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RESEARCH ARTICLE

Beyond Adoption: Investigating Long-Term Digital Library Service Usage in Higher Learning Institutions

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Abstract: The growth of wireless technologies and ubiquitous mobile devices has transformed the way library resources and services are delivered to users. Most libraries have adopted mobile library applications (MLA) to improve their service delivery. Despite such widespread adoption, little attention has been paid to the long-term viability of MLAs for service provision. Accordingly, this study investigates mobile library application continuance usage intention among users of Higher Learning Institutions (HLIs) in Tanzania. This study integrates the Expectation Confirmation Model, Technology Acceptance Model, and Information System Success Model to explore library users' continuance intention toward MLAs. Furthermore, the integrated framework is extended by incorporating perceived value and application accessibility, while the moderating role of habit on continuance usage behaviour is also examined. A random sampling method was adopted to collect 361 valid and complete responses from libraries across Tanzanian HLIs for data analysis. Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed to test the proposed hypothetical relationships. The results reveal that perceived usefulness, user satisfaction, and habit exert significant positive effects on users' continuance usage of MLAs in HLIs. Moreover, service quality and system quality significantly affect perceived usefulness, and perceived usefulness in turn significantly influences perceived value. In addition, confirmation is found to positively affect both perceived usefulness and user satisfaction with MLA usage, whereas application accessibility significantly impacts perceived ease of use. This study yields theoretical contributions and practical implications, which facilitate subsequent scholarly research on MLAs, and support policymakers and service providers in formulating sustainable strategies for digital library services within HLIs.

Keywords: mobile library application, continuance usage, higher learning institution, digital library, Tanzania

1 Background

The development of wireless technologies and mobile smart devices, such as smartphones and tablets, enables access to a wide range of information and services at any time and from any location. Mobile smart devices offer a wide range of capabilities, including internet access via wireless technologies, multimedia capabilities, the ability to host mobile applications, and accessibility features, among others. These indispensable features and capabilities make mobile smart gadgets a tool in everyday life. For instance, in higher learning institutions (HLIs), the use of mobile devices has significantly improved the quality of information and services provided to learners. One of the essential areas where mobile smart devices have improved service delivery and information access is university libraries. Through these developments, physical libraries have undergone a significant transformation. Notably, physical libraries worldwide are shifting to digital and online formats, in which content is accessible online (Deja et al., 2021; Tait et al., 2016). Libraries are no longer considered centers for storing physical books but rather for disseminating knowledge through e-learning and e-research. Digital and online services enhance libraries' capacity to provide services anywhere, anytime. Library users can quickly access resources and services via mobile devices.

For many libraries, the use of technology is a critical success factor in service delivery. Despite the adoption of digital libraries and the shift from physical to mobile libraries in developing economies, library users still prefer online search to digital libraries provided

through mobile library applications (MLA) (Xu & Du, 2018). Users' preference for online search over MLA suggests that continued use of MLA-based mobile services remains a challenge and warrants further investigation. Furthermore, there is limited knowledge about the use of MLA continuance in emerging economies, as most studies in this area have been conducted in Europe and Asia (Liu et al., 2023; Rafique et al., 2021; Wang et al., 2018; Yip et al., 2020). Additionally, prior studies on MLA concentrated on the initial adoption of the MLA (Dash et al., 2023; Liu et al., 2023; Yip et al., 2020). However, the current research takes a different direction by investigating the continued usage behaviour in developing economies. This is because studies show that the success and sustainability of IS depend on sustained use rather than first-time adoption (Bhattacherjee, 2001; Mishra et al., 2023). Therefore, examining the continued usage of MLA in emerging economies will enable libraries to understand how to provide long-term viability services to readers. Furthermore, this study examines the quality attributes of MLA, user habits, perceived value, and system application accessibility. Additionally, the study examines the moderation effects of habit, an aspect rarely studied.

The study integrates the Expectation Confirmation Model (ECM) for IS, the Technology Acceptance Model (TAM), and the IS Success Model to examine the continuance acceptance of MLA. ECM is a specialized theory for studying technology-related post-adoption behaviours; thus, it is an appropriate theory for the study (Mishra et al., 2023). On the other hand, TAM provides a framework for assessing the utility of the technology in terms of its benefits, usability, and user-friendliness. Therefore, integrating TAM with ECM provides a means of understanding the drivers of continued usage of MLA and its utility in the delivery of library services. External factors can influence the key TAM constructs: perceived usefulness and perceived ease of use, which in turn affect other constructs (Davis, 1989b; Hong & Yu, 2018). System quality attributes (information quality, system quality, and service quality) play a crucial role in IS success (Delone & McLean, 2003) and influence users' perceptions of system usefulness (Aeni Hidayah et al., 2020; Prasetyo et al., 2021). Therefore, system quality attributes have also been integrated into the ECM and TAM to examine the continuance of MLA use. Furthermore, the study examines the effects of perceived value and application accessibility on TAM constructs critical to MLA continuance usage. Also, habit is a fundamental component of behaviour formation, as it persists even when the conscious motivation to perform a particular behaviour ceases (Gardner, 2014). Therefore, it is crucial to cultivate persistent behaviour, including the continuous use of MLA. Given the essential role of habit in IS research, the study examines the moderating effect of users' habit of using digital services on the relationship between the TAM and ECM constructs and continuance usage of MLA.

The remainder of the paper is structured as follows: the second section reviews the literature on MLA, and the third section presents the research model and hypothesis development. The fourth section covers methodology, while the fifth introduces the data analysis and results. Section six presents the results, and section seven discusses the study's implications and conclusion.

2 Literature Review

2.1 Digital library

University libraries have been transformed in how they provide services to users; the ubiquity of internet access has made library services accessible anywhere, anytime (Liu et al., 2023). Most library users have access to mobile devices such as smartphones and tablets, allowing them to connect to numerous library platforms to access digital library resources and services (Liu et al., 2023). With digital library services, users no longer face time or location barriers to accessing library resources and services. Furthermore, libraries are no longer complaining about physical space for accommodating physical books or a large number of readers; instead, they are using many resources to build digital, physical collections, which will enhance their reach as well as allow readers to access resources away from physical libraries (Hamad et al., 2018).

The popularity of digital library services has increased recently due to their advantages over traditional libraries. Research shows that with digital libraries, users can access library resources in different formats, such as text, video, and audio (Liu et al., 2023). Furthermore, the usage of digital library services has enabled users to receive personalised and customised services due to their reading habits, searching content, and visiting content (Yip et al., 2020). All these have been achieved by integrating intelligence algorithms powered by Artificial intelligence to provide effective and efficient services to library users. Most AI tools, such as Chatbots, Robots, and Big Data, enable quick and accurate service delivery to library users. Liu et al.

(2024) explained that MLA allows users to search for information quickly and facilitates quick interaction between readers and librarians. Due to the preceding explanation, it is inevitable for the library to adopt the digital library service, which allows it to provide high-quality services to its customers.

Numerous studies have been conducted to examine the adoption of MLA in Universities. Most of these studies have concentrated on the adoption of digital library services in Tanzania (Khomo et al., 2023; Liu et al., 2023; Yip et al., 2020). While the adoption of technology is considered to be a critical stage in the usage of the technology, it may not guarantee the sustainability of the users in using the technology (Bhattacherjee, 2001; Ye et al., 2023). Therefore, sustainable factors need to be examined to enhance the continuance usage intention of MLA.

2.2 Continuance Usage Intention Theories

The concept of technology adoption has been widely examined to study users' behaviour in the use of technology. Continuance usage intention is considered a tendency to keep conducting an existing behaviour repeatedly (Ye et al., 2023). Furthermore, examining the adoption of technology enables service providers to understand the patterns among the users, understand better user experience and usability, and predict future uses. Most studies have concentrated on the initial adoption of the technologies, which consider the initial decision on adoption only (Bhattacherjee, 2001). However, researchers suggest that examining post-adoption behaviour is more critical because it assures users' continued use of the technologies (Bhattacherjee, 2001; Yang et al., 2016; Ye et al., 2023). Theories such as TAM, Theory of Planned Behaviour, Unified theory and Acceptance Use of Technology (UTAUT), Extended TAM, TAM3, UTAUT2, and Diffusion Innovation Theory (DIT) have been extensively used in examining the initial adoption of technology (Mishra et al., 2023). While some have used the same theories to examine continuance usage behaviour, Bhattacherjee (2001) suggested the usage of post-adoption variables that focus more on continuance usage for sustainability. However, due to the complexity of examining the continuance behaviour, which may be influenced by social, technological, and psychological factors, adopting only one theory may not capture various essential aspects required for continuance usage behaviour. Therefore, this study integrated the Expectation Confirmation Model for IS, TAM, and the IS Success Model to examine the sustainability of digital libraries in Tanzania.

3 Research Model and Hypotheses Development

This study integrates the Expectation Confirmation Model for IS, TAM, and the IS Success Model to develop the research model for this study. The research model has thirteen (13) hypotheses depicting direct and indirect hypothetical relationships (see Figure 1).

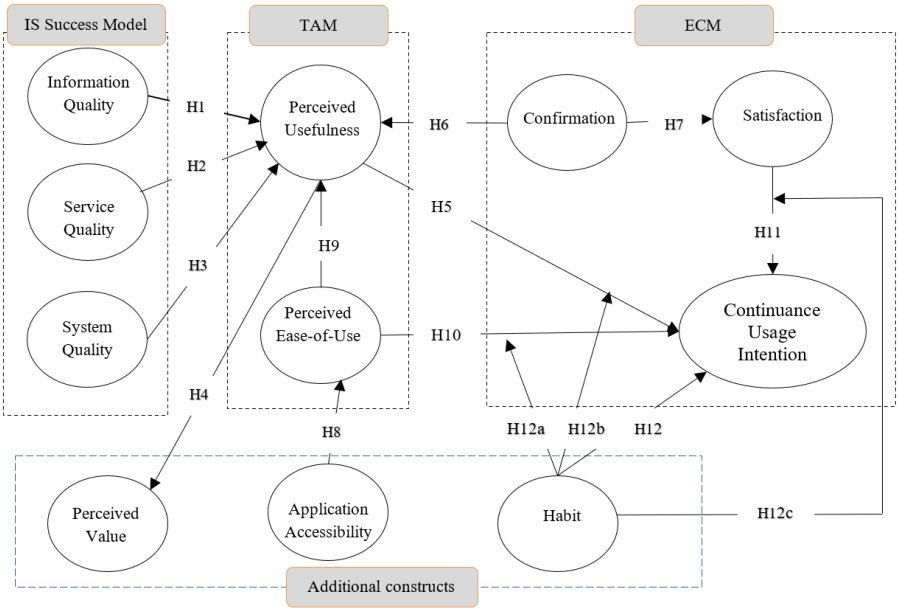

Figure 1 Proposed Conceptual Model

Information success theory explains how service quality, system quality, and information quality influence satisfaction and usage of information systems (Delone & McLean, 2003). Various studies have examined the influence of service, system, and information quality on adopting digital libraries and concluded that the three attributes significantly impact perceived usefulness (Cheng, 2020; Thong et al., 2002; Xu & Du, 2018). If users of digital libraries believe that information provided through digital library services is inaccurate, outdated, and very limited, then they will never perceive the digital service to be valid and helpful; hence, the likelihood of using the system providing the digital service will be very low (Cheng, 2020; Xu & Du, 2018). If the system quality attributes, such as navigation, layout, menu, and recovery from errors, are superb, the likelihood of finding the digital library services useful and acceptable becomes high (Cheng, 2020; Xu & Du, 2018).

Support services, such as timely and adequate assistance and the quality of the information provided, such as accuracy, up-to-date, and user acceptance, attract the sense of usefulness of digital services. Consequently, for users to consider the digital service helpful, the system's quality attributes, service, and information should meet their expectations. Likewise, if users of MLA perceive the application to be of high quality in terms of service and system, they will perceive MLA as beneficial. Based on this explanation, this study postulates that.

H1: Information quality has a positive and significant influence on the perceived usefulness of MLA.

H2: Service quality has a positive and significant influence on the perceived usefulness of MLA

H3: System quality has a positive and significant influence on the perceived usefulness of MLA

Perceived usefulness is the extent to which an individual believes using an information system will enhance their job performance (Davis, 1989a). Perceived usefulness is essential in adopting an information system (Davis, 1989b). When the user of an information system believes that using a particular technology could simplify and improve their performance, then the likelihood of adopting that technology becomes high. Likewise, when users think that using MLA will enable them to access library resources, their intention to continue using it will also intensify. Further, Several studies have concluded that perceived usefulness tends to influence continuance usage of information systems (Cheng, 2020).

Additionally, users' evaluation of the service's or information system's value correlates with the expected advantages that the system could offer. Usually, users evaluate the usefulness of the product or service based on cost-benefit analysis (Molinillo et al., 2023). The usefulness of the service or system drives a user's perceived value of the system or service (Yang et al., 2016). When users perceive the system or technology to have value based on the benefits it offers against its cost, the likelihood of continuing the system or services increases. Perceived value constitutes quality, price, emotion, and social (Molinillo et al., 2023). Therefore, the study postulates that:

H4: Perceived value has a positive and significant influence on the perceived usefulness of MLA.

H5: Perceived usefulness has a positive and significant influence on the continuance usage of MLA

Users tend to evaluate the actual usage of the system against their prior expectations. Based on this evaluation, the user decides to continue using the information if satisfied with previous expectations and decides to continue using an information system or service if satisfied (Bhattacherjee, 2001). In summary, when MLA users confirm their prior expectations during actual usage of the service or an information system, their level of satisfaction also increases. Previous studies have confirmed the influence of confirmation of expectations and satisfaction (Nguyen & Dao, 2024; Obeid et al., 2024; Tessema & Cavus, 2024). Additionally, when users confirm their expectations, their perceptions of the usefulness of the services or an information system are elevated (Bhattacherjee, 2001). The positive impact of confirmation of expectations on the perceived usefulness of the service or information has been investigated and confirmed in previous studies (Gupta et al., 2020; Halilovic & Cicic, 2013; Sreelakshmi & Prathap, 2020; Stone & Baker-Eveleth, 2013). Hence, this study hypothesizes that:

H6: Confirmation has a positive and significant influence on the perceived usefulness of MLA.

H7: Confirmation has a positive and significant influence on MLA satisfaction.

System accessibility features allow users to access the system successfully (Culnan, 1984). If the system is accessible anytime, anywhere, the likelihood of users using the system tends to be high (Riana et al., 2021). Otherwise, if the system is inaccessible most of the time because of the complexity of its features, low internet speed, or poor infrastructure, users will tend to ignore the system. System accessibility features affect the system's ease of use (Karahanna & Straub, 1999) and, consequently, the overall continuance usage of the system. Equally, the quality of network infrastructures and the system accessibility features will increase the user's likelihood of using MLA to access library e-resources. Based on prior explanation, this study postulates that:

H8: System accessibility positively and significantly influences MLA's perceived ease of use.

Perceived ease of use is the extent to which an individual believes that using an information system will be free from effort (Davis, 1989a; Xu & Du, 2018). When users think they can navigate easily and intuitively, find instructions quickly and easily, recover from errors, and receive feedback quickly, they will likely adopt the information system (Davis, 1989a). Likewise, when users believe that the information system is easy to use, their likelihood of continuing to use the system tends to be very high. Likewise, a well-designed MLA with various features, which include easy accessibility of information, text-to-speech options, adjustable font size, and keyboard navigation options, will influence the continuance of MLA usage. Several studies have shown that perceived ease of use positively and significantly influences continuance usage of information systems (Xu & Du, 2018). Moreover, ease of use increases the system's utility, positively shaping the user's perceptions of the system's usefulness. The positive influence of perceived ease of use on the perceived usefulness of the systems has been confirmed in previous studies, such as Mohammadi (2015) and Nguyen et al. (2024). Hence, the user's perceived usefulness increases as the system becomes easy to use. Likewise, effortless use of MLA tends to influence its perceived usefulness and continuance. Based on the above explanation, this study hypothesizes that.

H9: Perceived ease of use has a positive and significant influence on the perceived usefulness of MLA

H10: Perceived ease of use has a positive and significant influence on the continuance usage of MLA

Satisfaction is a post-evaluation of the initial user expectation, attained when a user has a positive feeling after evaluation (Bhattacherjee, 2001). When users generate negative feelings over prior expectations, they will be dissatisfied and stop using an information system or a service. Studies have shown that users with a high level of satisfaction are likely to keep using information systems or services (Bervell et al., 2024; Kurniawan et al., 2024; Ng et al., 2022; Tam et al., 2018). Equally, when library users are satisfied with the benefits of using MLA, their likelihood of continuing to use MLA increases. Based on this argument, this study postulates that:

H11: Satisfaction has a positive and significant influence on the continuance usage of MLA

Habit is the extent to which an individual tends to perform a particular behaviour automatically because of repetitive use of technology (Limayem et al., 2007). When users continue using the information system repetitively, it becomes a habit that influences their attitude toward continuing to use it (Limayem et al., 2007; Tam et al., 2018). Studies have shown that the continued usage habit is formed because of the prior learning process (Limayem et al., 2007). Several studies have examined the influence of habits on technology and concluded that it has a positive influence (Limayem et al., 2007; Tam et al., 2018). Correspondingly, when users frequently use MLA to access e-library resources, they are likely to develop habits; consequently, their continued usage behaviour of MLA will be very high. Furthermore, the habit can moderate the relationships between constructs of the study in various contexts, as reported in previous studies (Agag & El-Masry, 2016; Chiu & Huang, 2015; Sharifi Fard et al., 2019). As the user develops a habit of using an information system or service, the influence of other factors on the continuance of an information system or service becomes irrelevant since more usage of the service or an information system will be performed out of habit (Cheung & Limayem, 2005). Hence, even if the service or information does not meet users' expectations, is complex to use, or is not helpful, they can continue using it because it has become a habit. For similar reasons, the strength or direction of the relationship between perceived usefulness, perceived ease of use, and satisfaction with MLA may change depending on the user's habit of using information systems or e-services. Based on this explanation, this study postulates that:

H12: Habit has positive and significant effects on the continuance usage of MLA.

H12a: Habit moderates the relationship between perceived ease of use and the continuance usage of MLA.

H12b: Habit moderates the relationship between perceived usefulness and the continuance usage of MLA.

H12c: Habit moderates the relationship between satisfaction and the continuance usage of MLA.

4 Methodology

4.1 Research Instrument Development

The study employed a quantitative research design to guide the research process. A quantitative research design was selected because the study focuses on testing the causal relationships between the study variables. A questionnaire was developed for data collection in line with a quantitative research design. The questionnaires had three main sections. The first section is an introduction cover page that introduces the respondents to the area under investigation.

The cover letter explains the right to participate, withdraw from the study, and ethical issues as recommended by Podsakoff et al. (2003). The cover letter also contains the consent form, for which all respondents were requested to sign before proceeding. The second section included demographic details for respondents. The last section was the measurement items. As Joo and Yeon Lee (2011) suggested, only pre-validated measurement items adapted from previous studies were considered to ensure that the measurement items properly account for the construct. The study slightly adjusted all measurement items to fit the context of this study. Each item was measured using a 5-point Likert scale, which ranges from 1 (strongly disagree) to 5 (strongly agree), considered easy to interpret and increasing response quality (Sachdev & Verma, 2004).

Five library and technology acceptance professionals were invited to review the developed research instruments for clarity, completeness, and relevance of the research items (Pentang, 2023). Comments from experts were used to improve the research instrument of this study. Pre-testing of the questionnaire was conducted by using 20 respondents selected from two libraries located in the Dar es Salaam region to determine if the questionnaire is clearly understood, and there are no ambiguous statements (Mwogosi & Mambile, 2024). Respondents were requested to check the correctness of the questionnaire's wording, flow, and overall clarity (Mwogosi & Mambile, 2024; Sujood, 2024). Suggestions from pre-testing were incorporated to improve the questionnaire before it was distributed. The final statements used for developing the research instruments are shown in Appendix A. An electronic questionnaire was developed using Google Forms for data collection.

4.2 Sample Size and Sampling

Sampling was done in two stages. The first stage was to identify potential respondents with experience using library digital resources, and a questionnaire link was sent to students from 11 HLIs. The responses were compiled into one Excel sheet to create a comprehensive list of potential respondents. The second stage involved employing the RAND function to randomly select a total of 600 users who utilize the various digital library services (Rafique et al., 2021). Only respondents with experience using digital library resources were contacted via email addresses provided when responding to the questionnaire. The main questionnaire was then mailed to the selected contacts, allowing them to complete it. Several reminder emails were sent to ensure that respondents completed our questionnaire. The data were then collected for 12 weeks, from February 2024 to April 2024. Reminder emails were sent from the 7^{th} week to remind respondents to respond to the questionnaire.

4.3 Data Analysis

A variance-based structural equation modeling (VB-SEM) data analysis technique was used. This technique is used if the purpose of the study is to explore the phenomenon and predict statistical models designed to explain causal relationships (Sarstedt et al., 2017). Smart PLS, a variance-based structural Equation modeling tool, was the perfect match for this study because the focus of this study was to explore and predict the continuance intention to use MLA in HLIs. The analysis was done in two steps, as suggested by Hair et al. (2016). The first step was assessing the measurement model, and the second was evaluating the structural model to ascertain the hypothetical relationship depicted in the proposed model.

5 Results

A total of 374 responses, equivalent to a 62.3% response rate, were received for data analysis. A thorough data cleaning was conducted to address the issue of missing values. Thirteen responses were dropped due to significant missing values. Twenty-one responses had a small number of missing values, and therefore, Little's MCAR test was conducted to examine if the data were completely missing at random and if it could not impose a bias effect on the findings (van Ginkel et al., 2019). The finding shows that the impact of the missing values was insignificant ($p = 0.67$), indicating that the data are missing completely at random. Therefore, all missing values were imputed using the Expectation-Maximization algorithm. Hence, 361 valid responses were considered valid and reliable for the subsequent data analysis.

The demographic statistics indicate that 91.4% of respondents were young, reflecting respondents belonging to millennials and Generation Z, characterized by their technology savviness and patience with the technology (Kim et al., 2021). Females constitute 49%, while males constitute 51%. The finding mirrors the male-dominated population in Tanzania's HLIs (TCU, 2023). Detailed information about the demographic profile of the respondents is reported in Table 1.

Table 1 Demographic Profile of the Respondents

Category	Variable	Frequency	Percent
Gender	Male	184	51.0
	Female	177	49.0
Age	18-24	161	44.6
	25-34	98	27.1
	35-44	71	19.7
	45-54	23	6.4
	Above 54	8	2.2
Education Level	Certificate	17	4.7
	Bachelor	205	56.8
	Diploma	114	31.6
	Postgraduate	19	5.3
	Masters	6	1.7
Usage Experience	Low	277	76.7
	High	84	23.3

5.1 Nonresponse Bias

Studies have shown that nonresponse becomes critical when the response rate falls below 70% (Rousset et al., 2025). Based on the response rate of this study (62.3%), nonresponse bias was evaluated by performing wave analysis that compares the responses of the early respondents (63%) and the late respondents (37%) as recommended by Mentzer and Lambert (2014) and Hoard (2025). The comparison test was implemented to test the Chi-square (χ^2) of the respondents who responded without being reminded and those who responded after being reminded. The finding shows no significant difference ($p = 0.034$) between the characteristics of early and late respondents. Therefore, it was concluded that nonresponse bias does not exist in the data collected.

5.2 Common Method Bias

Since the study applied a self-report survey to collect data, it is vulnerable to common method bias issues that could be the source of systematic measurement error (Polas, 2025; Yao & Xu, 2021). Therefore, several procedural remedies were taken to address the issue of common method bias that can distort the findings by misreporting the true relationship between the variables, as suggested by Podsakoff et al. (2003) and Polas (2025). Firstly, to increase the validity and reliability, pre-testing the questionnaire and item relevance testing were conducted to avoid leading, double-barreled, irrelevant items and ambiguous questions, and ensure the research instrument was clear and concise (Polas, 2025). Secondly, respondents were informed about confidentiality and anonymity during data collection to reduce social desirability (Polas, 2025). Lastly, Harman's one-factor test, a statistical method to examine common method bias on the sample data by performing exploratory factor analysis (EFA), was implemented as suggested by Podsakoff et al. (2003) and Polas (2025). The findings show that the variance explained by a single factor is 43%, below the 50% threshold (Polas, 2025), which signifies that common

method bias is not an issue in the current study.

5.3 Measurement Model Assessment

Structural Equation Modeling (SEM) requires the hypothesized model to be assessed in two steps: the measurement model's assessment and the structural model's evaluation (Anderson & Gerbing, 1988). The purpose of evaluating the measurement model is to establish the quality of the measurement items that form the measurement model. The quality of the measurement items is established by assessing three aspects: reliability, convergent validity, and discriminant validity. The reliability of the measurement items was evaluated using Cronbach's alpha (α) and composite reliability (Rho_a and Rho_c). The study found that the values of both Cronbach's alpha (α) and composite reliability (Rho_a and Rho_c) were higher than 0.7 thresholds, signifying that the measurement model is reliable (Hair et al., 2019). Further, the evaluation of convergent validity indicated that the Average Extracted Values were above the suggested thresholds of 0.5 (Fornell & Larcker, 1981), suggesting that convergent validity has been achieved. Furthermore, all factor loadings exceed 0.7, thus satisfying the convergent validity criteria, as shown in Table 2 and Figure 2.

Table 2 Results of the Measurement Model Reliability and Convergent Validity

Construct	Cronbach's alpha (α)	Composite reliability (rho_A)	Composite reliability (rho_C)	Average variance extracted (AVE)
APACC	0.730	0.763	0.843	0.642
CI	0.932	0.932	0.957	0.880
CNF	0.924	0.930	0.952	0.869
HBT	0.922	0.924	0.951	0.865
INFQ	0.840	0.939	0.896	0.742
PEOU	0.852	0.854	0.901	0.694
PRCV	0.701	0.703	0.870	0.770
PU	0.869	0.884	0.911	0.719
STSF	0.907	0.922	0.935	0.784
SVSQ	0.920	0.924	0.961	0.926
SYSQ	0.752	0.977	0.845	0.648

Note: APACC: Application Accessibility; CI: Continouance Intention; CNF: Confirmation; HBT: Habit; INFQ: Information Quality; PEOU: Perceived Ease of Use; PRCV: Perceived Value; PU: Perceived Usefulness; STSF: Satisfaction; SVSQ: Service Quality; SYSQ: System Quality.

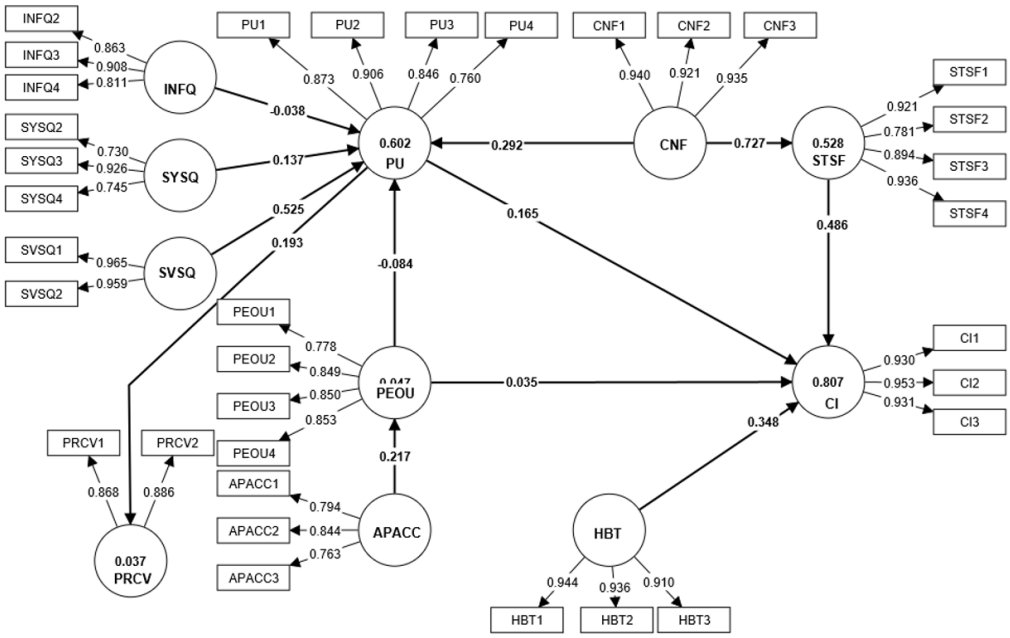

Figure 2 Measurement Model

Along with reliability and convergent validity, the study assessed the discriminant validity. Discriminant validity is deemed adequate if the Heterotrait-Monotrait (HTMT) ratio values are less than 0.85 (Henseler et al., 2014). As shown in Table 3, the HTMT ratio values were within the acceptable range; hence, discriminant validity was achieved.

Table 3 Results of the Heterotrait – Monotrait (HTMT) Ratio

Construct	APACC	CI	CNF	HBT	INFQ	PEOU	PRCV	PU	STSF	SVSQ	SYSQ
APACC											
CI	0.058										
CNF	0.056	0.801									
HBT	0.102	0.877	0.750								
INFQ	0.104	0.055	0.049	0.031							
PEOU	0.262	0.031	0.126	0.029	0.239						
PRCV	0.038	0.027	0.037	0.103	0.099	0.031					
PU	0.063	0.795	0.735	0.810	0.068	0.102	0.243				
STSF	0.064	0.871	0.783	0.769	0.036	0.070	0.050	0.699			
SVSQ	0.086	0.873	0.740	0.621	0.024	0.019	0.113	0.799	0.737		
SYSQ	0.117	0.042	0.053	0.061	0.072	0.323	0.181	0.145	0.095	0.043	

5.4 Structural Model Results

The assessment of the structural model involved the estimation of the coefficients of determination (R^2), effect sizes (f^2), predictive relevance (Q^2), and path analysis. Moreover, the bootstrapping procedure was set at 5000 iterations, as recommended by Hair et al. (2019), to estimate the hypothetical relationships. As a rule of thumb, the R^2 values of 0.75, 0.50, and 0.25 are referred to as substantial, moderate, and weak, respectively (Henseler et al., 2014). The study yielded 80.7%, 4.7%, 3.7%, 60.2%, and 52.8% of the variance toward continuance intention, perceived ease of use, perceived value, perceived usefulness, and satisfaction, respectively. The findings suggest that the model's explanatory power is good in explaining the continuance intention to use the MLA. Effect sizes (f^2) are often used to determine the impact of the significant relationships, complementing the *p*-values (Selya et al., 2012). According to Cohen (1988), Small, medium, and large effect sizes are represented statistically as 0.02, 0.15, and 0.35, respectively. Accordingly, the hypothesis testing results indicate that habit's influence on continuance intention (f^2 = 0.223) has a medium effect. In contrast, service quality on perceived usefulness (f^2 = 0.364), satisfaction on continuance intention (f^2 = 0.580), and confirmation and satisfaction (f^2 = 0.789) have large effects. The remaining significant relationships have minor effects.

Besides the effect sizes and the coefficients of determination, the study evaluated the model's predictive relevance (Q^2). The study found that the Q^2_{predict} values are positive (*CI = 0.0725, PEOU = 0.037, PRCV = 0.001, PU = 0.542, STSF = 582*); thus, the model has good predictive relevance (Shmueli et al., 2019). The $Q^2$was estimated using PLS_{predict}, a procedure coined by Shmueli et al. (2019), which supports out-of-sample predictive capabilities, unlike Stone-Geisser's Q^2 criterion. The Cross-Validated Predictive Ability Test (CPAT) further validated the model's predictive relevance. CVPAT is an advanced procedure that addresses the weakness of PLS_{predict} to provide statistical tests for comparing different models (Sharma et al., 2022). The CVPAT results indicate that the PLS's SEM average loss difference is negative and significant for all indicators, confirming the model's predictive ability, as shown in Table 4.

Table 4 CVPAT Results

Construct	Average loss difference	*t*-value	*p*-value
CI	-0.804	9.385	0.000
PEOU	-0.629	7.754	0.000
PRCV	-0.668	7.754	0.000
PU	-0.611	8.033	0.000
STSF	-0.495	6.592	0.000
Overall	-0.410	9.545	0.000

5.5 Hypotheses Testing Results

Figure 3 and Table 5 present the direct effects of the hypothesized relationships. The findings show that ten (10) of the twelve (12) hypotheses were supported, while two (2) were not. The results confirm that service quality, system quality, confirmation of expectations, and perceived ease of use significantly influence perceived usefulness (t = 9.725, t = 3.260, t = 5.354, and t = 2.520), respectively; therefore, hypotheses H2, H3, H6, and H9 were supported. Unfortunately, information quality did not significantly influence perceived usefulness (t = 0.967); hence, H1 was rejected. On the other hand, perceived usefulness significantly influenced perceived value (t = 3.548) and continuance intention (t = 3.823); hence, H4 and H5 were confirmed. Furthermore,

application accessibility significantly influenced perceived ease of use (t = 4.748); thus, H5 was supported. The findings confirm the hypothesized influence of confirmation on satisfaction (t = 19.470); therefore, H6 is supported. The study also found that system accessibility significantly affects perceived ease of use, as indicated by H8 (t = 4.748). Regrettably, perceived ease of use did not significantly influence continuance intention (t = 1.1703); therefore, H10 was rejected. Moreover, satisfaction (t = 8.778) and habit (t = 5.895) significantly influenced continuance intention; hence, H11 and H12 were also supported.

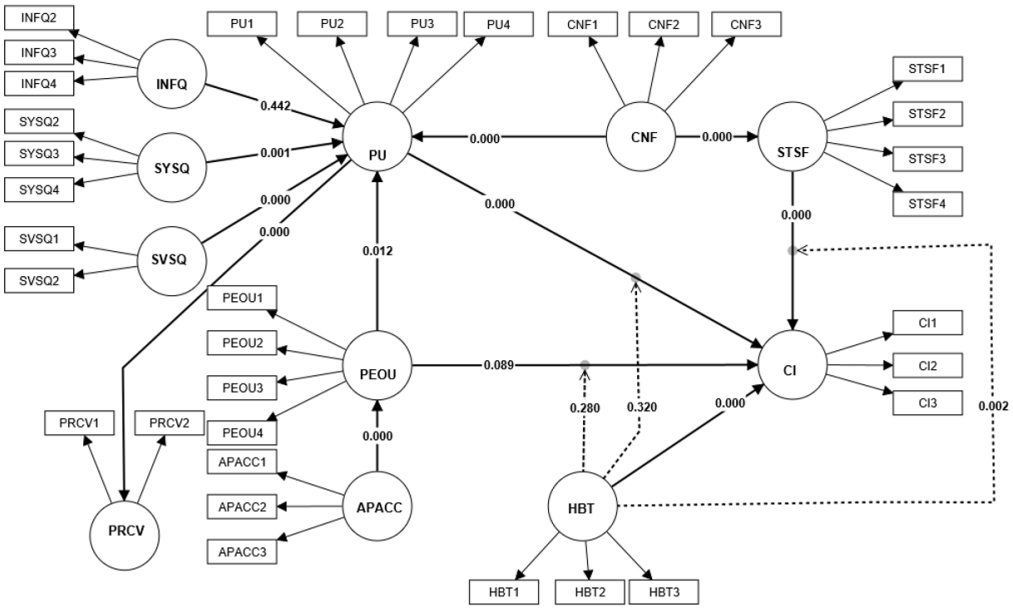

Figure 3 Structural Model Analysis

Table 5 Hypotheses Testing

Hypotheses	Paths	t-statistics	p-values	f^2	Remarks
H1	INFQ → PU	0.769	0.442	0.004	Not Supported
H2	SVSQ → PU	9.725	0.000	0.364	Supported
H3	SYSQ → PU	3.260	0.001	0.044	Supported
H4	PU → PRCV	3.548	0.000	0.039	Supported
H5	PU → CI	3.823	0.000	0.061	Supported
H6	CNF → PU	5.354	0.000	0.111	Supported
H7	CNF → STSF	19.470	0.000	0.789	Supported
H8	APACC → PEOU	4.748	0.000	0.049	Supported
H9	PEOU → PU	2.520	0.012	0.016	Supported
H10	PEOU → CI	1.703	0.089	0.006	Not Supported
H11	STSF → CI	8.778	0.000	0.580	Supported
H12	HBT → CI	5.895	0.000	0.223	Supported

The moderating results revealed that habit moderates the relationship between satisfaction and continuance intention (t = 3.154); thus, H12c was supported. Against expectations, the habit was not found to moderate the relationship between perceived ease of use and continuance intention, nor the relationship between perceived usefulness and continuance intention, which means *H12a* and *H12b* were rejected. Moderation results are indicated in Table 6 and Figure 4.

Table 6 Moderating Effect Testing

Hypotheses	Paths	t-statistics	p-values	f^2	Remarks
H12a	HBT × PEOU → CI	1.080	0.280	0.004	Not Supported
H12b	HBT × PU → CI	0.994	0.320	0.004	Not Supported
H12c	HBT × STSF → CI	3.154	0.002	0.048	Supported

6 Discussion

This study examines the sustainability of MLA in providing digital library services in HLI in Tanzania. The study integrated the Expectation Confirmation Model for IS, IS Success Model,

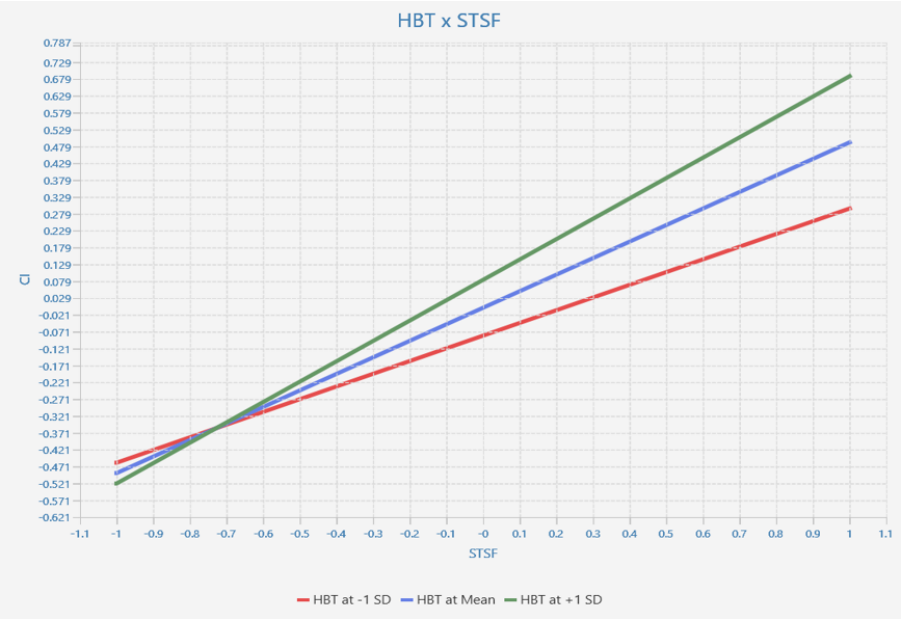

Figure 4 Moderation Effects for Habit and Satisfaction on Continuance Intention

TAM, system accessibility, perceived value, and habit to develop a research model for the study. Additionally, the study examines the moderating effect of habit on the users' intention to continue using MLA in HLI in Tanzania. The results revealed that as the service and system quality increase, the users' perception of MLA's usefulness also increases. Service and system qualities should be improved and prioritized so that library users can realize the usefulness of digital library services. The same result has been reported in previous studies by Liu et al. (2024), Rafique et al.(2021) and Xu and Du (2018).

The findings indicate that once users confirm their expectations, they perceive MLA as beneficial, and the likelihood of continued use increases. Therefore, the benefits of using MLA should be emphasized to confirm the previously expected benefits, thereby supporting the sustainability of the digital library services. Conversely, if users disconfirm their expectations, they perceive the information system or service as useless and refrain from continued use. Preceding studies have reported similar findings (M Ayyoub et al., 2023; Dhiman & Jamwal, 2022). Moreover, the results indicate that library users perceive that the usefulness of MLA enhances their access to digital services, which in turn increases users' motivation to continue using MLA. Thus, adding valuable features to MLA will increase its value. Consequently, users will be attracted to continue using it. This finding is consistent with Yang et al. (2016). Moreover, system application accessibility significantly influences the ease of use of MLA. This result is congruent with previous studies from Riana et al. (2021) and Tyagi et al. (2022), which examined the influence of application accessibility on adoption. Therefore, system accessibility requirements for MLA should be considered to enable easy and swift usage of MLA (Xu & Du, 2018). Consistent with Khomo et al. (2023) and Tyagi et al. (2022), the study's findings demonstrated that perceived ease of use significantly influences the perceived usefulness of MLA. The findings imply that an easy-to-use MLA will likely increase the user's perception of the application's usefulness for accessing library resources, hence, the sustainability of the MLA service.

Confirmation was also found to influence satisfaction with using MLA. Once library users confirm the previously expected benefits, they will be satisfied and continue using the MLA. The finding aligns with previous studies (Foroughi et al., 2023; Mi Alnaser et al., 2023). The findings also revealed that habits positively and significantly impact continuance intention to use MLA. The finding means that the habit of using MLA continuously builds the users' habits, which will finally translate into sustainable usage of MLA. The tendency of habitual usage of information systems, which translates into continuance usage, is well-documented (Ly et al., 2022; Wu et al., 2014).

The habit was also found to moderate the relationship between satisfaction and MLA continuance usage intention. Findings indicate that frequent use of MLA strengthens the influence of satisfaction on continuance intention. This result is consistent with previous findings, which showed a significant moderating effect of habit on the relationship between satisfaction and

continuance intention (Karami et al., 2023; Nazir et al., 2023; Wu et al., 2014). The finding implies that a satisfactory user experience motivates MLA users to continue using the system, consistent with their usage habits.

Nevertheless, findings show that information quality does not influence perceived usefulness. This is because the MLA is considered mandatory in HLIs; Therefore, library users are more concerned with functional necessity than with the quality of the information. Additionally, findings show that perceived ease of use does not influence continuance. This is because, in a continuance context (post-adoption), users are becoming familiar with the mobile application, and perceived ease of use is no longer a concern. Furthermore, in most Higher Learning libraries in Tanzania, mobile applications may be required for accessing library services. Therefore, in contexts where the use of the technology is mandatory, perceived ease of use may not be a driving factor for continuance use.

7 Implication

7.1 Theoretical Implications

While most previous studies examining the continuance usage of MLA and digital libraries have concentrated on the direct and indirect relationships, the moderating effect on the direct relationship has yet to be researched. As a result, there is a knowledge gap on how moderating impacts the continuance intention to use MLA. Therefore, this study introduced habit as a moderating variable to examine how the effects of the endogenous variable on the intention to continue using MLA tend to change based on the routine habit of using MLA. The findings reveal that habit moderates the relationship between satisfaction and the intention to continue using MLA. These findings extend the literature knowledge on the moderating effect of habit on continuance usage.

The study integrated three theories/ models, *TAM, ECM for IS, IS Success Model*, *habit, system application accessibility,* and *perceived value*, to develop a research model for the study. The fashion in which these theories and variables of the study were integrated and operationalized is unique to the researchers' best knowledge. The model provides a consolidated model to investigate MLA continuance intention, borrowing insights from technology acceptance/adoption, information system success factors, and post-adoption perspectives. The resulting model accounted for 80.7% (R^2 = 80.7) of the variance of all endogenous variables. The obtained coefficient of determination signifies the excellent explanatory power of the model and thus provides further validation of the resulting research model.

7.2 Practical Implications

The study provides insights to assist practitioners in implementing sustainable digital library services in HLI, particularly in developing economies. Findings revealed that service and system qualities are essential in boosting MLA's perceived usefulness, which, in turn, cultivates the user's desire to continue using MLA. The implication is that librarians and developers of MLA should pay attention to enhancing the services' quality by providing the system with a well-designed interface and effective navigation menus to enable users to navigate quickly around the MLA Also, the system should be designed so that minimal time is needed to retrieve and display the data to users by improving the system database's caching and indexing mechanisms. Libraries should also provide 24/7 support and ensure the MLA is accessible anytime, anywhere, to users so they can use the system productively.

Service providers should communicate with library users to receive user experience information, enhancing the quality of the services. Further, training users and providing a help menu are also essential to allow users to understand how MLA is used to access library resources. Not only that, but service providers should also provide user manuals that will enable users of the MLA to learn and use the system effectively and efficiently. Doing so will reduce the time spent finding information on the MLA. Also, service providers should continuously conduct needs assessments to assess library users' expectations and find the best way to fulfil them. Needs assessment can be done through surveys to improve the expected services. Additionally, without jeopardizing the user's privacy, preferences, and cookies could be configured to collect data that may be used to deliver personalized data to library users to enhance user experience in using MLA.

In line with the significant impact of habit on the intention to continue using MLA and in strengthening the relationship between satisfaction and user continuance intention, library

administrators should devise ways to cultivate the user's habit of using MLA. For instance, they can provide incentives such as loyalty programs to encourage users to access library digital services frequently through MLA. Typical loyalty programs include providing early access to new books or any other reading material and free digital book downloads. To motivate participation, frequent and active users of MLA could earn recognition in the form of badges or belts. Also, the developers could include push notifications in the MLA that inform users of the new readings in the MLA.

8 Limitations and Future Studies

Despite valuable findings from this study, there are several limitations worth reporting. The study employed a cross-sectional study, which collected data only once and over a short period. Findings generated from this study may have limitations in their applicability due to the time. The behaviour of respondents may have changed over a long period. Therefore, future studies should consider conducting longitudinal studies, which may collect data over a long period. Furthermore, the study employed quantitative research-based techniques only. Using only one method may affect findings due to the techniques' weaknesses. Future research using the same conceptual model may be conducted using mixed methods so that the quantitative findings may be triangulated by using qualitative techniques.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author.

Informed Consent Statement

Informed consent was obtained from all subjects included in the study.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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