

Measuring the success of library 2.0 technologies in the African context: the suitability of the DeLone and McLean's model

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Abstract

The study aimed to examine the adoption of library 2.0 technologies among undergraduate students in the African context, and focused at the Muhimbili University of Health and Allied Sciences (MUHAS) of Tanzania. Not much research has been done to investigate the successful adoption of library 2.0 systems in the African context. This study assessed the success factors for the adoption of library 2.0 applications by using the DeLone and McLean's information systems (IS) success model. A case study research design was used in this study. Self-administered questionnaires were distributed to all first year undergraduate students (n=408) at MUHAS, with a rate of return of 71.8%. This study used the Structural Equation Modelling (SEM) approach to investigate the research model. The study findings confirm the validity of using the proposed IS model for library 2.0 adoption assessment. The users' intention to reuse is quite important, and accurately predicts the usage behaviour of library 2.0 services. The perceived net benefits had the strongest effect on users' intention to reuse library 2.0 systems than any other determinants within the model. Among the three quality-related constructs, service quality had the strongest total effect on perceived net benefits and intention to reuse. Compared with system quality, information quality had the largest effect on user satisfaction. It is thus important for librarians to consider all these factors for effective adoption of library 2.0 projects in research and academic institutions. This is the first comprehensive study focusing on the health sciences library patrons' usage behaviour of library 2.0 applications in Tanzania, and reveals findings that are useful for planning and implementing library 2.0 initiatives in other institutions with similar conditions.

Keywords: DeLone & McLean Model, Information Systems Success, IS Success Model, library 2.0, web 2.0, Tanzania

Introduction

The advancement of technology, termed as web 2.0 that focuses on user participation and collaboration, has transformed the operation of information services and resource sharing in academic libraries. Web 2.0 technologies enhance library services by improving communication with customers, promoting and marketing services, and imparting information literacy skills to users (Chua & Goh, 2010). Web 2.0 refers to a "collection of technologies such as blogs, wikis, RSS feeds, social networks etc, where users are able to add, share and edit the content, creating a socially networked web environment" (Anderson, 2007). With the conception of the term "Web 2.0", other terms were created, such as Library 2.0 which refers to the integration of the Web 2.0 technologies in a library environment.

Library 2.0 is a "model for constant and purposeful change; Library 2.0 empowers library users through participatory, user-driven services. Through the implementation of the first two elements, Library 2.0 seeks to improve services to current library users while also reaching out to potential library users" (Casey & Savastinuk, 2007). With Library 2.0, library services are frequently evaluated and updated to meet the changing needs of library users (Pienaar & Smith, 2008). The library 2.0 technologies encourage users to participate in the planning and execution of library services through their feedbacks (Pienaar & Smith, 2008).

With collaboration and knowledge sharing between users and libraries through library 2.0, library services have the ability to evolve and improve on a constant and rapid basis. In the information science perspective, library 2.0 tools include the following categories: (i) information acquisition for gathering information from sources external to library (e.g. blogs, wikis); (ii) information dissemination for distributing information by libraries to users (e.g. RSS); (iii) information organization to facilitate representation of content and subsequent search and retrieval (e.g. social tagging); and (iv) Information sharing to enable bilateral flow of information between libraries and their users (e.g. instant messaging, and social networking services) (Chua & Goh, 2010). Library 2.0 enables the libraries to change and provide demand-led services by concentrating on the needs of users already using the library and non-users whom the library may reach out to bring into the library.

An increasing number of studies have been conducted to better understand the library 2.0 user's behaviour and their impact. Previous research on library 2.0 applications has focused on the user's acceptance and behavioural usage of web 2.0 and library 2.0 applications (Ayiah & Kumah, 2011; Booth, 2009; Burhanna, Seeholzer, & Salem, 2009; Garoufallou & Charitopoulou, 2011; Kim & Abbas, 2010; Ponte & Simon, 2011). Other studies also assessed the extent of web 2.0 applications prevalent on library websites through content analysis methods (Chua & Goh, 2010). However, little research has examined the success factors of the continued behavioural usage of library 2.0 applications in academic institutions, and especially in the African context. This gap is contributed to the low application of web 2.0 among African libraries. Few African university libraries have embraced the application of web 2.0 systems, such as 15 French speaking countries in western Africa (Samb, 2011), South Africa (Wood, 2009), Tanzania, (Muneja, Abungu, & Makori, 2012) and Zambia (Banda 2011). Thus, most studies in the African context focus on the development of library 2.0 applications, while little empirical evidence exists on the usage behaviour of these systems. It is thus imperative to assess success factors of the continued behavioural usage of library 2.0 applications in academic institutions, and particularly in the African context.

Library 2.0 applications can be regarded as a kind of information system (IS) that library users' access or share relevant information, participate, interact and collaborate. Previous research has revealed findings that lend support to the general quality of an IS and that it could significantly affect users' behavioural usage and intention to reuse the system (DeLone & McLean, 2003, 2004; Petter, DeLone, & McLean, 2008; Petter & McLean, 2009; Urbach & Müller, 2012; Wu & Wang, 2006). To better serve all users in the library 2.0 environment, academic libraries need to assess the needs of different types of users including students and staff, and determine success factors that can enhance usage of library 2.0 applications. Success factors affecting adoption of library 2.0 applications may differ in different countries, and different categories of research communities or disciplines. It is therefore imperative to assess the adoption of library 2.0 applications in different localities or research disciplines for effective deployment of library 2.0, particularly in African countries where the application of web 2.0 in academic libraries is still low.

Therefore, this study aimed to examine the adoption of library 2.0 technologies among undergraduate students in the African context, and focused at the Muhimbili University of Health and Allied Sciences (MUHAS) of Tanzania. The study examined the undergraduate students' usage intention to reuse library 2.0 application by using the DeLone and McLean's (2004) information systems (IS) because it addressed the study objectives. It has been suggested that "despite the multidimensional and contingent nature of IS success, an attempt should be made to reduce significantly the number of measures used to measure IS success, so that research results can be compared and findings validated" (DeLone &

McLean, 2004). Based on IS success model, the study re-specified and validated IS model to examine library 2.0 adoption via the structural equation modeling (SEM) approach. The study examined the role of quality (service quality, information quality and system quality) in influencing user perceived net benefits, satisfaction and intention to reuse library 2.0 application in a health science Tanzanian public university. The paper provides a brief background of the development and implementation of library 2.0 technologies at MUHAS library, the conceptual model and research hypotheses development, research methodology, results, discussions, implications for research and practice and conclusion.

The implementation of library 2.0 technologies at MUHAS

MUHAS Library is the leading biomedical and health sciences university library in Tanzania. The library is part of the Muhimbili University of Health and allied Sciences (MUHAS) which became a university in its own right in 2007, having previously been a college of the University of Dar es Salaam. The library currently houses over 100,000 volumes of materials, subscribes to over forty academic databases, and has automated its services, established a digital institutional repository, and provides a wide range of other information and reference services. In order to serve the growing demands of increasing numbers of its clients, within and outside the University, the library therefore adopted emerging social and dynamic technologies in order to develop a more responsive range of user-focused services. In July 2012, the library adopted web 2.0 services for the purpose of providing access to information, getting feedback from users, to enhancing interactive and collaborative learning, and promoting library services. The library, therefore, developed the following tools:

- *Social bookmarking and tagging systems:* These tools are used to organize and categorize web-based scholarly literature in the health science discipline and share them as subject guides to faculty and students via the library website. The MUHAS library used an external web service, known as delicious (<http://delicious.com/>) to manage library information resources of more than 100 annotated web links.
- *Single-click downloadable library toolbar:* The library developed a downloadable library toolbar to allow single click access to a wide range of library collection and enhance use of library services at MUHAS. This toolbar was developed with the help of Conduit (www.conduit.com). The single-click library toolbar contains several products and services provided by the library, which include a link to MUHAS library website, MUHAS emails, MUHAS homepage, Google web search, library catalogue, links to e-resources, and other social networks such as library page on facebook and blog. The library expects to increase the frequency of use of different services available through the downloadable library toolbar.
- *Blogs and mashups:* Blogs are used at MUHAS for delivering health content through online search tool to search for e-resources at the library website, posting information on training schedule, new information resources at the library, online tutorials on information search techniques, international and local conferences, and other information that may be relevant to faculty and students. The library used an external free service to provide its blog service, known as blogger which is the most common blogging platform used by libraries. Statistics show that the blog has total page views of over 12,614, where it receives an average of 1400 hits per month, with most viewers from Tanzania.
- *RSS feeds:* The library integrated RSS feeds on its website, blog and facebook page to instantly update its users on new and useful e-resources or pertinent information being added on the website or blog.
- *Social networks:* In this category, facebook seemed to be a good choice to communicate with library users at MUHAS, since most students are already using this tool for social

and educational purposes. The MUHAS library facebook page is still being promoted, and has already accumulated 163 members.

- *Wiki*: In supporting learning and information literacy activities, the library used wiki to provide online training modules and annotated links on various topics. The library wiki was developed by using free hosting services provided by google site. The library wiki provides online training modules in the form of power point presentations on various information literacy aspects, including online search strategies, evidence based practice, citation and reference management, and use of web 2.0 technologies.

Conceptual model and research hypotheses development

The information systems (IS) success model has been widely used to study various aspects of information system as summarized by Petter, DeLone and McLean (2008), where 180 examples have been described. Another meta-analysis study of 52 empirical studies indicate that relationships within the IS success model at the individual level of analysis found support for the relationships that encompass the IS success model (Petter & McLean, 2009). The empirical studies indicate that IS success models (DeLone and McLean (1992, 2002, 2003) are appropriate to examining technology usage and continuance.

The DeLone and McLean's (1992) full model proposes six major dimensions of IS success, namely (1) system quality, (2) information quality, (3) use, (4) user satisfaction, (5) individual impacts, and (6) organizational impacts. The extended model (DeLone & McLean, 2002, 2004) incorporates service quality as the third quality dimension and intention to use and net benefits as the other new dimensions. DeLone and Mclean (2004) propose that a high-quality system will be associated with more use, more user satisfaction, and positive net benefits. In other words, system quality, service quality and information quality positively influence intention to use, actual system usage and user satisfaction while intention to use, actual use and user satisfaction influence net benefit (Delone & Mclean, 2004).

Scholars however argue that the IS success model has not been tested and empirically validated (Seddon, 1997; Wang, 2008). Studies support the view that quality factors (information, system and service) influence attitude and behavior in an IS context. However, there have been many debates on the relationships of the right-hand side of the IS success model (Wu & Wang, 2006). Scholars argue that the system use in the original D&M model of IS success is a behavior and should be interpreted as a consequence of IS success, not as a determinant of impacts or benefits (Seddon, 1997). According to Wu and Wang (2006), "system use is necessary but not sufficient to generate system benefits". Due to difficulties in interpreting the dimension use, DeLone and McLean (2004) proposed the intention to use as an alternative measure to actual use of IS in some contexts.

The model by Wang and Yu (2006) further re-specified and validated the IS success model (Delone & Mclean, 2004), and consists of five dimensions: information quality, system quality, perceived net benefits, user satisfaction and system use. Wang and Wu (2008) hypothesized that user satisfaction results from personal feelings and attitude, which cannot influence system benefits. However, perceived system benefits can influence user satisfaction. Therefore, individual impact and net benefits can cause user satisfaction (rather than vice versa) (Wu & Wang, 2006). The IS success model by Wang and Wu (2008) also specifies that system use is affected by perceived net benefits and user satisfaction, which, in turn, are influenced by information quality, system quality and service quality in the knowledge management system context. Based on the IS success models of Wang and Wu (2006) and DeLone & McLean, (2000), this study adopted the following six variables of the IS success model, which included information quality, system quality, service quality, net

benefits, user satisfaction, and intention to reuse. Figure 1 represents the theoretical model for this paper. The research model hypothesizes that intention to reuse is affected by perceived net benefits and user satisfaction, which, in turn, are influenced by information quality, system quality and service quality.

While previous studies on library 2.0 and website evaluation have empirically shown the importance of the information quality, system quality and service quality (Chua & Goh, 2010; Kim, 2011; Masrek, Jamaludin, & Mukhtar, 2010), none has empirically shown the relationship between these qualities and user satisfaction and behavioural intention to reuse. Similarly, very limited library 2.0 studies have empirically shown the relationship between user satisfaction, net benefits and behavioural intention to reuse. The study therefore assesses whether factors such as information quality, systems quality and service quality are predictors of net benefits and user satisfaction in the context of academic library 2.0 systems. Similarly the findings would ascertain whether perceived net benefits and user satisfaction are a determinant of behavioural intention to reuse.

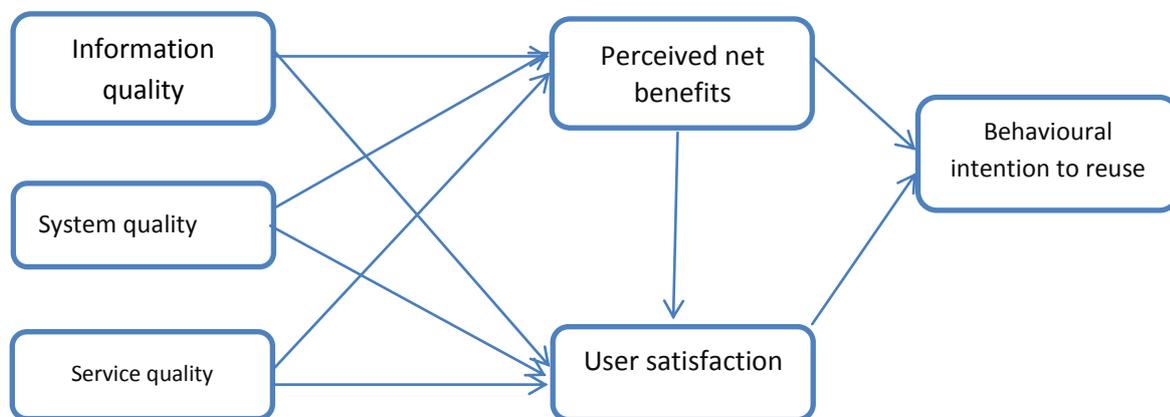


Figure 1: Library 2.0 success model

Information quality

In the web 2.0 environment, information quality can be defined as measuring the users’ perception of the content quality of web 2.0 application in a specific library website. Factors such as personalization, completeness, relevancy, easy to understand, and security are examples of qualities that can influence users to gather or share content and return to the site on a regular basis (Delone & Mclean, 2004). Information quality has been found to strongly influence user satisfaction in the context of academic library portal (Masrek et al., 2010) and other fields in IS (Petter et al., 2008; Petter & McLean, 2009; Urbach & Müller, 2012). The literature reviews of IS success studies also revealed that information quality had a moderate effect on net benefits (Petter et al., 2008; Urbach & Müller, 2012). Previous studies of ISs have shown that information quality positively impacts the perceived value and user satisfaction, which in turn, significantly impact the intention to reuse IS (Wu & Wang, 2006). These results indicate the positive influence that information quality has on users’ satisfaction, perceived net benefits and intention to reuse. As library users perceive that the information quality on library 2.0 application is better than those of others, they are more likely to continue using the system. Information quality is therefore significant in assessing the users’ perceived net benefits and satisfaction, which in turn, is a direct driver of intention to reuse library 2.0 applications because “library services are largely information-intensive” (Chua & Goh, 2010). Thus, this study proposes the following hypothesis:

H1: Information quality has a positive effect on user satisfaction in the library 2.0 context.

H2: Information quality has a positive effect on perceived net benefits in the library 2.0 context

System quality

In the web 2.0 environment, system quality measures the desired characteristics of the information system (Delone & Mclean, 2004). The system quality reflects the general performance that users perceive when interacting with web 2.0 systems, such as library 2.0 functions (Wang & Lin 2011). The system quality can be measured by the following aspects: usability, availability, reliability, adaptability, and response time (e.g., download time) (Delone & Mclean, 2004), ease of access and privacy (Chua, Goh, & Ang, 2012). System quality has been found to be a strong indicator of user satisfaction in the context of IS (Petter & McLean, 2009; Raeth, Smolnik, Urbach, & Zimmer, 2009; Urbach & Müller, 2012; Wu & Wang, 2006). The literature reviews of IS success studies also revealed that system quality moderately influenced net benefits in IS environment (Petter et al., 2008; Urbach & Müller, 2012). System quality was found to significantly impact the intention to reuse IS through both perceived value and user satisfaction (Wang, 2008). Thus, library users are more likely to continue reusing the library 2.0 applications due to a better interaction experience they have with the system. Hence, the following hypotheses are proposed:

H3: System Quality has a positive effect on User Satisfaction in the library 2.0 context

H4: System Quality has a positive effect on Perceived net benefits in the library 2.0 context

Service quality

The service quality can be conceptualized as the overall support delivered by the library, ICT support department, and web 2.0 service providers such as blogger, social network sites etc (Delone & Mclean, 2004). In a library setting, Library service quality comprises information access (content/scope and timeliness), personal control (ease of navigation and convenience), effect of service (responsiveness and reliability) and library as a place (utilitarian space) (Heath, Boykin, & Webster, 2002). A study of web 2.0 application in 120 library websites from North America, Europe and Asia established that the presence of Web 2.0 applications was found to be associated with the overall quality and, in particular, service quality of library websites (Chua & Goh, 2010). Service quality was also found as a significant predictor of user satisfaction in the context of academic library portal (Masrek et al., 2010). The literature reviews of IS success studies also revealed that service quality had a moderate effect on net benefits and user satisfaction (Urbach & Müller, 2012). Service quality was found to significantly impact the intention to reuse IS through both perceived value and user satisfaction (Wang, 2008). The interactive and participatory nature of web 2.0 application can influence users to use library 2.0 services. On the one hand, the librarian plays an important role in providing support to patrons in library 2.0 environment by: providing promised services dependably and accurately (reliability); providing prompt assistance (responsiveness); inspiring trust and confidence (assurance); and offering individualized attention to library users (empathy) (Chua & Goh, 2010). On the other hand, web 2.0 service providers offer a wide range of services to support users such as personalization and customization of user interfaces. Various web 2.0 applications allow incorporation of multimedia content, javascript or third-party plug-ins to enhance the appearance or interactivity of their pages on library 2.0 services such as blogs, or social networks, blogs (Wang & Lin, 2011). Web 2.0 service providers also provide a wide range of content management functions, such as pre-defined categories, keywords, tags, such as blogging service providers (Wang & Lin, 2011). Thus, library users are more likely to adopt and use library 2.0 applications if there are useful supportive functions from web 2.0 service

providers and adequate support from librarians/IT support unit in a University setting. Therefore, the following hypotheses are proposed:

H5: Service quality has a positive effect on user satisfaction in the library 2.0 context

H6: Service quality has a positive effect on perceived net benefits in the library 2.0 context

Perceived net benefits

According to Delone and Mclean (2004), net benefits refer to both positive and negative impacts of IS on customers, suppliers, employees, organizations, markets, industries, economies, and even our societies. This definition in the model is conceptually too broad to define. When using the updated D&M model, Delone and Mclean (2004) suggest that researchers need to clearly and carefully define the stakeholders and the context in which net benefits are to be measured. In the context of this study, perceived net benefits refer to positive impacts of the library 2.0 applications on individual library users. The perceived net benefits dimensions of individual impact may include awareness/recall, decision effectiveness, individual productivity, job effectiveness, job performance, job simplification, learning, productivity, task performance, usefulness and task innovation (Urbach & Müller, 2012). Previous studies show that perceived net benefits is a significant predictor of user satisfaction and intention to use the IS system (Petter & McLean, 2009; Wu & Wang, 2006). These studies show that perceived net benefits of using information system such as library 2.0 application can influence users' satisfaction and intention to reuse the specified system. Therefore, this study proposes the following hypotheses:

H7: Perceived net benefits has a positive effect on intention to reuse in the library 2.0 context

H8: Perceived net benefits has a positive effect on user satisfaction in the library 2.0 context

User satisfaction

User satisfaction is the level of satisfaction a user has with a system relative to what the user expected upon first use of the system (Seddon, 1997). User satisfaction can be measured by using items such as adequacy, effectiveness, efficiency, enjoyment, information satisfaction, and system satisfaction (Urbach & Müller, 2012). Previous IS studies have also indicated that satisfaction is a significant predictor of intention to reuse (Petter & McLean, 2009; Wang, 2008). These studies show that user satisfaction with library 2.0 application can influence behavioural intentions to reuse the specified system. Thus, the following hypothesis is tested:

H9: User Satisfaction has a positive effect on Intention to reuse in the library 2.0 context.

Intention to Reuse

Intention to reuse refers to the favourable attitude of the user towards the library 2.0 system that result in repeated use behaviour of gathering or sharing content (Wang, 2008). Prior IS studies have consistently indicated that intention to reuse is an important factor in determining information system acceptance by users in IS fields (Wang, 2008).

Methodology

The case study research design was used to collect data from all first year undergraduate students at MUHAS. A total of 408 self-administered questionnaires were sent out to all first year undergraduate students at MUHAS. A total of 293 students took part in the survey, with a rate of return of 71.8%. The objective of the survey was to establish the undergraduate students' intention to reuse library 2.0 applications. Tables 1, 2 and 3 list the

respondents' demographic characteristics, including gender, age, degree programmes, usage of web 2.0 tools and library 2.0 services.

The survey items were developed by using research instruments as proposed by various scholars. The indicators to measure the five research constructs are listed in Table 5. A five-point Likert scale, ranging from "1 = strongly disagree" to "5 = strongly agree", was used for all the items in the survey questionnaire, where each construct measured four to five items. Information quality was measured by assessing four indicators (information timeliness, relevancy, completeness and accuracy) (Delone & Mclean, 2004; Masrek et al., 2010; Wang & Lin, 2011). Three items (system reliability, availability, and usability) were used to represent system quality (Delone & Mclean, 2004; Wang & Lin, 2011). Four items (service responsiveness, empathy, reliability and assurance) were used to operationalize service quality (Delone & Mclean, 2004; Kim, 2011; Masrek et al., 2010; Wang, 2008). Three items (time saving in accessing content, enhanced learning and academic performance enhancement) were employed to measure perceived net benefits (Delone & Mclean, 2004; Kim, 2011; Park, Zo, Ciganek, & Lim, 2011). Two indicators (satisfaction in content access and distribution, and satisfaction for library 2.0 systems) were used to measure user satisfaction (Delone & Mclean, 2004; Wang & Lin, 2011). Repeated visits to library 2.0 system was used to measure behavioural intention to reuse (Wang, 2008). The measurement indicators were pre-tested with 100 fourth and fifth year medical undergraduate students at MUHAS. Some indicators were modified based on the responses in the pilot test.

The structural equation modelling (SEM) approach was used to validate the research model. AMOS version 21.0 was used to analyze the hypotheses generated. The study used the two-step analytical procedure as recommended by Hair *et al.* (2010) whereby, the Confirmatory Factor Analysis (CFA) was conducted to examine the reliability and validity of the measurement model, and the structural model also was analysed to test the associations conceptualized in the research model.

Results

The demographical information including gender, age, degree programme, and technical skills is presented in Table 1. In this study, more males (67.6%; n=198) participated in the study than females (32.4%; n=95). The average age was 23 years, with most respondents aged between 21 and 25 years (47.1%; n=138). Most students were enrolled in the Doctor of Medicine degree program (52.2%; n=153).

Table 1: Demographic details of study participants (N=293)

		Frequency	Percentage
Gender	Female	95	32.4
	Male	198	67.6
Age	20 years and below	101	34.5
	21 – 25 years	138	47.1
	26 – 30 years	32	10.9
	31 years and above	22	7.5
Degree program	Doctor of Medicine	153	52.2
	Doctor of Dentistry	23	7.8
	Bachelor of Pharmacy	34	11.6
	Bachelor of Nursing	60	20.5
	RTT	7	2.4
	BMLS	16	5.5

Prior to determining the factors affecting the intention to reuse library 2.0 services, it was deemed necessary to find out the level of experience and usage of web 2.0, library website and library 2.0 technologies. All respondents acknowledged that they had used at least one web 2.0 tool available on the internet. Most students had used web 2.0 technologies for less than a year (76.8%, n=225), followed by those students who had used web 2.0 services for less than two years (14.3%, n=42), while few respondents had used web 2.0 sites for more than 3 years (8.9%, n=26). Table 2 shows that most respondents (91.8%, n=269) had personal accounts on various web 2.0 services. The majority of students had personal accounts on social networks tools (71.4%, n=197) and blogging tools (53.3%, n=147). The study findings imply that most students had experience with web 2.0 tools, and thus they formed a viable target group to assess their intention to reuse web 2.0 services provided through the library website.

Table 2: Students' personal accounts in web 2.0 tools (N=269)

Web 2.0 tools	Frequencies	Percent
Audio Sharing tools (i.e. Podomatic etc)	18	6.50%
Discussion Forums (i.e. Google Groups, etc)	38	13.80%
Online Calendars - (i.e. Google Calender)	24	8.70%
Presentations tools (i.e.SlideShare etc)	29	10.50%
RSS Readers (i.e. Google Reader)	43	15.60%
Social Networking tools (i.e. Facebook)	197	71.40%
Voice over IP (VoIP)/Instant Messaging (IM) (i.e. Skype)	28	10.10%
Blogging tools (i.e.Blogger)	147	53.30%
Photo Sharing tools (i.e. Flickr etc)	29	10.50%
Remote collaboration tools(i.e GoogleDocs)	20	7.20%
Social Bookmarking/Tagging tools (i.e. Del.iciou.us)	125	45.30%
Video sharing tools (i.e You tube)	97	35.10%
Microblogging tools (i.e.Twitter)	49	17.80%

Note: Multiple responses were allowed

Students were also asked to indicate if they had used library website and library 2.0 services, and their frequency of using library website. Table 3 shows that most students had used library website (85.4%, n=250). Despite high level of familiarity and usage of web 2.0 services, students were not frequent users of library website, where 38.6% (n=113) had used library website once in a while. Similarly, a low percentage of respondents (37.2%, n=109) had used research tools developed by library using web 2.0 services. It was therefore important to determine factors that can enhance adoption and usage of library 2.0 services at the university.

Table 3: Use of library website and library 2.0 tools (N=293)

		Frequencies	Percentage
Have you ever used MUHAS library website	Yes	250	85.4
	No	43	14.7
How often do you use MUHAS library website?	Never	43	14.7
	Once in a while	113	38.6
	Monthly	21	7.2
	Weekly	76	25.9
	Daily	40	13.7
Have you ever used research tools developed by the MUHAS library using web 2.0 sites?	Yes	109	37.2
	No	184	62.8

Measurement model

The first-order confirmatory factor analysis (CFA) was conducted using AMOS 21 to test the measurement model. Common six model-fit indices were used to evaluate the overall goodness-of-fit, which included the following: (1) the chi-squared normalization by degrees of freedom (X^2/df); (2) the adjusted goodness-of-fit index (AGFI); (3) the non-normalized fit index (NNFI); (4) the comparative fit index (CFI); (5) the incremental fit index (IFI); and (6) the root-mean-square error of approximation (RMSEA). Table 4 presents the results of CFA for measurement model. The ratio of the chi-squared value to the degrees of freedom X^2/df for measurement model was 2.179 ($X^2 = 664.728$ with $df = 305$), which is smaller than 3 as recommended by Hair *et al.* (2010), and it indicated a good fit for measurement model. All other model-fit indices showed good fit for the measurement model. The thresholds below were adopted as recommended by Hair *et al.* (2010).

Table 4: Fit indices for measurement and structural models

Fit measures	Recommended values	Measurement model	Structural model
X^2/df	≤ 3.00	2.179	2.334
AGFI	≥ 0.80	0.822	0.809
CFI	≥ 0.90	0.958	0.952
IFI	≥ 0.90	0.958	0.952
RMSEA	≤ 0.08	0.064	0.068
NNFI (TLI)	≥ 0.90	0.951	0.945

The measurement model was further assessed for convergent validity of scale items, which was assessed by using three criteria: reliability, composite reliability, and the average extracted variance. Reliability of factors was estimated by assessing the cronbach alpha, and factor loadings from the confirmatory factor analysis. Cronbach's alpha coefficient for each aspect was examined. Cronbach's alpha coefficient exceeding the 0.7 threshold indicates a high level of consistency among the aspects; a Cronbach's alpha coefficient exceeding 0.9 indicates a much higher level of consistency among the aspects. The Cronbach's alpha coefficients of the six constructs all exceeded 0.8, and five aspects had Cronbach's alpha coefficients higher than 0.9, which indicates the instrument used for the study was highly reliable.

Convergent validity was further evaluated by examining the factor loadings from the confirmatory factor analysis (see Table 5). According to Fornell and Larcker (1981), all indicator factor loadings should be significant and exceed 0.7. All factor loadings of the items in the confirmatory factor analysis of the measurement model were greater than 0.7 and were significant at $p=0.001$. Thus, all factors in the measurement model had adequate reliability and convergent validity.

Table 5: Result of CFA for measurement model

	Internal reliability Cronbach alpha	Factor loading
System quality	0.945	
15- Web 2.0 tools on library website are user friendly (usability)		0.911
14- It is easy for me to share the content & post comments on library web 2.0 (usability)		0.833
16- Library web 2.0 service is always available so I can use it whenever I want (availability)		0.910
13- It is easy to find the information I need from the library web 2.0 tools (usability)		0.866
18- Web 2.0 tools on library website operate reliably (reliability)		0.878
Information quality	0.918	
9- Library web 2.0 provide me with complete set of content (completeness)		0.829
7- Library web 2.0 tools provide me with the most recent content (timeliness)		0.872
5- Content contains links to e-resources that are necessary to complete my assignments (relevance)		0.902
1- Library web 2.0 disseminate accurate information (accuracy)		0.753
2- Information provided by Library web 2.0 tools is timely (timeliness)		0.849
Service quality	0.897	
28- Web 2.0 tools on library website give prompt service to users (responsiveness)		0.853
26- Web 2.0 tools on library website understand and adapt to the user's specific needs (empathy)		0.803
25- Web 2.0 tools on library website can be dependent upon to provide what is promised (reliability)		0.839
19- Web 2.0 tools on library website are trustworthy (assurance)		0.849
Perceived net benefits	0.946	
41- It provides useful information for my research project/assignment		0.877
40- It enhances the quality of my research project/assignment		0.900
37- It enables me to acquire new skills on information searching		0.894
36- It helps me to find information that I need		0.895
35- It enables me to reduce time that I would use to search information (time saving)		0.846
Satisfaction	0.913	
46- I am satisfied to continue posting comments on library web 2.0 tools even if others in my field do not (Repeated visits)		0.873
47 - I am satisfied with library web 2.0 tools efficiency		0.915
48 - I am satisfied that library web 2.0 tools meet my information needs		0.896
43- Overall, I'm very satisfied with library web 2.0 tools		0.718
Behavioural intention to reuse	0.943	
33- I'm willing to encourage other people to reuse web 2.0 tools on library website		0.881
31- In the future, if I have any need for information, I will reuse library web 2.0 tools		0.877
32- I will reuse library web 2.0 tools in the near future (repeat visit)		0.931
34 - Overall, I intend to use library web 2.0 tools frequently		0.883

Convergent validity was also evaluated by using composite reliability and average variance extracted. Composite reliability assessed the internal consistency of the measurement model. The recommended criteria for composite reliability (CR) is 0.70 or above, and an average variance extracted of more than 0.50 (Hair 2010). The results of the convergent validity using CFA are shown in Table 6 which shows that all the composite reliability values are above 0.90 and the average variance extracted is above 0.60. Thus, the research model can be considered to have acceptable convergent validity.

Discriminant validity assesses the extent to which a concept and its indicators differ from another concept and its indicators (Bagozzi, Yi, & Phillips, 1991). According to Fornell and

Larcker, when the square root of the average variance extracted is greater than its correlations with all other constructs then discriminant validity has been established (Fornell & Larcker, 1981). Table 6 indicates that all the square roots of the AVEs were greater than the correlations between the construct and any other construct in the model (satisfying Fornell and Larcker's (1981) criteria for discriminant validity). All diagonal values exceeded the inter-construct correlations, and thus, the results confirm that the research instrument had satisfactory construct validity. Therefore, the CFA measurement model had adequate reliability, convergent validity and discriminant validity.

Table 6: Composite Reliability (CR), Average Variance Extracted (AVE) and Discriminant Validity of constructs

	CR	AVE	Service quality	Information quality	System quality	Perceived net benefits	User satisfaction	Intention to reuse
Service quality	0.903	0.699	0.836					
Information quality	0.922	0.702	0.875	0.838				
System quality	0.945	0.775	0.937	0.821	0.880			
Perceived net benefits	0.946	0.779	0.796	0.748	0.718	0.883		
User satisfaction	0.914	0.729	0.810	0.833	0.780	0.850	0.854	
Intention to reuse	0.940	0.798	0.811	0.769	0.719	0.863	0.826	0.893

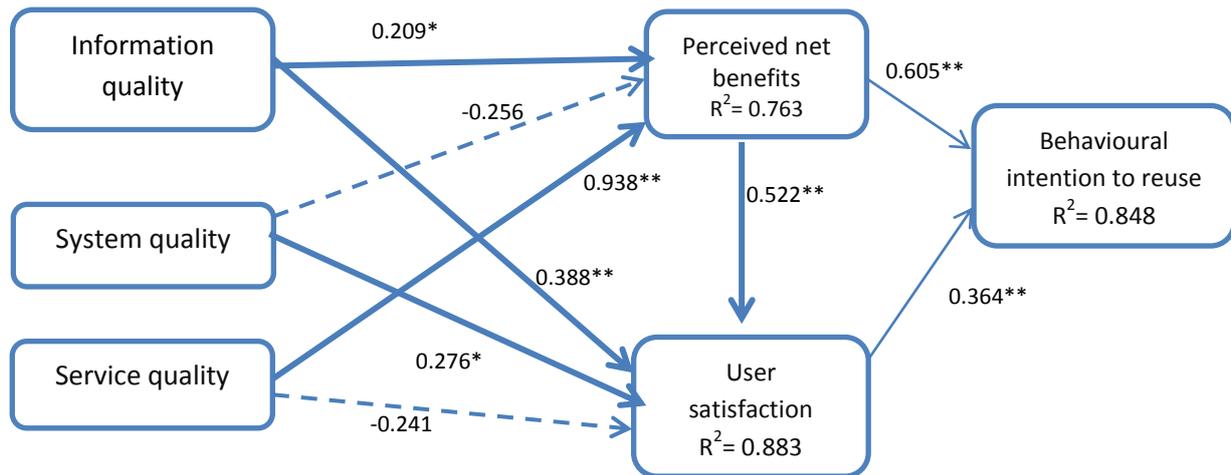
Structural Equation modelling

The same set of goodness-of-fit indices was used to observe the structural model. Table 4 indicates that the observed normed X^2 for structural equation model was 2.334 ($X^2 = 723.620$ with df 310), which is smaller than 3 as recommended by Hair et al. (2010), and this indicated a good fit for SEM model. The results also indicate that all indices surpassed the recommended values, and thus the structural model of this study exhibited a good fit (AGFI = 0.809, NNFI = 0.945, CFI = 0.952, IFI = 0.952, RMSEA = 0.068).

Figure 2 indicates the structural equation modelling results, and it shows the standardized path coefficients, their significance for the structural model, and the coefficients of determinant (R^2) for each endogenous construct. The standardized path coefficient indicates the strengths of the relationships between the independent and dependent variables. R^2 represents the percentage of variance of a dependent variable that was explained by its predictors. Firstly, information quality had significant positive influences on user satisfaction and perceived net benefits, thus, hypotheses H1, H2 were supported ($b = 0.388$, and 0.209 respectively). These results implied that increased information quality of the library 2.0 applications would be associated with increased user perceived net benefits and user satisfaction. Secondly, system quality had a significant positive effect on user satisfaction, but it had no effect on perceived net benefits. Thus, hypothesis H3 was supported ($b = 0.276$), but hypothesis H4 was not. Thirdly, service quality had a significant positive effect on perceived net benefits, but had no effects on user satisfaction. Thus, hypothesis H6 was supported ($b = 0.938$), but not H5. Fourthly, perceived net benefits appeared to be a significant determinant of user satisfaction, and intention to reuse, hence H7 and H8 were supported ($b = 0.522$, and 0.605 respectively). Lastly, the effect of user satisfaction on intention to reuse was also significant, and thus H9 was supported ($b = 0.364$). On the whole, the study findings supported seven out of nine hypotheses. The research model indicates that information quality, system quality and service quality can account for 76.3% of the variance in perceived net benefits, and the same three quality factors can explain

about 88.3% of the variance in user satisfaction. Collectively, these factors explain 84.8% of the variance in behavioural intention to reuse.

Table 7 summarises the direct, indirect and total effects of information quality, system quality, and service quality on perceived net benefits, user satisfaction and behavioural intention to reuse. It is worth noting that perceived net benefits had the strongest direct effect on behavioural intention to reuse compared with the other determinants within the model. Among the three quality-related constructs, service quality had the strongest total effect on behavioural intention to reuse. Further, service quality had the strongest effect on perceived net benefits, while information quality had the largest effect on user satisfaction



Note: * $p < 0.05$, ** $p < 0.01$

Figure 2: Hypotheses testing results

Table 7: The direct, indirect and total effect of variables depicted

	Direct effect			Indirect effect			Total effects		
	Perceived net benefits	User satisfaction	Intention to reuse	Perceived net benefits	User satisfaction	Intention to reuse	Perceived net benefits	User satisfaction	Intention to reuse
Information quality	0.209	0.388		0.109	0.307		0.209	0.497	0.307
System quality	-0.256	0.276		-0.134	-0.103		-0.256	0.143	-0.103
Service quality	0.938	-0.241		0.489	0.658		0.938	0.248	0.658
Perceived net benefits		0.522	0.605			0.190		0.522	0.795
User satisfaction			0.364						0.364

Discussion of study findings

The findings from the present study provide significant support for the IS success model. Seven of the nine proposed hypotheses were supported. The data collected from this study yielded five main findings. Firstly, perceived net benefits had the strongest direct effect on intention to reuse compared with any other determinants within the model. Similar findings were revealed by other IS studies (Petter et al., 2008; Petter & McLean, 2009). Perceived net benefits play a critical role to the library 2.0 services success measurement and management. Apart from relying on users' satisfaction and quality measurement, it is also important for library management to assess the users' perceived net benefits in order to improve user's participation and usage of library 2.0 services and boost membership of their services. Similar to previous IS studies (Petter et al., 2008; Urbach & Müller, 2012), the study findings also indicated that information quality and system quality were significant

predictors of perceived user benefits. There is a need to improve information, system and service quality of the library 2.0 systems for users to continue reusing library services.

Secondly, the study findings indicate that among the three quality-related constructs, service quality had the strongest total effect on perceived net benefits and intention to reuse. Cha and Goh (2010) also found that the presence of Web 2.0 applications was found to correlate to the overall quality of library websites, where the association was strongest with service quality. Consistent findings were revealed by other studies in the information systems field (Petter et al., 2008; Y. Wang, 2008). The interactive and participatory nature of library 2.0 applications could have contributed positively to service quality dimensions. Further, the reliability, assurance, responsiveness and empathy of librarians contributed to the strong influence of service quality on perceived of library 2.0 systems among the surveyed library users. The patron membership to library 2.0 services can thus develop and improve if the library service quality is appropriately managed. Library 2.0 applications can be used as a way to disseminate information and engage users while visiting a library website, thereby influencing them to continually reuse the library services effectively.

Thirdly, compared to system quality, information quality had the largest effect on user satisfaction in this study. These findings corroborate the results of previous IS studies (Masrek et al., 2010; Petter et al., 2008; Petter & McLean, 2009; Urbach & Müller, 2012). Indications are that users were satisfied with the quality of information provided through the library 2.0 sites, which influenced them to use the site. Although library 2.0 applications allow user generated content, it is also important for librarians to ensure quality of content in these systems to create a higher level of patronage, and boost user's behavioural intention to re-use the library websites.

Fourthly, the finding that system quality did not have a significant direct influence on user perceived net benefits, was similar to previous studies in knowledge management system context (Wu & Wang, 2006). However, this finding was inconsistent with most previous studies in IS which found a strong association between system quality and user satisfaction (Petter et al., 2008; Urbach & Müller, 2012). The findings of the present study show that the system quality in library 2.0 environment is essential but not a significant factor for users to attain net benefits. Librarians thus need to ensure that the library 2.0 applications are operational, reliable, available and user friendly to encourage users to reuse the system. According to Wu and Wang (2006), system quality may be important at the initial stages of implementing IS, but its significance subsides with time. Lastly, the result that service quality had no significant effects on user satisfaction implies that user support provided by librarians on web 2.0 environment were necessary but not sufficient to shape user's beliefs and to affect their intention to reuse the library 2.0 system. However, this finding was contrary to most previous studies in IS which found a strong correlation between service quality and user satisfaction (Petter et al., 2008).

Conclusions

The study findings demonstrate that the information systems (IS) success model is suitable in guiding the understanding of the contributing factors with respect to library user's intention to reuse library 2.0 applications. The Study findings supported the IS success model well, where seven of the nine hypothesized relationships were found to be significant. The 84.8 percent overall explanatory ability exhibited in the validated research model, also testified to the potential of the information systems (IS) success model in evaluating the success of library 2.0 in the African context. In summary, the study found that information quality, system quality, service quality, perceived net benefits, user satisfaction and intention to reuse are important factors for evaluating the success of library 2.0 system. In

general, the perceived net benefits had the strongest direct effect on behavioural intention to reuse compared with other determinants within the model. Among the three quality-related constructs, service quality had the strongest total effect on perceived net benefits and intention to reuse. Compared to a system quality, information quality had the largest effect on user satisfaction. Lastly, system quality did not have significant influence on user perceived net benefits, while service quality had no significant effects on user satisfaction. The study shows that a re-specified and validated IS success model (Delone and Mclean 2004) can be adapted to analyse factors that contribute to successful implementation of library 2.0 systems in similar environments.

Implication for practice

This study has several implications for the success and effectiveness of library 2.0 applications. The study findings indicate that librarians should pay attention to IS success factors when planning and implementing library 2.0 services in order to ensure success from such investments in four folds. Firstly, the significance of perceived net benefits factor implies that library 2.0 adoption may be enhanced by assessing and improving the net benefits perceived by patrons as being necessary for them to maintain their intention to use library 2.0 services. Secondly, the findings indicated that service quality played a key role in driving users' usage intention. Librarians should strive to enhance overall service quality of their library 2.0 applications to increase patrons' usage intention. Students are the major readers and contributors of online content on library 2.0 platform. Increasing their usage intention helps to enrich the content of the library 2.0 platform. Hence, libraries should provide reliable library 2.0 services, provide prompt attention to user's queries and demands, ensure trust and confidence, and offer individualized attention to library users to stimulate patrons' usage intention. Libraries should identify skilled librarians to manage library 2.0 functions in addition to their normal job responsibilities in order to ensure high quality of services. Librarians should also take the advantage of a wide range of web 2.0 functions and services to add value to their library 2.0 services and strengthen user's usage intention, especially among students. Thirdly, the information quality was found to play a key role in increasing user satisfaction with library 2.0 services. Librarians should focus on enhancing information quality to raise user satisfaction in library 2.0 application. Information relevance, accuracy, timeliness and completeness are the main factors leading to the success of library 2.0 applications. Librarians should develop means to monitor online content to ensure good quality of information including user generated content. The users' intention to continue using library 2.0 services can increase due to a high level of user satisfaction, and thus be able to account for high investment costs involved in developing and maintaining the library 2.0 services. Lastly, the usage of library 2.0 can also improve when the system quality is in place to enhance user satisfaction and continued usage of library 2.0 services. Librarians need to ensure that the library 2.0 services are reliable, available and user friendly to encourage users to reuse the system.

Implications for research

Many IS success factors have been evaluated in prior studies. These studies have evaluated the success of information systems as a multi-dimensional construct through the influence of quality factors, user satisfaction and net benefits on system use (Wu & Wang, 2006). Wang (2008) also re-specified and re-validated the multidimensional model for assessing e-commerce systems success. Wang (2008) found that intention to reuse was affected by perceived value and user satisfaction, which, in turn, were influenced by information quality, system quality and service quality. This study conceptualized and re-specified the IS success model, and the validated model consists of six dimensions: system quality, service quality and information quality, perceived net benefits, user satisfaction, and intention to reuse. The re-specified model indicates that the quality factors (i.e. information, system and service)

influence the net benefits and user satisfaction, while net benefits and user satisfaction are antecedents of intention to reuse, and the intention to reuse is a surrogate measure of IS success. The factors examined provide a strong basis for the understanding of the success of web 2.0 in a library setting. The study has also bridged the gap of limited evaluation of success of IS in a library setting. It has also contributed to the body of knowledge on the library 2.0 systems because little empirical data exists in the developing world context although much of the literature exists in the developed countries. Thus, the re-specified IS success model and the validated 27-item research instrument can be adapted to test research hypotheses and theories not only in the context of library 2.0 technologies, but also a other related aspects such as web 2.0/social media, and digital libraries in other institutions with similar conditions. The validated 27-item research instrument with good reliability and validity can be an important tool for measuring library 2.0 system success dimensions, and a basis for describing, elaborating and comparing differences among the study findings. The results can provide a better understanding of how to plan and implement successful web 2.0 systems in a library setting.

Limitations and further research

There are two main limitations in this study. This study focused only on a single health science public university whereas, the scope of data collection was limited to only first year undergraduate students at MUHAS. This study can be expanded to assess the adoption of library 2.0 services among different types of library users across a large number of public and private universities and other tertiary institutes within Tanzania and beyond. Further, experimental studies on the influence of library 2.0 applications on users' usage behaviour can validate the information system success model, together with other dimensions that were not evaluated in this study, such as system use and organizational net benefit constructs. This research is significant since the applicability of the information systems (IS) success model with regard to adoption and usage of library 2.0 services in the African context has received little attention when compared to other technology contexts.

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