within the frame of reference of those capable of the evaluation of the benefits of the system (Alshibly, 2015). Highlighting the satisfaction and benefits of factors that play a significant role in success determination can help organizations in outlining how effective and successful the web information systems are (Alshibly, 2015; DeLone & McLean, 2016; Lee et al., 2016; Vaezi et al., 2016). Henceforth, organizations require a framework that is well structured and meet context requirement, together with advanced tools in assisting with examining complex web-based systems and their quality in contrast to defined standards (ELdesouky, Arafat, & Ramzey, 2008; Forsgren et al., 2016; Mwangi, 2016; Teeroovengadum et al., 2016). In the same vein, it has been stated that scholarly work in academics is conducting and expansion of research horizon in various fields of study (DeLone & McLean, 2016).

It is therefore highly important to engineering and formulate robust system quality assessment frameworks (Sugiyanto et al., 2016; Zahran et al., 2014). The antecedents of users' satisfaction which includes quality components, have been brought to light in many comprehensive studies in research. Within these studies, the researches have been a guide to show that one of the principal urgent issues is systems' quality. Sadly, this has also gained very little empirical attention. Not forgetting to mention

that, there also exist limited association between different metrics and frameworks as well (Laumer, 2016; Mwangi, 2016; Petter et al., 2012; Sugiyanto et al., 2016; Vaezi et al., 2016). Consequently, the support from management plays a very important position in the success of systems which affects satisfaction. Thus, in future research, this should be deployed in comprehensive studies (Fadhel, 2015; Wang & Song, 2017). In addition, an important role is also played by culture in this regard, and for this reason, there is a need for scholars to conduct an examination of this construct in presenting more generalizable findings (Berger, Geimer, & Hess, 2017). It is worth taking note of that individuals as users often switch from the use of one system to another because of the dissatisfaction experienced. Similarly, when the users also have doubts or concerns about the systems' quality and its provision of information, they also switch to the use of alternative systems (Rouibah, Lowry, & Almutairi, 2016). Many studies concerned with the implementation of systems have sprung forth, with an outline of businesses experiencing large losses financially because of system failures (Maier et al., 2013).

Within that context, many organizations can also be tracked to be providing statistical records about these losses. For instance, a case of 27,000 students enrolled at the University of Massachusetts, University of Stanford, and Indiana University were faced with severe consequences because of the information system failure at their individual institutions (Dwivedi et al., 2015). Based on the CHAOS's report (2015), Shane Hastie (2015) has made the assertion that a lot of work still needs to be done in achieving significant successful outcomes from systems because of the low performance percentage of projects success (Chaos, 2014; Shane Hastie, 2015). One should not forget to mention that systems failure is of huge concern to the business world, organizations, stakeholders and marketplace (Khred, 2017; Moh'd Al-adaileh, 2009). With respect to the statistical records from international data corporation, a total of 43 billion US dollars have been spent on information systems (Khred, 2017). This indicates that there is a large interest in practical studies as a valid means for benchmarking these systems with the aim of tracking the results of the ICT investments, in explaining its advantages to the organization and make better plans in future for systems and ICT investments (Khred, 2017).

This agrees with the issue in the country of Yemen as its higher education system aims at enhancing and improving the institution's management and likewise facilitate the users which are mostly comprised of students (Khred, 2017). It is generally known that the universities in the country are dissatisfied with the information systems and facing a lot of challenged regarding the justification of these massive expenses and investments (Khred, 2017). Cakir, (2017) said an important factor for student is students' satisfaction, and this is one of the quality indications to determine if a system will be successful or not. The dictionary definition of satisfaction states it as "a feeling of happiness or pleasure because you have achieved something or got what you wanted", while contentment is defined as "the state of being happy and satisfied". In some other resources, students' satisfaction and student contentment are used interchangeably, but for the study, the term students' satisfaction will be used. A description for contentment could be the perception of being happy because of fulfilment of desires and needs after participating in an activity. On the other hand, when considering students' satisfaction according to, it can be defined as satisfaction and contentment regarding various dimensions of the service the student gets. Students' satisfaction can be defined as the contentment that learning activities, teaching activities and facilities trigger in students (Cakir, 2017).

High rate of system fails, limited of engineered frameworks that can help organization to know about the quality and benefits of their systems towards the users' satisfactions and loyalty, lack of theoretical grounding, lack of data collection and empirical data. In the Arab word knowledges about systems quality and success are lack in line with almost nonexistence studies in Yemen with the high numbers of systems dissatisfying users and organizations. There is a hardness in engineered a framework that measures quality factors in the higher education domain. In parallel, relationship of users' satisfaction towards loyalty of users to the systems is ambiguous. Researches are invited to investigate these issues. It's highly recommended to engineer a framework that make integration between the theories of software engineering and information systems such as ISO 20510 and DM 2003. It's of most important to conduct a comprehensive study that develop a novel framework, can solve all or parts of

the issues mentioned above (Fadhel, Idrus, Ibrahim, Omar, et al., 2018; Fadhel, Idrus, Ibrahim, & Omar, 2018). When considering research on variables that could have a significant effect on success, it is observed that very few literatures are existent (DeLone & McLean, 2016; Mwangi, 2016; Petter, DeLone, & McLean, 2013). This reason, together with the inconsistent and mixed results (DeLone & McLean, 2016; Mardiana, Tjakraatmadja, & Aprianingsih, 2015; Snead Jr, Magal, Christensen, & Ndede-Amadi, 2014), have shown the loopholes in knowing the actual causes of systems success. Taking into consideration the limitations in engineering approaches to build standard WIS framework, it is difficult for the existing systems to meet the users' needs within the higher education domain. These existing systems are observed to also fail in sufficient measurements of systems success due to the problem of being domain-specific (Mebrate, 2010; Mwangi, 2016; Singh & Kumar, 2014; Sugiyanto, Siti, & Sarwosri, 2016; Zahran, Al-Nuaim, Rutter, & Benyon, 2014).

Till date, the information available about the success of the website systems are scanty (Stefanovic, Marjanovic, Delić, Culibrk, & Lalic, 2016), and this is likewise the case when considering Arab countries whereby, empirical research about the success of system is practically non-existent (Khred, 2017). This is one of the reason why there is a high rate of system failures, which in turn causes financial losses and leads to business risks (Baheshwan, 2016; Bloch, Blumberg, & Laartz, 2012; DeLone & McLean, 2016; Dwivedi et al., 2015; Khred, 2017; Maier, Laumer, Eckhardt, & Weitzel, 2013). A cognitive gap differentiates the expectations of the users from the systems, and the perception of the users (Vaezi, Mills, Chin, & Zafar, 2016). An investigation of the variables responsible for quality of systems, based on the context, is therefore urgently required as a common definition for information quality does not exist (McNab & Ladd, 2014; Mebrate, 2010; Mwangi, 2016). Considering the domain of higher education, the engineering of a framework with the ability of measuring quality remains a challenge (Teeroovengadum, Kamalanabhan, & Seebaluck, 2016). Due to the dearth in research, there is very little information available about the influence of loyalty on non-commerce systems. Till now, the effect of the research relationships between loyalty and satisfaction are quite blur and unclear (Khred, 2017; Mohammadi, 2015; Mosahab, Mahamad, & Ramayah, 2010). Similarly, the measurement of the success and quality of systems in Mukalla's universities is immature and this agrees with the high rate of dissatisfaction expressed by users and organizations towards the systems (AbdulMonsif, 2015; Baheshwan, 2016; Fadhel, 2015; Khred, 2017). It has been broadly elaborated upon, that systems' failure remains a key challenge for organizations, and in a bid to manage this shortcoming by addressing this failure, the measurement of systems by suitable engineered quality framework emerges as a prospective solution in increasing the success rate in future systems initiatives (Baheshwan, 2016; Bloch et al., 2012; Dwivedi et al., 2015; Fadhel, 2015; Khred, 2017; Moh'd Al-adaileh, 2009). The ability of a system being either a failure or success remains one of the most prominent areas of interest in research. For this reason, it is important to understand the reasons why some systems achieve the expectation required of them, while others fail. This is a complex arena for research scholars in the area (Dwivedi et al., 2015).

3. Problems and Aims

The heavy IS investment by the organizations is under high pressure for justification, high level of systems failure in line with high number of dissatisfying users, and hardness of systems' success measure remaining a major issue requiring a framework so that it can be understood better (Afolabi, 2018; Fadhel, Idrus, Ibrahim, & Omar, 2018; Khred, 2017; Obotu & Ogezi, 2018; Sugiyanto, Siti, & Sarwosri, 2016). Henceforth, measuring and understanding the success and quality of university's web-based system is important. This will be considered in the context of Mukalla universities, in presenting a comprehensive engineered quality framework suitable for providing a detailed guide to these categories of systems and meeting context requirement, as considered from the users' perspective. Therefore, in a nutshell, the aim of this study seeks the development of a novel framework for university web-based systems, being the higher education domain in the country. This is achieved by the measurement of how successful Mukalla universities web-systems are, and thus determining the key factors towards achieving satisfaction of its users.

4. Instrument Questions

First IV perceived information quality (PINFQ) will measure the accuracy, content and understandability using: 1-The information outputs of my university web system (including on-screen and printed outputs) are Complete. 2-The information outputs of my university web system (including on-screen and printed outputs) are concise and are easy to understand. 3-It is easy to find what I'm looking for when using my university web system. 4-The information outputs of my university web system (including on-screen and printed outputs) are accurate and is free from errors. 5-My university web system provides the precise information I need. These questions adapted from (Byrd, Thrasher, Lang, & Davidson, 2006; Chen & Kao, 2012; Chiu, Chao, Kao, Pu, & Huang, 2016; Davarpanah & Mohamed, 2013; Edlund & Lövquist, 2012; Fadhel, 2015; Gorla, Somers, & Wong, 2010; Mohammadi, 2015; Wang & Liao, 2008; Zaied, 2012).

Second IV perceived system quality (PSYSQ) will measure the adaptability and sophistication using: 1-It is easy for me to become skilful by using my university web system. 2-In general, I find my university web system is easy to use. 3-My university web system is well integrated. 4-My university web system has a short time lag between input and output of data as example (registration process). 5-My university web system has a short response time for on-line enquiry. These questions adapted from (Chiu et al., 2016; Fadhel, 2015; Gorla, Somers, & Wong, 2010; Mohammadi, 2015; Zaied, 2012).

Third IV perceived ease of use (PEOU) will measure easiest of the systems using: 1-I find my university web system flexible to interact with. 2-My interactions with my university web system during doing online process were clear and understandable. 3-My university web system is convenient for me. 4-My university web system is laid out in a modern and fashionable. These questions adapted from (Devaraj et al., 2002; Khawaja & Bokhari, 2010; Liu, Chen, Sun, Wible, & Kuo, 2010; Mohammadi, 2015; Wolfinbarger & Gilly, 2003).

Forth IV perceived reliability (PREL) will measure maturity, fault tolerance, recoverability, availability and reliability using: 1-My university web system never stops unexpectedly. 2-When there is a problem in some part or parts in my university web system I still can browse and perform some of process. 3-In case of interruption of fault, my university web system recovers properly. 4-In general, my university web system is available 24/7. 5-I believe that my university web system is reliable. These questions adapted from (Aghazadeh, Pirnejad, Aliev, & Moradkhani, 2015; Alves et al., 2015; Constantin, 2013; Devaraj, Fan, & Kohli, 2002; Mebrate, 2010).

Fifth IV perceived usability (PUSA) will measure the user interface aesthetics and protection from users' error using: 1-The interface design of my university web system is attractive. 2-All interface elements are well combined and harmonious in my university web system. 3-My university web system protects me from making errors when interring data. 4-My university web system errors messages clearly indicate to me how to correct the problem. 5-In my university web system, it is easy to recover from the error quickly. These questions adapted from (Alves et al., 2015; Astani & Elhindi, 2008; Padayachee, Kotze, & van Der Merwe, 2010; Wolfinbarger & Gilly, 2003).

Sixth IV perceived functionality (PFUN) will measure the navigation and search using: 1-It is easy to go to the home page while I'm browsing any other page in my university web system. 2-While using my university web system, I can easily navigate backwards through previously visited pages. 3-My university web system provides varied search options (e.g. By faculty, courses, etc.). 4-Search hints are provided when wrong search keywords are used.
These questions adapted from (Mebrate, 2010).

Seventh IV perceived efficiency (PEFF) will measure the time behaviour and accessibility using: 1-It is possible to find in my university web system what I want in a reasonable time. 2-My university web system enables me to get on to it quickly. 3-My university web system does not use advertises or unwanted plug-ins. 4-I can access my university web system from my favourite browser. 5-It is easy to get and browse any part on my university web system. These questions adapted from (Alves, Wangenheim, Lacerda, Savaris, & Wangenheim, 2015; Khawaja & Bokhari, 2010; Mebrate, 2010; Rocha, 2012; Zehir, Sehitoglu, Narcikara, & Zehir, 2014).

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Eight IV perceived security (PSEC) will measure the security privacy and trust using: 1-I believe my university web system is secure. 2-Overall, I trust my university web system. 3-My university web system has adequate security features that make you feel secure while using. 4-I believe that the information offered by my university on the university web system is sincere and honest. 5-The output information of my university web system is secure. These questions adapted from (Al-Manasra, Khair, Zaid, & Taher Qutaishat, 2013; Alves et al., 2015; Malik, Shuqin, Mastoi, Gul, & Gul, 2016; Valvi & West, 2013; Webb & Webb, 2004; Wolfinbarger & Gilly, 2003).

First DV students' satisfaction (STSA) will measure satisfaction using: 1-My university web system is of high quality. 2-My university web system has met my expectations. 3-My interaction with my university web system is very satisfying. 4-Overall, I am satisfied by using my university web system. 5-Overall, I'm happy with my university web system. These questions adapted from (Al-Azawei & Lundqvist, 2015; Chiu et al., 2016; Constantin, 2013; Eppler, Algesheimer, & Dimpfel, 2003; Fadhel, 2015; Jeon, 2009; Kiran & Diljit, 2011; Liaw & Huang, 2013; Mohammadi, 2015).

Second DV loyalty (LOYA) will measure loyalty using: 1-I will be using more of my university web system in the future. 2-I will recommend my university web system to others. 3-I will say positive things about my university web system to others. 4-I like using my university web system. 5-I use my university web system frequently. These questions adapted from (Constantin, 2013; Eppler et al., 2003; Jeon, 2009; Kiran & Diljit, 2011; Mohammadi, 2015; Valvi & West, 2013; Zehir et al., 2014).

Third DV benefit (BENE) will measure the benefit using: 1-My university web system helps me to retrieve my information easier and quickly. 2-My university web system saves my time. 3-Overall, I obtained benefits from using my university web system. 4-My university web system is an important and valuable aid to me. 5-My university web system has a large, positive impact on me as a user. These questions adapted from (Chiu et al., 2016; Dernbecher, 2014; Fadhel, 2015; McGill, Hobbs, & Klobas, 2003; Wang & Liao, 2008; Wixom & Watson, 2001).

5. Hypothesis Development

H1, Perceived quality of information significantly affect students' satisfaction of university web site system. Quality of information has a significant influence on users' satisfaction with a positive sign (Chiu, Chao, Kao, Pu, & Huang, 2016; Delone & McLean, 2003; Fadhel, 2015; Mahmood, M.A., Solis, A.O., Gemoets, L.A., Hall, L.L. and Hebbal, 2005; Petter, DeLone, & McLean, 2008). Empirical research studies have shown that there is a validated relationship between user satisfaction and information quality. A typical instance can be found in support for the relationship between quality of information and user satisfaction as noted in the article of (Mahmood et al., 2005). An empirical support for positive quality of information significantly impact satisfaction with the system is significant (Mahmood et al., 2005). Information quality accordingly, Edlund and Lovquist (2012), have also asserted that systems quality in terms of the information provided also defines the end-user satisfaction and thus, guides as to what length, it is reaching up to its expectations. Notably, user may end up experiencing frustration, if they fail to achieve accurate and quality information from the provided systems.

H2, Perceived quality of system significantly affect students' satisfaction of university web site system. Quality of system has a significant influence on users' satisfaction with a positive sign (Delone & McLean, 2003; Fadhel, 2015; Khayun & Ractham, 2011). Systems that are identified with a huge number of satisfaction when emphatically leveraged TAXIS are as hypothesized by him. The quality of systems is termed as an imperative factor in user satisfaction (Delone and McLean, 2003). It alludes a specialized level of systems (Delone and Mclean, 2004; Delone and McLean, 2003; Teo, Srivastava, and Jiang, 2008) as can be referred in (Khayun and Ractham, 2011). System quality in the views of Edlund and Lövquist (2012), in connection to the elaborations of Bharati and Chaudhary (2004) and Wixom & Watson (2001), flexibility is also an important variable when it comes to outlining system flexibility. Ideally, a system is referred as flexible when it is flexible enough to bring

all the alterations in the system especially when new phenomenon occurs; situations evolve and/or demands change.

H3, Perceived ease of use significantly affect students' satisfaction of university web site system. Ease of use has a significant influence on users' satisfaction with a positive sign (Al-Azawei & Lundqvist, 2015; Chang, 2009; Ofori, Larbi-Siaw, Fianu, Gladjah, & Boateng, 2016). Research by (Chang, 2009) was based on Fishbein and Ajzen's theory of reasoned action (TRA) described the pattern of voluntary usage at an individual level (Fishbein & Ajzen, 1975; Venkatesh & Davis, 1996), Technology acceptance model includes perceived ease of use in the model: The level which an individual perceives using a system would be effortless (F. D. Davis, 1989). PEOU create perceptions amongst users and creates attitude amongst users. Ease of use based on the explanations of Davis (1989), Liébana-Cabanillas (2013), suggests that ease of use denotes to individual views regarding the usage of a system to be free from hassle and effort. This factor makes a major impact when it comes to the assertions of technology acceptance model (TAM).

H4, Perceived reliability significantly affect students' satisfaction of university web site system. Reliability, literature has supported a significant relationship between reliability on the use of student`s satisfaction when it comes to web portal usage, the result is in line with the researchers who found reliability significantly affect the satisfaction (Aghazadeh, Pirnejad, Aliev, & Moradkhani, 2015; Selvakumar, 2016; Shiratuddin, 2015). As cited in (Selvakumar, 2016) reliability is defined as the ability to perform the required service to customers dependably and accurately as promised to deliver. Dealing whatever the problems in systems encountered by customers, performing the required function right from the first time, services being rendered at maturity, fault tolerance, recoverability and availability record are the paradigm of reliability which will strongly influence the level of customer satisfaction. Mihajlović (2017), in his article investigate the effect of reliability on satisfaction by hypothesizes the following reliability of the systems has an influence on e-SQ satisfaction the results of his analysis confirmed his hypothesizes (Mihajlović, 2017). Reliability in connection to IT refers to capability of a system to offer or provide designated functions and features in a time (Mbiwa, 2014). Accordingly, Shiratuddin (2015), suggests that degree to which, a product and/or component executes the outlined conditions as per the specifications.

H5, Perceived usability significantly affect students' satisfaction of university web site system. Usability, past studies in the regard have also outlined a strong association of usability perceptions with student`s satisfaction with web-site systems (Aghazadeh et al., 2015; Al-Manasra, Khair, Zaid, & TaherQutaishat, 2013; Casaló, Flavián, & Guinalíu, 2008; Suwawi, Darwiyanto, & Rochmani, 2015). Greater levels of usability will be associated to lower levels of difficulty to manage that functionality as recited in (Casaló et al., 2008). As a result, usability has been traditionally considered a key factor for predicting intentions to use a system quoted in (Casaló et al., 2008). More specifically, focusing attention on the internet, website usability reflects the perceived ease of navigating the site or making purchases through the internet and it is considered a critical factor on the development of electronic systems mentioned in (Casaló et al., 2008). Casaló et al., (2008), propose that system usability has a direct and positive influence on satisfaction the result is confirmed that usability direct influence satisfaction. Usability in Theoretically, is referred with several definitions. Pertaining to Human Computer Interaction (HCI) usability is defined as per the guidelines of ISO 9241-11 which suggests it as the measure to which a specific tangible or intangible commodity can be effectively used by the target users to satisfy their goals and needs. Likewise, pertaining to software and technology, it refers to product potential in meeting customer expectations (Fernandez, Insfran, & Abrahão, 2011).

H6, Perceived functionality significantly affect students' satisfaction of university web site system. Functionality, literature on this regard has also underlined functionality to be of high significance when it comes to student`s satisfaction whilst using university websites and related systems (Aladwani & Palvia, 2002; Lu, Wang, & Hayes, 2012; Mebrate, 2010; Tandon, Kiran, & Sah, 2017a, 2017b). Tandon et al., (2017a) reported that system functionality refers to the extent to which website operates in the way it is structured and is expected to perform as users' desire. Tandon et al., (2017a, 2017b) in his articles propose that Website functionality has a significant positive relation with customer

satisfaction and there is a significant positive association between website functionality and customer satisfaction. Results of both articles confirmed the proposed hypothesis. Functionality is referred as Suitability, functionality is the degree to which a product or systems offers processes and functionality that meets the desired expectations of the customers (Shiratuddin, 2015).

H7, Perceived efficiency significantly affect students' satisfaction of university web site system. Efficiency, literature available on current regard has also confirmed its significance relationship with user`s satisfaction with e-platforms of the university (Alkhouli, 2017; Chagharvand & Babu, 2012; Chiou, Wu, & Sung, 2009; Firdous & Farooqi, 2017). The study of Firdous & Farooqi (2017), revealed that the six quality dimensions namely reliability, efficiency, responsiveness, fulfilment, security/privacy and website design have a meaningful relationship with customer satisfaction in internet banking and were the proposed indicators to measure customer satisfaction. One of these proposed indicators is efficiency has a significant positive association with on customer satisfaction. Analysis of correlation matrix shows that the correlation between system efficiency and customer satisfaction is estimated to be 0.706. This value indicates that there is a very significant and positive correlation between the variables at 70%. Efficiency is also very important when it comes to performance of the software and to what length it is relatively using minimum resources compared to other alternative options in a given situation (Mbiwa, 2014).

H8, Perceived security significantly affect students' satisfaction of university web site system. Security the extent to which system protects information and important data related to personnel involved in the transaction significantly enhances user satisfaction with the web system of the university (Chagharvand & Babu, 2012; Hidayat, Saifullah, & Ishak, 2016; Malik, Shuqin, Mastoi, Gul, & Gul, 2016). As noted in Hidayat et al., (2016) another important factor affecting customer satisfaction in online environment is security. Cited in (Hidayat et al., 2016) reveal that a positive perception of financial security can have a positive effect on online customer satisfaction levels. Their study also confirms that perceptions of online security play an important role in online customer satisfaction. Security refers to the degree to which a product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorization (Shiratuddin, 2015). H9, students' satisfaction significantly affect loyalty towards university web site system. Satisfaction, review of the literature has suggested that satisfaction of student with system and online portals can be of significant value an enhancing loyalty with these e-platforms (Constantin, 2013; Hidayat et al., 2016; Valvi & West, 2013). Satisfaction has been recognized as the most researched factor in relation to e-loyalty cited in (Valvi & West, 2013). In terms of e-loyalty, a positive relationship with satisfaction has been proven. It is generally held that satisfaction is positively related to loyalty. These observations have been constant over various countries and cultures reported in (Valvi & West, 2013). However, a minority of researchers have found weaker associations between satisfaction and loyalty. Thus, the following hypotheses are offered as satisfaction is likely to have a positive and direct association with E-Loyalty (Valvi & West, 2013). The result confirmed the hypotheses. Satisfaction in the arena of higher education, there is limited evidence available and scholars have showcased confusions pertaining to measuring student satisfaction due to its multidimensional nature (Hemsley-Brown et al., 2010). Loyalty Enhanced student loyalty can seriously lead towards competitive positioning and thus resulting in obtaining more students for the institution and eliminating the existing ones. They also spread positive word of mouth which helps in enhancing profitability (Nesset and Helgesen, 2009; Termizer and Turkyilmaz, 2012) cited in (Egyir, 2015).

H10, students' satisfaction significantly affect benefit of university web site system. Satisfaction, Review of the literature has suggested that satisfaction of student with system and online portals can be of significant value towards system benefit (Chiu et al., 2016; Fadhel, 2015; Wahyudi, Respati, & Ardianto, 2017). The results of empirical studies showed a strong relationship between user satisfaction and benefit systems. A study investigating the relationship between user satisfaction and the effects on the organization and found that satisfaction is correlated with the performance of the basic benefit level and what do users get cited in (Wahyudi et al., 2017). Hypothesis of (Wahyudi et

al., 2017) is user satisfaction significantly influence benefit of DAPODIK information system, results confirmed the hypothesis. Benefit DeLone and McLean (2016), have outlined that some of the most prominent measures for assessing IS success are designers, managers, users and so on. Therein, the net impacts are system outcomes which are generally compared to the core purpose of the system. For this reason, the Net impacts construct will be the most contextual dependent and varied of the six D&M Model success dimensions (DeLone & McLean, 2016).

6. Methodology

Survey is a suitable approach for studying complex phenomenon of implementing technology in an organizational setting (Majchrzak, Rice, Malhotra, King, & Ba, 2000; See, 2012). It is conducted for the assessment of individual perceptions, behaviours and attitudes (Weisberg, Krosnick, & Bowen, 1989). Survey further serves a way of measuring the research variables with the aim of explaining how each variable are related in a study (See, 2012; Zmud & Apple, 1992). The type of research conducted in study could either be quantitative, qualitative or a combination of both. The choice of selecting the best method depends on the objectives of the research and the aim a research is hoping to achieve (Fadhel, 2015; Myers & Avison, 1997; Yin, 2013). The quantitative approach is selected in this research and this entails the collection of data using questionnaire technique, whereby the instruments have been pretested by users. In software engineering (quality & testing) and information systems fields the suitable number of expert reviewers for reviewing the validity and eligibility of the research or the instrument or the framework or the method is 4 (Fadhel, 2015).

The study framework and instrument are validated by a one specialized expert with experience more than ten years in the position of systems director and seven specialized academic lecturers (Professor, visiting lecturer, associated professor and senior lecturer) with minimum PhD qualification from universities in Yemen, Malaysia and India. All the notes and suggestion of the validators has been applied. The instrument has been translated to Arabic language, the translation validated by authorized translation company which confirmed that translation is entirely true, compatible and devoid of any potential faults. After the validation with the experts and confirmed the Arabic translation, researchers performed a pre-test. Pre-test was conducted to verify if respondents have any complexity in understanding the questionnaire, or whether there exists any uncertainty or bias in the questions used in survey (Wahab, 2016). Therefore, nine students were involved for a discussion to make clear the contents of the instrument. After that, researchers collected the pilot, results were excellent and showed signs of success. The real data collection process will be collected using census method from 2018 respondents which are undergraduate bachelor's degree students in level four from all three top universities in Mukalla. After finished the process of real data collection the results will be reported in the next article as soon as possible.

7. Pilot Test

The pilot study was conducted for a total of 33 students and Cronbach's coefficient alpha is the test of reliability consistency used. This test is suitable as its usage is for multipoint scale items (Cronbach, 1946; Davarpanah & Mohamed, 2013). With respect to the findings obtained, it is stated that the higher the amount of coefficient is an indication of better measure. In an ideal sense, the value of the Cronbach's coefficient alpha should be greater than 0.70 (Pallant, 2013). Regarding to the factor loading results was excellent all items are above 0.6. The results of rho_A, composite reliability and average variance extracted are very excellent. The results of reliability for the pilot study is presented in Table 1.

Table 1. Construct Reliability and Validity of the Variables.

Factor	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Benefit	0.8177	0.8191	0.8726	0.5784
Ease of Use	0.7734	0.7914	0.8550	0.5976
Efficiency	0.8019	0.8076	0.8635	0.5597
Functionality	0.8097	0.8239	0.8769	0.6435
Information Quality	0.8520	0.8540	0.8950	0.6317
Loyalty	0.8011	0.8018	0.8633	0.5591
Reliability	0.7905	0.7938	0.8569	0.5460
Satisfaction	0.8189	0.8290	0.8749	0.5857
Security	0.8097	0.8113	0.8682	0.5693
System Quality	0.8328	0.8380	0.8827	0.6023
Usability	0.8191	0.8256	0.8741	0.5825

Table 2. Factor Loading Results

Factor	Items	Load
Benefit	Benefit1	0.7713
	Benefit2	0.7653
	Benefit3	0.7964
	Benefit4	0.7162
	Benefit5	0.7511
Efficiency	EFF1	0.7444
	EFF2	0.7812
	EFF3	0.7823
	EFF4	0.7771
	EFF5	0.6468
Ease of use	EU1	0.8162
	EU2	0.7113
	EU3	0.8532
	Eu4	0.7002
Functionality	FUN1	0.8772
	FUN2	0.8158
	FUN3	0.8534
	FUN4	0.6407
Information Quality	IQ1	0.676
	IQ2	0.8361
	IQ3	0.8372
	IQ4	0.8206
	IQ5	0.7927
Loyalty	Loy1	0.6816
	Loy2	0.6967

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	Loy3	0.7908
	Loy4	0.7971
	Loy5	0.7648
Reliability	REL1	0.7315
	REL2	0.6623
	REL3	0.7302
	REL4	0.8083
	REL5	0.7547
System Quality	SQ1	0.7099
	SQ2	0.815
	SQ3	0.7908
	SQ4	0.6924
	SQ5	0.8595
Satisfaction	Satisf1	0.6681
	Satisf2	0.7209
	Satisf3	0.9047
	Satisf4	0.7517
	Satisf5	0.7609
Security	Sec1	0.7425
	Sec2	0.7372
	Sec3	0.784
	Sec4	0.6852
	Sec5	0.8172
Usability	USab1	0.6997
	USab2	0.8235
	USab3	0.8221
	USab4	0.7216
	USab5	0.7404

8. The Framework
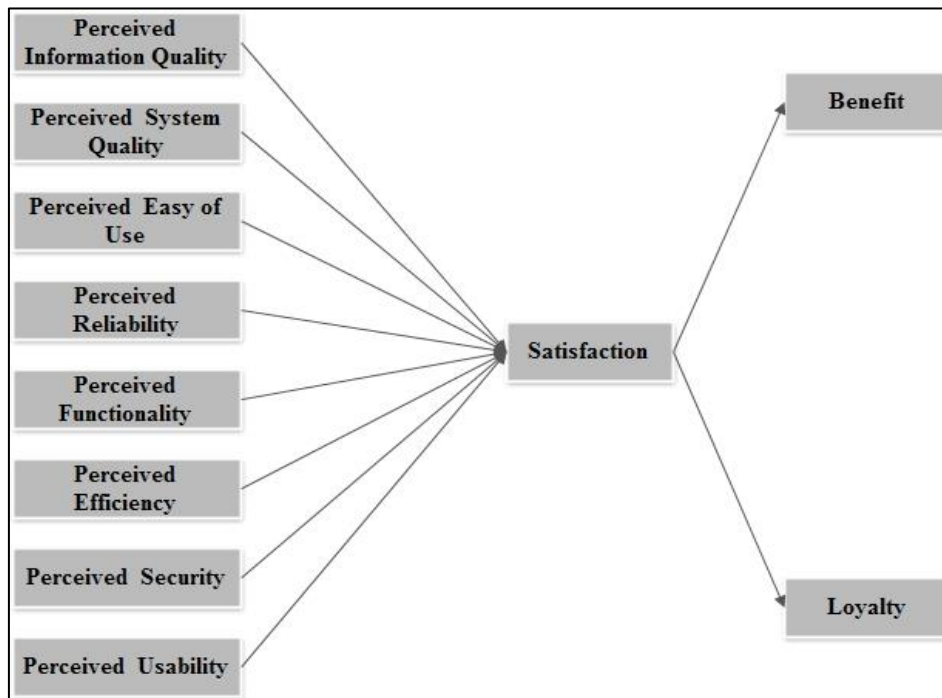
Figure 1: The Framework

9. Conclusion & Future Work

There exists a high rate of system failures and limitation in the engineered frameworks that can assist an organization in understanding the quality of their systems and its benefits towards its users to guarantee satisfaction and loyalty. These problems are because of the deficiency in theoretical grounding, data collection and empirical data. In the Arab community, there is a lack in knowledge about the quality of systems and their quality.

This is in line with the country of Yemen where there are non-existent studies despite its large percentage of dissatisfied system users and organizations. It is therefore challenging to engineer a framework with the ability to measure quality factors to make an impact on the higher education domain. This challenge also extends to the lack of quality factors that influence users' satisfaction.

A consideration of the relationship between the satisfaction of users and their resultant loyalty to the systems is quite ambiguous, thus the motivation of researchers to delve into an investigation of these issues. The engineering of a framework is highly recommended. This framework makes an integration between software engineering theories and information systems such as ISO 20510 and DM 2003. Therefore, the importance of conducting a comprehensive study for the development of a novel framework that can adequately solve all or some of these challenges and issues, cannot be undermined. The aim of this research is to target these issues and challenges in contribution to the body of knowledge. The statistical tools used are PLS, because there will be a development of a framework and prediction of results. The usage of PLS is well justified in literature as consults of the experts have stated them as suitable tools. The results from then pilot test are excellent and acceptable, therefore the researcher can move on to implementing data collection since the research instrument is well developed and validated. The discussion of the result after the data collection will be presented next.

In fact, ISO 25010 is a general metric, multi faces features, characteristics with the sub-characteristics are too many that makes a hard job for the researchers to perform the measurement directly using it. The researcher also, faces a problem of how they can use ISO 25010 or its features such as security to solve the issues, but this can be tackled by every usage of ISO 25010 should be based on the context and the researchers. How the researchers will facilities these features are up to them and their studies, problems, issues, objectives and scope. Researchers focusing only and using usability feature of ISO

25010 in their researches, but this framework (standard) is a general one. Still needs for more studies that can investigate the issues of software engineering quality and testing. The framework features other than usability can be used to test all systems criteria efficiently and covers various users' perspectives (systems users, systems developers, systems managers (admins)). Information systems evolution and systems success measure need to be investigated from perspectives of software engineering & computer science and any other valid perspective that can add something new.

Developers and system admins perspectives are not targeted yet in this field of research, researchers are calling to investigate these perspectives either quantitatively or qualitatively. Investigate the ISO 25010 features such as compatibility, portability and maintainability will lead to add new value and contribution to the field.

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