Functional Suitability Evaluation Framework for the Off-Campus Access Systems in Academic Libraries

Kenneth Kariuki Kibithe
Department of Information Technology
Murang'a University of Technology, Kenya

John Gichuki Ndia
Department of Information Technology
Murang'a University of Technology, Kenya

Jane Wanjiru Njuki
Department of Information Technology
Murang'a University of Technology, Kenya

ABSTRACT

Academic libraries have adopted the use of off-campus access systems in facilitating remote access to licensed electronic resources. Although they are widely used, users often face difficulties, like broken links, bad redirecting and authentication problems that hinder their academic tasks Despite the growing reliance on these systems, there is a lack of empirically validated frameworks for evaluating their functional suitability in academic library environments. This study examines attributes that influence the functional suitability of off-campus access systems, and develops an evaluation framework to address this gap. The study used a descriptive research design, and sampled 384 student users from three universities in Kenya. The identified functional suitability attributes were confirmed using reliability analysis, correlation analysis, exploratory factor analysis, and multiple regression modelling. Based on the empirical results, the study developed and operationalized a Functional Suitability Evaluation Framework. The Framework incorporates empirically derived weights: functional correctness (0.390), functional appropriateness (0.340), and functional completeness (0.270), for the three functional suitability dimensions, and is supported by an evaluation tool and scoring guide. The study provides libraries and ICT departments with an evidence-based framework for systematically evaluating and improving the performance of off-campus access systems.

General Terms

Software Engineering, Software Quality Assurance, Information Systems, System Evaluation, Digital Libraries, Remote Access Systems.

Keywords

Functional Suitability, ISO/IEC 25010, Off-Campus Access Systems, Evaluation Framework.

1. INTRODUCTION

The adoption of eLearning by universities have turned academic libraries into digital service spaces by adopting use of electronic academic resources like journals and eBooks. Consequently, off-campus access systems have emerged as important infrastructure to enable students and researchers to access licensed electronic resources outside the physical library premises [1]. These systems are deployed using proxy services, authentication gateways, or federated access. They are at the center of supporting teaching, learning, and research activities, especially as distance learning, blended education, and remote research becomes widely adopted.

The effectiveness of library off-campus access systems largely depends on their functional suitability, which is determined by the extent to which a system provides functions that meet user requirements under given circumstances. The ISO/IEC 25010: 2023 software quality model defines functional suitability as functional completeness, functional correctness and functional appropriateness [2]. Functional suitability in the context of library off-campus access systems is reflected through the ability of the system to support the key functions, such as the ability to authenticate seamlessly, access e-resources accurately, and the system performance is reliable and continuous service delivery over a variety of devices and under a variety of internet conditions.

Users continue to face functional problems despite the proliferation of off-campus access solutions, including Ezproxy, MyLOFT, and eMaktaba [3], [4], [5]. The most frequent obstacles are long and tedious log-in processes, broken or redirected links to resources, compatibility with specific browsers or devices, and frequent system failures caused by the unstable internet connections. Such challenges are particularly acute in the situations when the internet connection is intermittent or unevenly distributed, as in most parts of Kenya. These functional shortcomings limit the usefulness of off-campus access systems and hinder the ability of users to maximize the use of available library e-resources [6].

Despite the fact that international software quality standards like ISO/IEC 25010 provide general guidelines on how to determine the quality of the system, they often fail to reflect the functional and contextual requirements that are unique to library off-campus access systems. The existing evaluation frameworks rarely focus on the practical experience of users or the practical reality of remote access to e-resources. As a result, universities do not have a systematic, context-dependent framework of evaluating the functional suitability of their off-campus access systems [7].

In this regard, this paper proposed a functional suitability evaluation framework of library off-campus access systems, which is based on user experiences and is aligned to the ISO/IEC 25010 functional suitability model [2]. The proposed evaluation framework focuses on functional areas of off-campus access systems such as; reliability, ease of login, effectiveness of content access and user satisfaction. The proposed framework aims at enabling informed decision-making, improvement of the system, and increased access to library e-resources by providing a practical and user-centred evaluation framework.

This study is guided by two objectives:

1. To determine the attributes that influence the functional suitability of off-campus access systems in academic libraries.
2. To develop a Functional Suitability Evaluation Framework to be used in evaluating off-campus access systems.

The rest of this paper is organized as follows; Section 2 presents conceptual background and literature review; section 3 presents the study methodology; section 4 presents the results; section 5 presents finding of the study. Section 6 presents the conclusion, section 7 presents recommendations and the paper ends with study limitations and future works.

2. LITERATURE REVIEW

This section reviews key concepts and prior studies relevant to evaluating off-campus access systems in academic libraries. It first defines off-campus access systems and their deployment approaches in university libraries. It then reviews dominant evaluation approaches used in information systems and digital library contexts and highlights their limitations when applied to off-campus access systems. The section further explains the ISO/IEC 25010 software quality model, focusing on functional suitability and its three sub-characteristics functional completeness, functional correctness, and functional appropriateness. Finally, it reviews empirical approaches for validating quality constructs and identifies the specific research gaps this study addresses.

2.1 Academic Library Off-Campus Access Systems

Off-campus access systems are part of modern academic library services that allow authorized users to access licensed electronic resources remotely. The off-campus access systems applications exist in the form of proxy-based systems, federated authentication services, and identity management platforms that interpose between users and publisher platforms. These systems are especially important for facilitating distance learning, blended learning, and research conducted outside the university network [8].

Past research on off-campus access has focused primarily on adoption patterns, barriers to access, and user satisfaction. Studies have shown that remote access services have a significant impact on the use of library electronic resources and students' academic performance when physical access to libraries is limited [7]. Nevertheless, empirical data also shows that users often have their access interrupted, authentication fails, broken links, and unstable routing to full-text materials. These challenges are even present in institutions with large electronic collections, indicating that access availability does not necessarily ensure effective utilization. Although these studies clarify salient access concerns, they often present off-campus access as infrastructure and not as complex software systems that should be evaluated systematically in terms of quality [9]. Consequently, most of the existing tests are descriptive in nature and focus on reported problems without offering systematic procedures of diagnosing functional inadequacies or directing system improvement.

2.2 Evaluation of Library Off-Campus Access Systems

Conventional information systems evaluation frameworks have largely focused on aspects such as usability, user satisfaction, system performance, information quality, and service quality. Examples include Fuzzy Logic–based models, Goal-Oriented Requirements Engineering (GORE), and User-Centered Design (UCD) frameworks. Fuzzy Logic models are useful in handling uncertainty and converting subjective user perceptions into quantitative evaluations, but they often rely heavily on expert judgment and subjective weighting, which may reduce transparency and consistency in system evaluation [10]. GORE frameworks focus on identifying stakeholder goals and aligning system requirements with those goals; however, they are primarily intended for system design and requirements specification rather than post-implementation system evaluation [11]. Similarly, UCD frameworks emphasize improving user interaction and usability through iterative design and user feedback, but they mainly focus on user experience rather than assessing the functional performance of systems [12]. Consequently, while these frameworks provide valuable insights into information system evaluation, they do not explicitly address the functional suitability attributes required to systematically evaluate off-campus access systems in academic libraries.

Nonetheless, there are a number of limitations outlined in the literature. To begin with, most evaluation frameworks rely on subjective user-satisfaction scales which might not be able to reflect underlying functional shortcomings. Secondly, usability-focused testing mainly covers interface design and navigation, ignoring basic functional elements, such as system-behaviour correctness, resource-routing accuracy, and authentication process reliability. Thirdly, the evaluation constructs are rarely empirically estimated in the existing frameworks that makes it difficult to prioritize improvement initiatives based on their practical contribution [13]. These limitations are especially acute to off-campus access systems, which act as a mediator between users and external publisher systems; errors or shortcomings can make otherwise useful interfaces useless. This has resulted in a need to come up with evaluation framework that consider the functional quality attributes and their impact on the overall system suitability.

2.3 ISO/IEC 25010 Software Quality Model

Functional suitability is a quality attribute defined in ISO/IEC 25010 as a core quality attribute, which refers to the extent of how a system meets both explicit and implicit requirements in given operational conditions. ISO/IEC 25010 further expounds functional suitability into three sub-characteristics: functional completeness, functional correctness and functional appropriateness [2].

Functional completeness refers to the extent to which a system has all functions required to satisfy the needs of the users [2]. Here, in the case of off-campus access systems, it includes access to core databases, supplementary materials, full-text resources, and integration with scholarly tools. Functional correctness deals with the correctness and reliability of the operations carried out, including stable authentication, correct routing of links, error-free downloads, and predictable system behaviour. Functional appropriateness addresses the effectiveness of system functions in helping users to accomplish their tasks, and it includes usability, workflow effectiveness, compatibility with other devices, and reduction of unnecessary access steps. Despite the popularity of ISO/IEC 25010 in the general software engineering and information systems research, its use in the assessment of off-campus access systems is limited [12]. The functional suitability is often not empirically validated and operationalized in pragmatic evaluation models, which limits the usefulness of the

model in estimating the functional suitability of off-campus access systems in practice.

2.4 Empirical Testing of Functional Quality Constructs

Empirical research in information systems evaluation proves the necessity of the validation of latent quality constructs through such statistical methods as reliability analysis, factor analysis, and regression modelling. The methods allow researchers to determine the construct coherence, inter-construct relationships, and measure the relative contribution of different quality attributes to the overall system performance or user satisfaction [14]. Digital library studies that have used exploratory factor analysis have found that reliability, accessibility, and usability are dimensions that affect the effectiveness of the system. Regression-based models have also shown that correctness and reliability of the system are more salient predictors of user satisfaction and continued use than the availability of resources. The implications of these findings are that perceived system value is more likely to be determined by functional correctness and task-fit as opposed to completeness alone [15]. Nonetheless, there has been limited research that has systematically incorporated these methods to confirm the constructs of functional suitability specific to off-campus access systems. Besides, empirical findings are seldom translated into weighted evaluation frameworks and operational tools, and there is a gap between scholarly findings and practice.

2.5 Research Gap and Study Contribution

The literature review has identified three gaps: off-campus access systems are not sufficiently evaluated for functional

suitability, despite their crucial role in academic resource access. Second, current evaluation strategies lack empirically validated frameworks that incorporate functional completeness, correctness, and appropriateness within a single framework. Third, empirical findings have not been translated into practical, weighted evaluation tools that libraries and ICT units can systematically apply [16]. The study addresses these gaps by investigating the functional suitability of off-campus access systems within the ISO/IEC 25010 model [2]. The study measures the relative impact of the constructs on the system suitability and operationalizes the results into a Functional Suitability Evaluation Framework through rigorous statistical analysis. Therefore, the study will help fill the gap between software quality theory and digital library practice, providing not only theoretical extension but also practical guidance on enhancing off-campus access systems [17].

3. METHODOLOGY

This section outlines the research methodology that will be used to determine and confirm the functional suitability attributes of off-campus access systems and to come up with the proposed Functional Suitability Evaluation Framework. It clarifies the research design, the research setting, sampling and data gathering methods, development of the instruments and statistical methods used. The analytical process is organized into a systematic process that includes reliability testing, correlation analysis, exploratory factor analysis, and multiple regression modelling, so that the framework can be empirically based and practical.

3.1 Research Design

The research design is quantitative and cross-sectional survey design with systematic statistical modelling. This design is proportional to both the empirical evaluation of the attributes of functional suitability, such as functional completeness, functional correctness, and functional appropriateness, and the creation of a data-driven framework of evaluation of off-campus access systems. The approach allows collecting user perceptions at one point in time and allows using the inferential techniques, such as reliability analysis, exploratory factor analysis (EFA), and regression modelling [18]. In this regard, the study aims at not only describing the attributes of functional suitability of off-campus access systems, but also outlining their comparative influence on the overall functional suitability.

3.2 Target Population and Sampling Size

Academic libraries of Masinde Muliro University of Science and Technology, Strathmore University and Muranga University of Technology were sampled to gather data. These institutions offer off campus access to licensed electronic resources via eMaktaba, EZproxy and MyLoft respectively [3], [4], [5]. The target population included undergraduate and postgraduate students, who are the major users of off-campus access services with Masinde Muliro University of Science and Technology having 20919 students, Strathmore University 7675 students and Murang'a University of Technology 7422 students. Students were chosen as the unit of analysis because they directly interact with off-campus access systems and are thus in the best position to evaluate the completeness, correctness, and appropriateness of functionalities based on actual usage experience. The student-centered approach to the study provided a consistent perspective and prevented confusion between end-user evaluation and administrative or technical opinions [19]. The Krejcie and Morgan table was used to identify a suitable sample size, 384 students from target population of 36016 students.

3.3 Target Population and Sampling Size

The questionnaire was developed based on a synthesis of the ISO/IEC 25010 functional suitability model and previous studies on the evaluation of off-campus access systems. The items were designed to measure three latent constructs defined in the ISO/IEC 25010 model [2]: Functional Completeness, Functional Correctness, and Functional Appropriateness. Each item was rated using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

To ensure content validity, the instrument was reviewed and refined by experts in information systems and digital library technologies to confirm that the items adequately represented the functional suitability constructs. Construct validity was supported through exploratory factor analysis to verify that the questionnaire items loaded appropriately on their respective constructs. In addition, statistical validity of the measurement model was assessed using the Kaiser–Meyer–Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity to confirm that the dataset was suitable for factor analysis [20]. Internal validity was maintained by aligning the questionnaire items with the study objectives and theoretical constructs derived from the ISO/IEC 25010 framework, while external validity was enhanced by selecting respondents who represent actual users of off-campus access systems in academic libraries, thereby improving the generalizability of the findings.

A pilot study was conducted using 10 percent of the total sample to assess the reliability of the instrument. Cronbach's alpha was computed for each construct. The results indicated satisfactory reliability levels: Functional Completeness (α = 0.81), Functional Correctness (α = 0.87), and Functional Appropriateness (α = 0.84). A Cronbach's alpha value of 0.70 or higher is generally considered acceptable for social science research (Wieringa, 2024). Constructs that produced an alpha value below 0.70 were revised to improve clarity and coherence, and redundant items were removed where necessary.

Data were collected using a structured self-administered online questionnaire. Participation in the study was voluntary, and responses were anonymized to minimize bias and encourage honest evaluation of the functional suitability of the off-campus access systems.

3.4 Analysis of Data

The analysis of data was carried out in a number of steps in accordance with the goals of the study [21]:

1. Reliability Analysis (Cronbach's Alpha)

Reliability analysis was conducted to assess the internal consistency of the measurement scales used in the study. Cronbach's alpha (α) is the most widely used coefficient for evaluating how closely related a set of items are as a group, essentially measuring whether multiple items that are designed to measure the same construct produce consistent results. An alpha value of 0.70 was adopted as the minimum acceptable threshold, which is consistent with the conventional benchmark established in the psychometric literature. Values below 0.70 suggest that the items within a scale are not sufficiently correlated with one another, raising concerns about whether they are all measuring the same underlying construct. Values approaching 0.90 indicate very high internal consistency, though excessively high values may signal item redundancy. By computing alpha coefficients for each sub-scale functional completeness, functional correctness, and functional appropriateness the study established that the instruments were reliable and that responses were not attributable to measurement error or ambiguity in item wording.

2. Correlation Analysis (Pearson's r)

Pearson product-moment correlation coefficients were computed to quantify the strength and direction of the linear relationships between the three functional suitability constructs functional completeness, functional correctness, and functional appropriateness and the overall Functional Suitability Index (FSI). The Pearson correlation coefficient (r) ranges from -1.00 to +1.00, where values close to +1.00 indicate a strong positive association, values near -1.00 reflect a strong negative association, and values around 0 suggest little or no linear relationship. This analysis served two purposes. First, it provided preliminary evidence of construct validity by confirming that each of the three sub-dimensions was meaningfully and positively associated with the composite FSI. Second, it allowed for an examination of multicollinearity, that is, whether the predictor variables were so highly intercorrelated with each other that they would undermine the stability of subsequent regression estimates. Statistically significant correlation coefficients ($p < 0.05$) were taken as evidence that the constructs were sufficiently related to the FSI to warrant inclusion in the regression model.

3. Exploratory Factor Analysis (EFA)

Exploratory Factor Analysis was employed to investigate the latent structure underlying the functional suitability items and to confirm that the measurement items grouped empirically in a manner consistent with the theoretically proposed sub-dimensions. Before conducting EFA, two prerequisite tests were applied to determine whether the data were appropriate for factor analysis. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy assesses whether the partial correlations among variables are small; a KMO value of 0.60 or above is generally considered the minimum acceptable level, with values above 0.80 regarded as meritorious. Bartlett's Test of Sphericity tests the null hypothesis that the correlation matrix is an identity matrix — that is, that variables are unrelated. A statistically significant result ($p < 0.05$) indicates sufficient intercorrelation among variables to proceed with factor extraction.

Principal Component Analysis (PCA) with Varimax rotation was used as the extraction and rotation method. PCA identifies linear combinations of variables that explain the maximum variance in the dataset, while Varimax rotation redistributes the variance so that each factor has a small number of large loadings and many near-zero loadings, making the factor structure easier to interpret. A factor loading threshold of 0.60 was applied, meaning that only items loading at 0.60 or above on a given factor were retained.

4. Multiple Regression Analysis

Multiple linear regression analysis was conducted to model the predictive relationship between the three functional suitability sub-dimensions functional completeness, functional correctness, and functional appropriateness and the dependent variable, the overall Functional Suitability Index (FSI). In this framework, the FSI served as a composite measure of users' overall perception of the system's functional suitability, while the three constructs functioned as independent predictor variables. The regression model takes the form:

$$FSI = \beta_0 + \beta_1(\text{Functional Completeness}) + \beta_2(\text{Functional Correctness}) + \beta_3(\text{Functional Appropriateness}) + \varepsilon$$

where β_0 is the intercept, β_1, β_2, and β_3 are the unstandardized regression coefficients for each predictor, and ε is the error term. To facilitate meaningful comparison of the relative contribution of each predictor to the outcome, standardized beta coefficients (β) were examined. Unlike unstandardized coefficients, standardized betas are expressed in units of standard deviation, removing the influence of differing measurement scales and allowing direct comparison across predictors.

3.5 Proposed Framework Development

The results of the reliability testing, exploratory factor analysis and regression analysis were synthesized to develop the Functional Suitability Evaluation Framework. The framework combines both empirically proven constructs and statistically calculated weights, thus, allowing a systematic assessment of off-campus access systems. It was also operationalized using an evaluation rubric and scoring guide to make it easy to apply in practice in academic libraries and ICT departments [22].

4. RESULTS

The section describes the empirical findings related to identification and validation of functional suitability attributes of off-campus access systems.

4.1 Identification of Functional Suitability Attributes of Off-Campus Access Systems

The functional suitability attributes were identified through a structured review of the ISO/IEC 25010 software quality model and prior studies on digital library and remote access systems. Consistent with ISO/IEC 25010 [2], functional suitability was operationalized into three dimensions: functional completeness, functional correctness, and functional appropriateness. Functional completeness captured attributes related to coverage of core databases, access to full-text resources, availability of supplementary materials, and integration with academic tools, reflecting the extent to which the system provides all required functions [6], [8]. Functional correctness encompassed authentication reliability, link resolution accuracy, file integrity, session stability, and absence of system crashes, consistent with literature emphasizing technical reliability in digital library portals and proxy-based systems [23]. Functional appropriateness included usability, task efficiency, navigation steps, device adaptability, system responsiveness, and integration with learning management platforms, aligning with human-centered design principles and technology acceptance research [9], [12], [16]. These literature-informed dimensions provided the conceptual foundation for the empirical measurement of functional suitability in off-campus access systems.

4.1.1 Functional Completeness

The highest composite mean (3.78) was obtained in functional completeness, which means that most students believed that the off-campus access systems were adequately prepared to facilitate academic activities. The most relevant features became access to core databases and full-text scholarly resources. However, significant gaps were also found, namely, the persistence of using alternative access methods, the exclusion of databases of specific programmes, and little integration with learning management systems and citation tools.

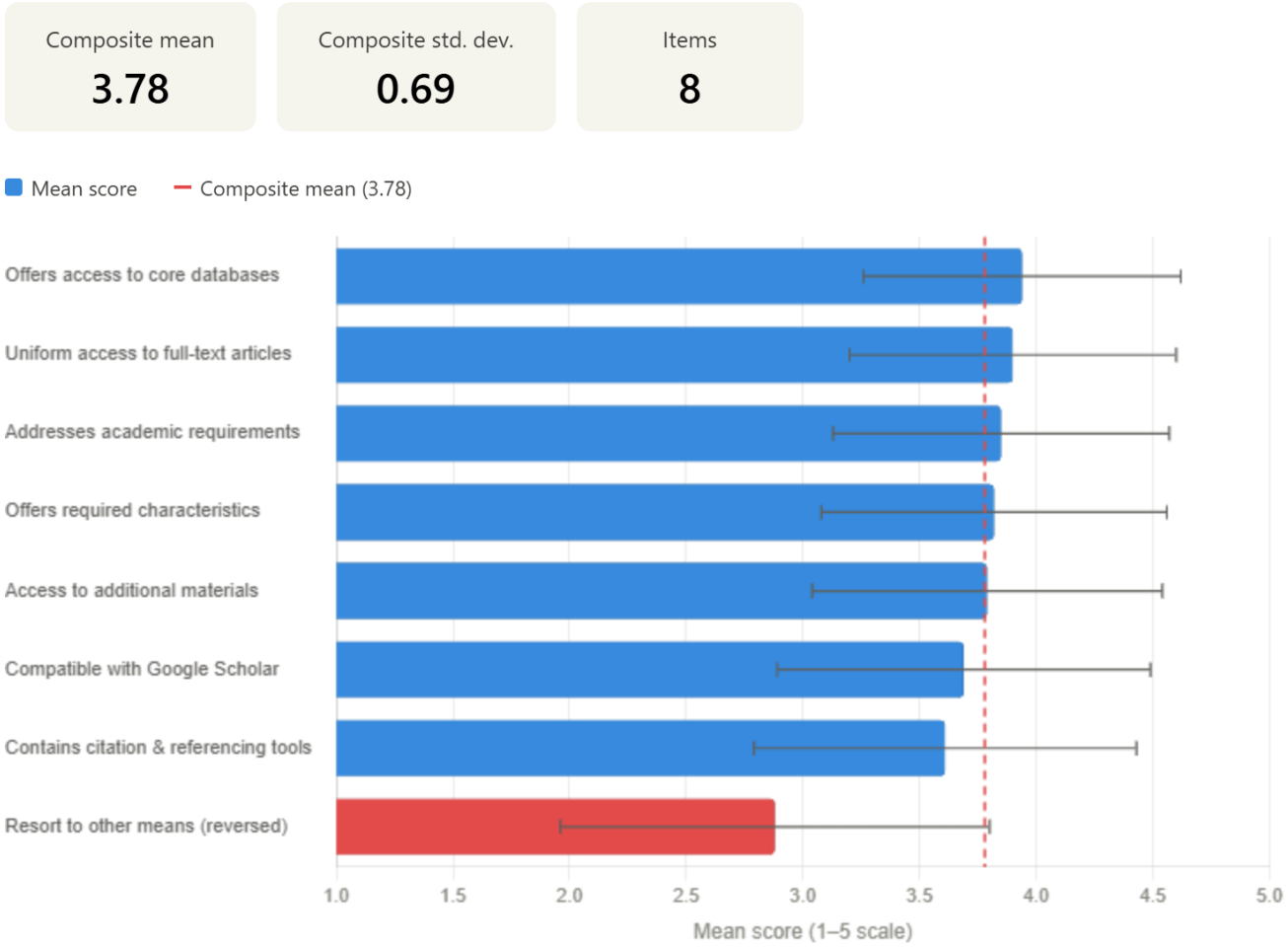

Figure 1: Functional Completeness Attributes of the Off-Campus Access System

4.1.2 Functional Correctness

Functional correctness had a moderate composite (3.65) indicating acceptable yet inconsistent system reliability. Correct resolution of linking, integrity of files and proper redirection to publisher platforms were generally favorable with students, but frequent issues were crashing of the system, failure to authenticate, and unstable sessions. These technical breakdowns threatened continuity in academic work and destroyed trust in the reliability of the system.

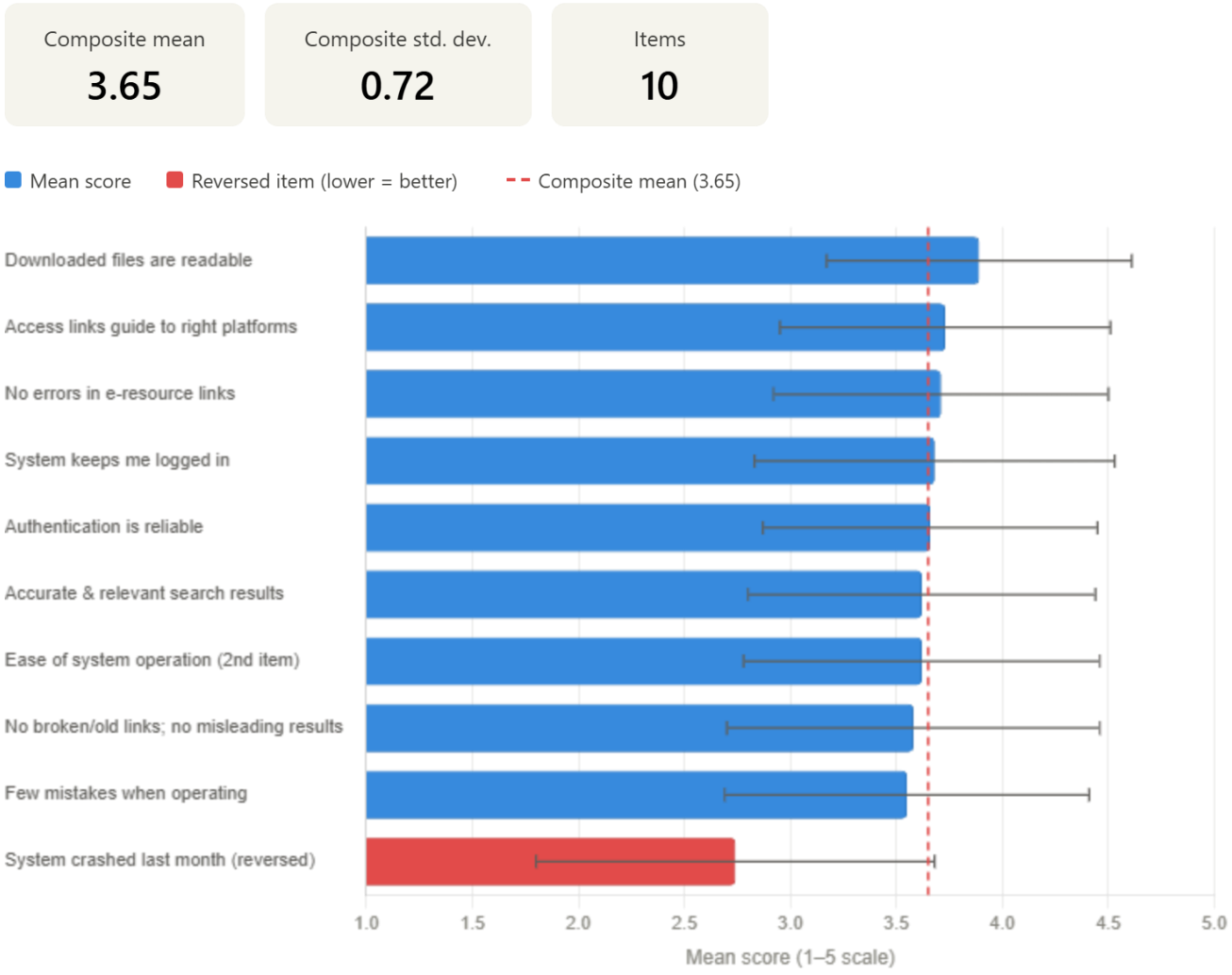

Figure 2: Functional Correctness Attributes of the Off-Campus Access System

4.1.3 Functional Appropriateness

Functional appropriateness recorded the lowest composite mean (3.58), highlighting efficiency and usability challenges. Although the system generally supported academic tasks, students reported excessive navigation steps, limited shortcuts, slow response times, and suboptimal mobile performance. These issues constrained task efficiency, particularly for time-sensitive academic activities.

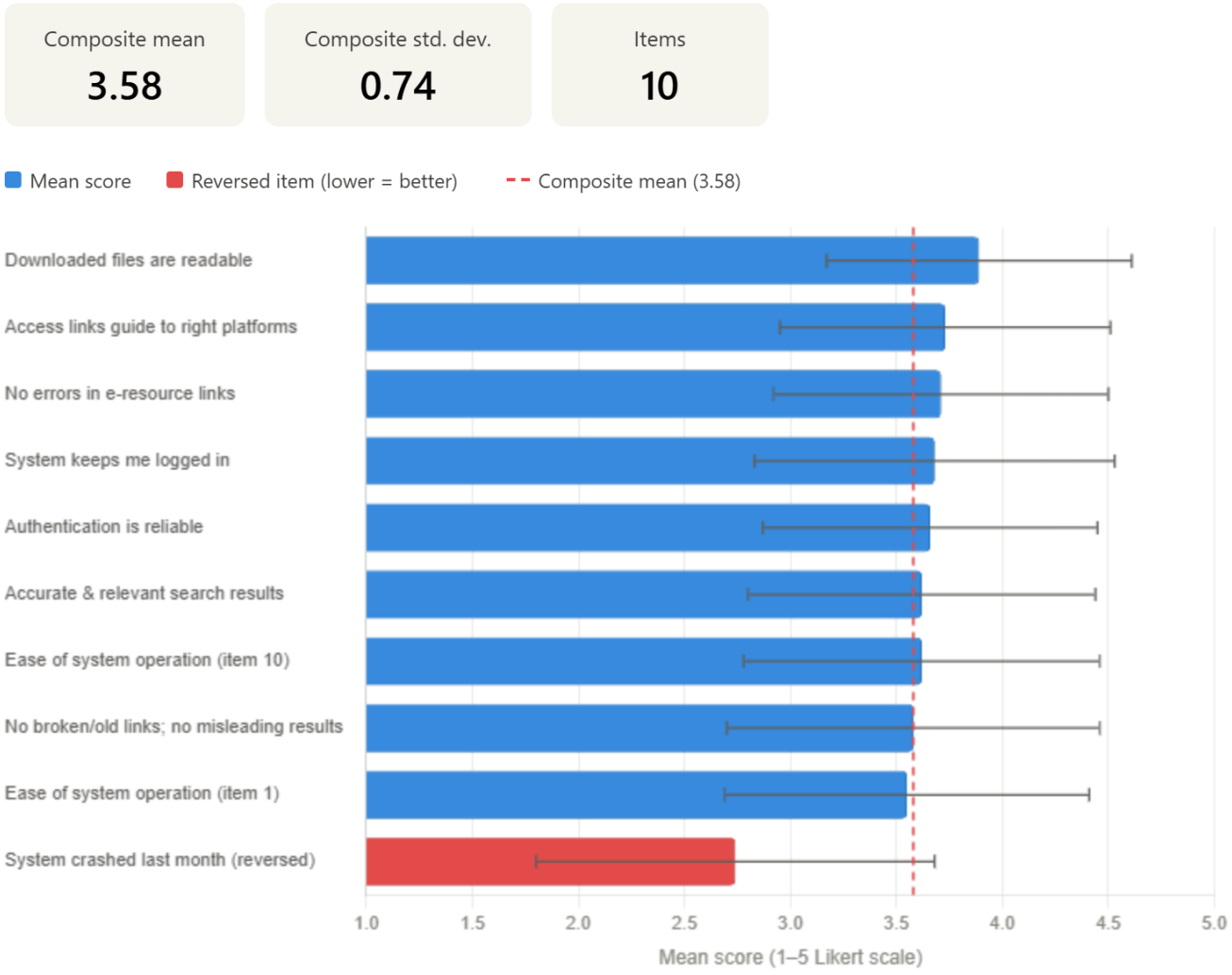

Figure 3: Functional Appropriateness Attributes of the Off-Campus Access System

4.2 Validation of Functional Suitability Attributes of Off-Campus Access Systems

This subsection presents the results used to validate the functional suitability attributes represented by the three functional suitability characteristics in ISO 25010:2023, functional correctness, completeness and appropriateness. The analysis done included reliability analysis, correlation analysis, exploratory factor analysis (EFA) and multiple regression analysis.

4.2.1 Reliability Analysis of Functional Suitability Constructs

The internal consistency was assessed using the Cronbach alpha coefficients. The constructs were all above the desired 0.70 threshold, which is a high level of internal consistency. The highest reliability was shown in functional correctness, which implied that the respondents were more able to interpret items related to system accuracy and reliability however, all the constructs were all highly reliable.

Table 1: Reliability Results for Functional Suitability Constructs

Construct	Items	Cronbach's α
Functional Completeness	8	0.881
Functional Correctness	10	0.903
Functional Appropriateness	9	0.874
Overall Scale	27	0.927

4.2.2 Correlation Between Functional Suitability Constructs and Functional Suitability Index

The Pearson correlation analysis was used to test the relationships between the functional suitability constructs and the Functional Suitability Index (FSI). Pearson correlation was selected because the composite construct scores were derived from multiple Likert-scale items and treated as continuous variables, and preliminary screening confirmed approximate normal distribution and linear relationships among variables (Creswell & Creswell, 2018; Kothari & Garg, 2019). The Functional Suitability Index (FSI) was computed as a composite score representing overall functional suitability. It was derived by aggregating the standardized scores of functional completeness, functional correctness, and functional

appropriateness, consistent with the ISO/IEC 25010 conceptualization that functional suitability is determined by these three interrelated dimensions (ISO/IEC, 2020, 2023). All the correlations were positive and significant. Functional correctness (r = 0.861), functional appropriateness (r = 0.847), and functional completeness (r = 0.812) were the most strongly related with functional suitability. These findings suggest that the enhancement of all three dimensions leads to the perceived system suitability, with the correctness having the strongest impact.

Table 2: Correlations Between Functional Suitability Constructs and Functional Suitability Index

Variable	FC	FCo	FA	FSI
Functional Completeness (FCom)	1	.712**	.658**	.812**
Functional Correctness (FCor)	.712**	1	.744**	.861**
Functional Appropriateness (FApp)	.658**	.744**	1	.847**
Functional Suitability Index (FSI)	.812**	.861**	.847**	1

4.2.3 Exploratory Factor Analysis of Functional Suitability Attributes

EFA confirmed the inherent framework of functional suitability attributes. The data was highly factorable (KMO=0.913); the Bartlett Test of Sphericity was significant ($\chi^2 = 5821.476$, $p < 0.001$) indicating that it was suitable in factor extraction. Three components whose eigenvalues exceeded 1 were selected, which together explained 67.60% of the total variance, which is higher than what is recommended in social science studies. Varimax rotation produced a three-factor component corresponding to: Functional Correctness, Functional Completeness and Functional Appropriateness. The items that were retained loaded ≥ 0.60 on their factors, and there were no cross-loadings.

Table 3: Total Variance Explained

Component	Eigenvalue	% Variance	Cumulative %
1	11.842	43.86	43.86
2	4.276	15.84	59.70
3	2.134	7.90	67.60

4.2.4 Item Reduction and Construct Validation

Six items were dropped because of low factor loadings or cross-loadings, mostly reverse-coded statements and indicators of failure frequency. The elimination of these items enhanced construct clarity and measurement stability and enhanced construct validity of the remaining constructs.

Table 4: Items Dropped Following Exploratory Factor Analysis

Item Code	Original Construct	Item Description	Factor Loading
B9	Functional Completeness	Use of alternative methods to find resources	0.47
B12	Functional Completeness	Citation and referencing tools	0.51
C18	Functional Correctness	System crash frequency	0.46
C24	Functional Correctness	Absence of irrelevant search results	0.52
D30	Functional Appropriateness	Excessive steps to complete tasks	0.49
D33	Functional Appropriateness	Support for real-time academic activities	0.43

4.2.5 Multiple Linear Regression Analysis

The predictive effect of the three constructs of functional suitability on the Functional Suitability Index (FSI) was conducted through multiple linear regression. The model was found to have a high level of explanatory power as it accounted 84.8% of the variance in functional suitability.

Table 5: Multiple Liner Regression Model Summary

R	R^2	Adjusted R^2	Std. Error
0.921	0.848	0.846	0.216

4.2.6 Multiple Linear Regression Coefficients

Functional correctness was found to be the most predictive factor of overall functional suitability, then functional appropriateness, and functional completeness. The results of this study are empirically valid in that reliability and accuracy are more important than resource availability in the determination of the effectiveness of off-campus access systems.

Table 6: Multiple Linear Regression coefficients

Predictor	Unstandardized Coefficient (B)	Std. Error	Standardized Beta (β)	t-value	Sig.
Constant	0.214	0.062		3.451	.001
Functional Correctness	0.411	0.039	.447	10.487	.000***

Functional Completeness	0.286	0.041	.301	6.983	.000***
Functional Appropriateness	0.352	0.037	.379	9.514	.000***

4.3 Development of the Proposed Functional Suitability Evaluation Framework

This section addresses the second objective of the study by translating the validated functional suitability constructs into a practical evaluation framework. Based on the results of the reliability test, correlation test, exploratory factor analysis, and multiple linear regression test, the subsection outlines how empirically supported relationships and construct weights were used to develop a Functional Suitability Evaluation Framework that is specifically designed to apply to off-campus access systems. The framework integrates various linear regression coefficients and operational evaluation criteria, thus facilitating a systematic and evidence-based method of evaluation and optimization of off-campus access systems in the context of academic libraries.

4.3.1 Proposed Functional Suitability Evaluation Framework

The empirical data that has been obtained as a result of the reliability test, exploratory factor analysis, correlation analysis, and multiple regression modelling provides a solid basis of the creation of a Functional Suitability Evaluation Framework that is intended to be used in off-campus access systems. The framework is based on the ISO/IEC 25010 software quality model, which defines functional suitability as one of the fundamental measures of system quality with reference to user demands and context of use. Three principals were used to construct the framework: (i) the empirical validation of constructs of functional suitability, (ii) evidence-based weighting of constructs based on relative influence and (iii) the correspondence of performance indicators with actual user interaction patterns in academic library settings.

The framework is organized into three empirically tested constructs, including Functional Completeness, Functional Correctness, and Functional Appropriateness. Reliability and factor analysis indicated that these constructs are coherent and stable dimensions of functional suitability, and regression modelling showed that they together predict overall functional suitability, with statistically significant but unequal effects. In this regard, the framework operationalizes functional suitability as weighted composite index instead of considering all the attributes as equal.

The regression analysis produced unstandardized beta coefficients of 0.411 for functional correctness, 0.286 for functional completeness, and 0.352 for functional appropriateness. Because unstandardized betas represent relative contribution rather than proportional weights, they were normalized by dividing each coefficient by their total (1.049) to ensure that the resulting weights sum to one. The normalized weights were therefore 0.39, 0.27, and 0.34 respectively. This normalization ensures that the final Functional Suitability Index remains within the original 1–5 measurement scale while preserving the relative influence of each construct. These weights show that the main determinants of functional suitability are related to the reliable authentication, proper routing of links, low error rates, and the reliable access to full-text resources. Despite the fact that Functional Completeness is still a prerequisite to the availability of academic resources and features, its relatively low weight implies that simple availability does not necessarily ensure efficient off-campus access unless systems are also working properly and supporting academic processes.

The concept of Functional Appropriateness plays a critical mediatory role in the framework, which represents usability, task efficiency, and compatibility with other devices. Its comparative weight highlights the significance of user-friendly interfaces, few access measures, and compatibility with academic procedures in determining the attitude of users to system efficiency. The results support the hierarchical order of the three constructs in the model and give empirical support to the combination of the three constructs into one evaluation tool.

The resulting framework converts the empirical data into a usable evaluation instrument that supports systematic evaluation, determines performance bottlenecks, and focuses on the improvement of the system. The framework offers empirically obtained weights, which means that the results of the evaluation process will be evidence-based and in line with the expectations of users, as opposed to being dependent on subjective assumptions. The given methodological approach increases the practicality of the framework as a decision-support tool of academic libraries and ICT units that aim to increase the reliability, usability, and effectiveness of off-campus access systems.

The proposed Functional Suitability Evaluation Framework is shown in Figure 1 and represents the three main constructs and their weightings.

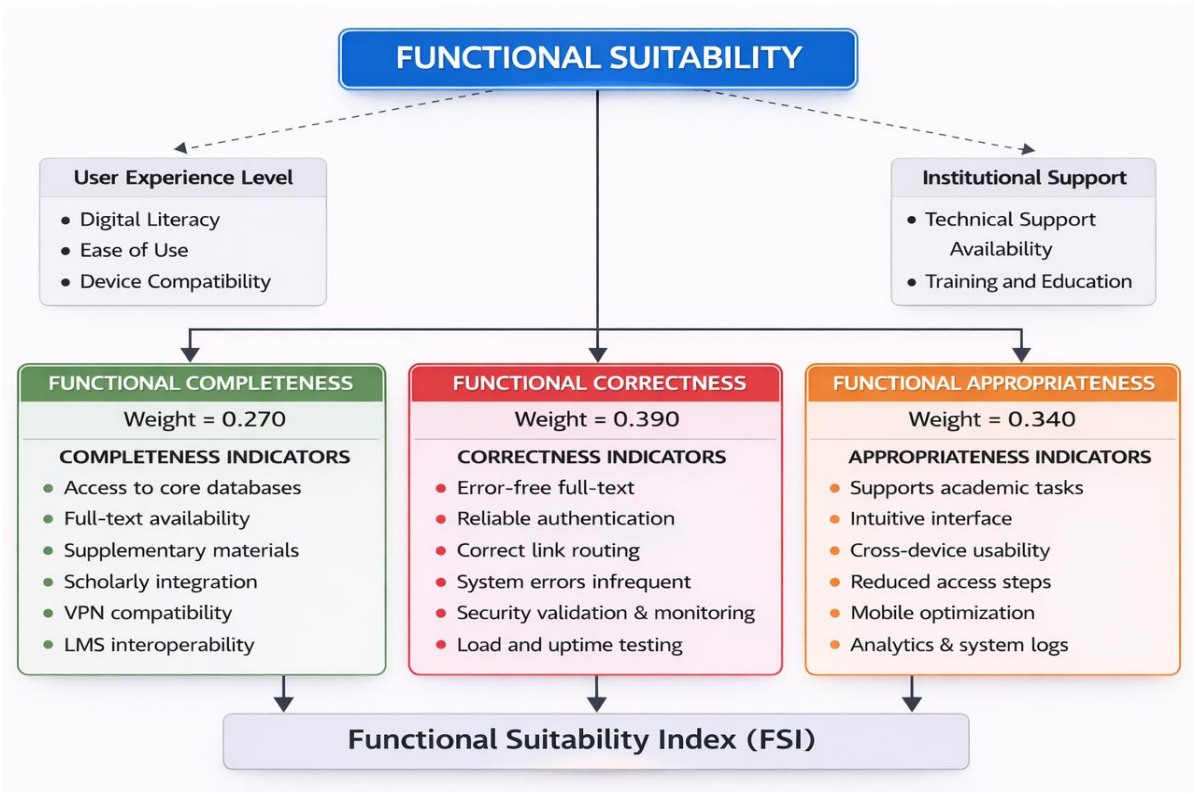

Figure 4: Proposed Functional Suitability Evaluation Framework for Off-Campus Access Systems

4.3.2 Operationalization of the Proposed Functional Suitability Evaluation Framework

The evaluation tool operationalizes the proposed Functional Suitability Evaluation Framework into a practical instrument that can be applied by academic libraries and ICT units to evaluate off-campus access systems. The rubric translates the empirically validated constructs into measurable evaluation criteria derived directly from the identified attributes. Each criterion is rated using a five-point Likert scale ranging from very poor (1) to excellent (5), and construct scores are computed as weighted averages based on regression-derived weightings. This approach ensures that the evaluation process is evidence-based, systematic, and aligned with user perceptions as well as the ISO/IEC 25010.

The Final Functional Suitability Score (0–5) is computed as a weighted composite of the three empirically validated constructs:

$$FSI = (0.270 \times FCom) + (0.390 \times FCor) + (0.340 \times FApp)$$

Table 7: Scoring Rubric for the Proposed Functional Suitability Evaluation Framework

Construct	Evaluation Criteria	Rating (1–5)
Functional Completeness	Access to core databases is consistently available	
	Full-text access is available for required materials	
	Access to supplementary materials (reports, e-books) is adequate	
	Integration with scholarly tools (Google Scholar, LMS) is effective	
	The system provides all necessary features to support academic work	
Score for Completeness = Average × 0.270		
Functional Correctness	Full-text links open without errors	
	Downloads (PDFs, documents) open correctly	
	The authentication process is stable and consistent	
	System routes users to the correct publisher platforms	
	Search results are accurate and relevant	

	Broken or outdated links are rare	
Score for Correctness = Average × 0.390		
Functional Appropriateness	The system supports the academic tasks performed by users	
	The interface is intuitive and user-friendly	
	The system works efficiently across devices	
	Steps required to access full text are minimal	
	The system enables efficient task completion	
	Shortcuts or quick-access tools are available	
Score for Appropriateness = Average × 0.340		

4.3.3 Interpretation of Functional Suitability Scores

The interpretation of the Functional Suitability Index (FSI) scores was based on the five-point Likert scale employed in the study. Since the FSI was computed as a weighted composite mean of Functional Completeness, Functional Correctness, and Functional Appropriateness, the resulting scores remain within the same 1–5 scale continuum. Consequently, interpretation is directly aligned with the original scale descriptors to preserve measurement consistency and conceptual clarity. This interpretation approach maintains alignment between measurement, analysis, and reporting, thereby strengthening the internal validity and practical applicability of the developed evaluation framework.

Table 8 Interpretation Guide for the Proposed Functional Suitability Index (FSI)

Mean Score	Functional Suitability Level	Interpretation
5	Very High Functional Suitability	System demonstrates strong reliability, efficiency, and task support
4	High Functional Suitability	System supports most academic access needs with minor limitations
3	Moderate Functional Suitability	Core functionality present but noticeable performance gaps
2	Low Functional Suitability	Significant usability or reliability constraints
1	Very Low Functional Suitability	System inadequately supports off-campus academic access

5. DISCUSSION OF FINDINGS

This study aimed at determining the attributes of functional suitability in off-campus access systems in academic libraries and to develop an empirically based evaluation framework. The findings indicate that functional suitability is a multidimensional construct that is affected by the interaction of functional completeness, functional correctness and functional appropriateness. Significantly, the dimensions do not add the same amount to perceived system suitability, thus criticizing evaluation methods, which concentrate on access provision as the only measure of perceived system suitability.

5.1 Functional Correctness in Library Off-Campus Access Systems

The study's empirical evidence shows that functional correctness is the strongest determinant of overall functional suitability. The result of both correlation and regression indicates that correctness has the strongest effect on perceived system effectiveness than completeness or appropriateness. This observation highlights the paramount role of system reliability, strict authentication measures, proper link resolution, and the supply of error-free access to full-text resources in remote academic settings. The consequences of such an outcome are both theoretical and practical. The scope of resources available has traditionally been considered the most important consideration in the evaluation of library systems, but the current results have shown that access is virtually useless without reliability. Even the most detailed collections are unable to assist the academic work in case the users face broken links, downloading errors, or unstable sessions. In this regard, the fact that functional correctness prevails helps to argue that precision and dependability are the core of digital academic services and should be prioritized when designing and evaluating an off-campus access system. These results imply that academic libraries should prioritize system reliability, authentication stability, and accurate link resolution over mere expansion of resource coverage when designing, configuring, or evaluating off-campus access systems.

5.2 Functional Appropriateness in Library Off-Campus Access Systems

The second strongest predictor of functional appropriateness was functional appropriateness, thus highlighting the relevance of usability and task fit in off-campus access systems. The high scores on the indicators of interface intuitiveness, device flexibility, workflow effectiveness, and fewer steps to access indicate that the students consider the quality of the system through the prism of its ability to support the successful completion of the authentic academic tasks, and not its technical features. These observations are consistent with the user-centered design theories which hold that good systems are closely aligned with the objectives and contextual use of users. The suitability of the system within the off-campus environment where users are largely dependent on their personal devices and network conditions are dynamic is a key to the continued use and academic efficiency. In turn, the results shed light on the fact that appropriateness is not a marginal issue but a constituent of functional suitability. The implication of this finding is that off-campus access systems

must be designed and evaluated with strong emphasis on task support, usability, and contextual fit, as technical correctness alone is insufficient to ensure effective academic use.

5.3 Functional Completeness in Library Off-Campus Access Systems

Though functional completeness was found to be a powerful predictor of functional suitability, it had the least influence when compared to the other two constructs. This fact suggests that though access to core databases, full-text resources, and supplementary materials is crucial, completeness is not enough to ensure successful off-campus access. Availability seems to be a prerequisite to users and the quality of the system is measured mainly on correctness and appropriateness scales. This observation disputes the evaluation frameworks that consider system effectiveness to be equivalent to subscription coverage or platform integration. Instead, the findings indicate that completeness is a zero point whereby correctness and appropriateness functions. Without credible performance and competent task assistance, completeness cannot be converted to concrete academic results. The implication of this result is that investments in expanding electronic resource coverage should be accompanied by parallel improvements in system functional correctness and appropriateness to realise tangible academic value from off-campus access systems.

5.4 Multidimensional Construct of Functional Suitability

The results of the reliability test, correlation analysis and the results of the exploratory factor analysis show that functional suitability can be best conceptualized as the three interrelated but distinct dimensions. The high internal consistency of all the constructs implies that functional completeness, functional correctness and functional appropriateness are coherent and stable domains of measurement. This empirical framework is very similar to the ISO/IEC 25010 software quality model, which strengthens its usability in the context of academic library technologies.

Close relationships among the three constructs indicate that functional suitability is an experience that operates as a whole rather than a collection of system attributes. When one dimension improves, it will affect the perceptions of the others. For example, stable authentication and correct link routing (functional correctness) can lessen user effort, thereby increasing perceived usability (functional appropriateness). This interconnection negates earlier studies of off-campus access systems that theorize the quality of access as an ecosystem of technical reliability, resource availability, and user interaction efficiency, rather than a technical outcome. These results imply that academic libraries and ICT departments should prioritize coordinated improvements across functional completeness, correctness, and appropriateness, rather than addressing individual system deficiencies in isolation.

5.5 Implications of Functional Suitability Evaluation Framework Development

These findings are combined into a Functional Suitability Evaluation Framework. The framework goes beyond a descriptive evaluation model to a predictive, prioritized evaluation model through the use of empirically validated constructs and weights obtained through regression. The weighting scheme is based on the real perceptions of the users as opposed to the normative assumptions, which allows the institutions to focus on the attributes that have the greatest impact on the functional suitability of off-campus access systems.

The framework also applies the ISO/IEC 25010 construct of functional suitability to the case of academic library off-campus access systems, which fills a significant gap in the range of standardized evaluation frameworks. In that way, it provides theoretical development and practical directions towards systematic evaluation, benchmarking and continuous improvement.

5.6 Study Contribution on Research and Practice

The findings suggest that effective off-campus access cannot be defined only by the availability of content; instead, it is determined by the correctness, appropriateness and completeness of access. The study offers empirical understanding to the evaluation of remote access technologies and gives a well-developed outline to make informed decisions in academic libraries. The study redefines the concept of functional suitability, its evaluation, and its improvement in the modern digital library environment by preempting functional correctness, appropriateness, and completeness.

6. CONCLUSION

This study concludes that completeness, correctness, and appropriateness are not equally important in the process of establishing the functional suitability of off-campus access systems. Correctness is the most important determinant in terms of functionality as reflected by the reliability of authentication, proper routing and error-free access hence the importance of reliable system behaviour in remote academic environments. One of the main contributions of the study is the creation of a Functional Suitability Evaluation Framework that is based on ISO/IEC 25010 and tested on the basis of user data. Therefore, the study concludes that the framework provides an evidence-based method of evaluating and improving off-campus access systems in academic libraries, combining statistical modelling and practical evaluation instruments.

7. RECOMMENDATIONS

Based on the findings in this study, academic libraries and ICT departments ought to focus on the functional correctness of off-campus access systems during the system design, configuration, procurement, and evaluation stages. The most influential determinants of overall functional suitability were found to be reliability, accurate authentication and proper routing of full-text resources. Although functional completeness by covering the necessary resources is also essential, institutions must also consider the improvement of functional appropriateness by improving usability, minimizing the number of access steps, and ensuring cross-compatibility with devices to enable effective completion of academic tasks. Further, the study recommends that the proposed Functional Suitability Evaluation Framework should be adopted as a systematic, evidence-based tool to be used to evaluate the off-campus access systems with focus on improving them, thus maximizing their utility in the support of teaching, learning, and research processes.

8. LIMITATIONS AND FUTURE RESEARCH

The current research was done among student users in only 3 universities in Kenya, which might limit generalizability. The

framework may be expanded in future studies by including other groups of users, including faculty members, researchers, and distance learners, to examine intergroup differences in perceptions of functional suitability. Longitudinal studies would also be able to evaluate the change in functional suitability after system upgrades or policy changes.

Future research can integrate system-generated performance measures, such as authentication success rates, link resolving logs, and uptime statistics, with user perception data to improve objectivity. Inter-institutional or inter-library consortium studies may also be used to set benchmarking standards of the proposed framework.

9. REFERENCES

[1] A. Smith, "Off-campus support in distance learning: How do students define quality?" Quality Assurance in Education, vol. 12, no. 1, pp. 28–38, 2021.

[2] ISO/IEC, ISO/IEC 25010:2023 Systems and Software Engineering—Systems and Software Quality Requirements and Evaluation (SQuaRE): System and Software Quality Models. Geneva, Switzerland: International Organization for Standardization, 2023.

[3] OCLC, "EZproxy," 2019. [Online]. Available: https://www.oclc.org/en/ezproxy.html

[4] MyLOFT, "MyLOFT library solutions," 2024. [Online]. Available: https://www.myloft.xyz/

[5] eMaktaba, "eMaktaba library service," Edusurf Limited, 2024. [Online]. Available: http://www.edusurflimited.com/

[6] R. J. Bazillion and C. Braun, "Technology and library users' automation and outreach: Library services to off-campus students," Journal of Distance Education, vol. 7, no. 2, pp. 67–75, 2019.

[7] S. Khan and R. Ali, "Assessing the functional correctness of digital library portals: A user perspective," Journal of Digital Information Management, vol. 17, no. 4, pp. 245–255, 2019.

[8] F. Alshammari, M. Alhadlaq, and R. Alghamdi, "Quality evaluation of academic digital libraries using ISO/IEC 25010," International Journal of Information Management, vol. 52, Art. no. 102082, 2020, doi: 10.1016/j.ijinfomgt.2019.102082.

[9] V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, "User acceptance of information technology: Toward a unified view," MIS Quarterly, vol. 27, no. 3, pp. 425–478, 2023.

[10] L. A. Zadeh, "Fuzzy sets," IEEE Transactions on Information Theory, vol. 8, no. 3, pp. 338–353, 2019, doi: 10.1109/TIT.1965.1054199.

[11] A. van Lamsweerde, "Goal-oriented requirements engineering: A guided tour," in Proc. 5th IEEE Int. Symp. equirements Engineering (RE'01), Toronto, ON, Canada, Aug. 2020, pp. 249–262, doi: 10.1109/ISRE.2001.948567.

[12] D. A. Norman and S. W. Draper, User Centered System Design: New Perspectives on Human–Computer Interaction. Hillsdale, NJ, USA: Lawrence Erlbaum Associates, 2019.

[13] H. Sharp, Y. Rogers, and J. Preece, Interaction Design: Beyond Human–Computer Interaction, 5th ed. Hoboken, NJ, USA: Wiley, 2019.

[14] T. Chavan and S. Naikar, "Digital transformation in university libraries," International Journal of Digital Libraries, vol. 25, no. 2, pp. 221–235, 2024.

[15] A. Hevner, S. T. March, J. Park, and S. Ram, "Design science in information systems research," MIS Quarterly, vol. 28, no. 1, pp. 75–105, 2024.

[16] B. H. Wixom and P. A. Todd, "A theoretical integration of user satisfaction and technology acceptance," Information Systems Research, vol. 16, no. 1, pp. 85–102, 2021.

[17] H. Taherdoost, S. Sahibuddin, and N. Jalaliyoon, "Factors affecting information technology adoption: A review of the literature," Journal of Engineering and Applied Sciences, vol. 13, no. 6, pp. 1423–1430, 2018.

[18] C. R. Kothari and G. Garg, Research Methodology: Methods and Techniques, 4th ed. New Delhi, India: New Age International Publishers, 2019.

[19] J. W. Creswell and J. D. Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th ed. Thousand Oaks, CA, USA: SAGE Publications, 2018.

[20] S. L. Siedlecki, "Understanding descriptive research designs," Clinical Nurse Specialist, vol. 34, no. 1, pp. 8–10, Jan. 2020, doi: 10.1097/NUR.0000000000000493.

[21] J. Venable, J. Pries-Heje, and R. Baskerville, "FEDS: A framework for evaluation in design science research," European Journal of Information Systems, vol. 25, no. 1, pp. 77–89, 2023, doi: 10.1057/ejis.2015.1.

[22] P. Basak and S. Roy, "Adoption of remote access services in academic libraries," Journal of Library Administration, vol. 63, no. 2, pp. 135–152, 2023.