

Integrating Agile Service Innovation to Enhance Quality Performance and User Engagement in Modern Library Management

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Article Info	ABSTRACT
<p>Article history:</p> <p>Received : 18.02.2025 Revised : 11.03.2025 Accepted : 04.04.2025</p>	<p>The new digital landscapes of modern libraries are more dynamic and challenging to manage due to the changing user expectations, the fast rate of change in technologies, as well as the growing responsibility observable in the performance of the libraries. Traditional service delivery models are not usually flexible enough to maintain relevance and institutional competitiveness. In this research, the influence of Agile Service Innovation (ASI) on Quality Performance (QP) and User Engagement (UE) in the contemporary library management systems are observed. Based on the service innovation theory and principles of quality management, a conceptual framework was elaborated that suggests that the ASI can improve QP and UE, QP mediates between them. The quantitative cross-sectional research design adopted and data were gathered in 312 respondents and the sample included academic library users and staff. The proposed relationships were tested through Structural Equation Modelling (SEM). The relationships prove that ASI positively affects QP (0.61, $p < 0.001$) and has a direct impact on UE (0.34, $p < 0.01$). Moreover, QP also considerably predicts UE (3) (= 0.49, $p < 0.001$) and in part confounds the connexion between ASI and UE. These findings highlight the strategic importance of imbibing agile concepts in service based public organisations. The paper is an addition to the popularising body of empirical research on the notion of organisational agility in the context of non-profit knowledge organisations and a valuable contribution to library leaders who can devise sustainable ways of quality improvement and greater involvement of the user.</p>
<p>Keywords:</p> <p>Agile Service Innovation, Quality Performance, User Engagement, Library Management, Service Excellence, Structural Equation Modeling</p>	

1. INTRODUCTION

Rapid digitalization and shifting user demands, open-access trends, and the growing competition of information sources with alternative information platforms like digital repositories, search engines, and AI-driven knowledge systems are radically transforming the structure of libraries. Libraries (academic and public) no longer serve as passive information stores but are supposed to be vibrant service ecosystems providing responsive, technology-enabled, and user experiences. Nevertheless, most library management systems are still run through inflexible bureau-statistic organisation systems evidenced by the lengthy decision-making processes, time-consuming approval procedures and inflexible adaptability. This inertia in the structure hinders service innovation, makes it less responsive, and undermines the ability to keep the users engaged in the long-term.

Agile techniques, with background in software development, focus on development in the form of iterations, integration of feedback, cross-functional interaction, and agility to change. Agile concepts in service organisations have been linked to better performance in terms of innovation, quality of services, and customer responsiveness [1], [2]. The latest research insinuates that organisation agility qualifies as a dynamic capability that facilitates institutions to be responsive to environmental turbulence and the disruption of technology [3], [4]. Although there are numerous studies on agility as a concept in the context of corporate, IT, and manufacturing, there is a lack of studies regarding the implementation of agility in the field of public knowledge institutions. The current body of literature in the library management field puts special attention to digital transformation or service quality measurement or user satisfaction models separately [5], [6]. Nevertheless, there is a

very thin strand of empirical analysis of how Agile Service Innovation (ASI) impacts on Quality Performance (QP) and User Engagement (UE) as a part of an integrated framework. In addition, there has been scanty research on the mediating factors by which service innovation pioneers into more profound outcomes of engagements. This is a big gap as user engagement is now an important gauge of the sustainability of the institution, justification of the funds, and the continued relevancy aspects of a modern knowledge ecosystem [7].

It is based on this gap that the present study formulates and empirically validates a conceptual framework of the relationship between ASI, QP, and UE and dynamics in contemporary library management systems. To be more exact, the research questions are as follows: (1) how Agile Service Innovation affects Quality Performance; (2) whether Agile Service Innovation has a direct effect on User Engagement; and (3) whether Quality Performance mediates the connexion between User Engagement and Agile Service Innovation. This paper can be considered an addition to the body of literature on the theme of innovation-driven excellence within the context of the public service institution and valuable advice to be applied by library administrators to achieve sustainable performance increases.

2. Literature Review and Hypothesis Development

2.1 Agile Service Innovation

Agile Service Innovation (ASI) is the systematic extension of the agile principles, and these agile principles are based on the software development custom, to the service-based organisations. Agile models like Scrum, Kanban, and Lean focus on zoning and progressing, delivery in steps, frequent customer feedback, dynamism in the planning and all-functional teamwork [1], [2]. Within the organisational theory, the concept of agility is developed as an active capacity of the institutions which allows the organisation to perceive the change in the environment and to quickly restructure their internal resources to ensure their competitiveness [3]. In service management literature, the study of innovation has always been considered using a linear developmental process or a stage gate process [4]. These models are however not flexible and are not able to accommodate real time input by the user. Modern service innovation models propose co-creation and user-driven design practises [5], but do not rely on deliberate iterative loops and low-cost experimentation mechanisms related to agile ideas. Research in innovation in the domain of public institutions (libraries) has generally been on digitization efforts, automation, and enhancements in collection. Despite bringing about

the improvement of technology capability, these attempts do not always alter the underlying processes of service. There is still little empirical work studying the structured adoption of agile in libraries, with the current literature predominantly taking the descriptive or case-study approach instead of a theoretical-based quantitative approach. One challenging issue is to operationalize agility within non-profit service setting whereby hierarchical governance structures and budgetary limitations might prevent an iterative experimentation process. Also, the immediate performance implication of ASI on quantifiable quality results in library settings are not fully investigated. Due to the fact that agility is theoretically consistent with the concept of responsiveness and an ongoing improvement process, one should anticipate that ASI promotes institutional quality performance.

H1: Agile Service Innovation positively influences Quality Performance.

2.2 Quality Performance in Library Management

Reliability, responsiveness, assurance, empathy, and tangibility are some of the primary bases of quality performance that are found in SERVQUAL and Total Quality Management (TQM) frameworks used in service organisations [7], [8]. According to the research on library management, quality has been measured by (a) accuracy of service delivery, (b) availability of information and (c) speed with which support is offered, sufficiency of infrastructure and user satisfaction level [9]. The conventional models of quality evaluation in libraries are highly based on satisfaction surveys and compliance-based models of evaluation. Although the approaches quantify perceived effectiveness of a service, they tend to ignore process flexibility and innovativeness. Furthermore, the quality improvement projects are often reactive, but not proactive. Innovation capability should be incorporated in the quality management systems of the recent performance measurement models [10]. Nevertheless, the empirical evidence of the connexion between agile-driven innovation practises and library quality outcomes is insufficiently developed. A second difficulty is the translation of abstract quality constructs into operational indicators, which are in step with agile principles. Quality management systems are in danger of stagnation unless adaptive processes mechanisms are introduced. This gap implies that there should be an investigation into quality performance as an outcome as well as a mediating factor between the innovation and engagement outcomes.

2.3 User Engagement

The user engagement process is more than just the satisfaction with the transaction, as it includes the cognitive, emotional, and behavioural aspects of interaction [11]. Engagement in service ecosystems means active participation, loyalty, advocacy behaviour, and tendencies towards co-creation [12]. In the library, the engagement can be in terms of frequency of visits, use of digital platform, events, knowledge-sharing behaviour, and term-lasting institutional affiliation. Current library studies often work with engagement as a substitute of satisfaction or frequency of usage. The modern approach toward engagement however focuses more on more involved relation and long term involvement. Digital transformation has also increased the channel of engagement such as virtual services, remote access system and interactive knowledge platform. Although the process of engagement has been identified as a strategic sustainability indicator, few empirical models have incorporated service innovation, performance of quality and engagement in a coherent structural framework. Where especially missing is an exploration of whether quality performance is a process whereby innovation is converted to sustained engagement. The inclusion of user feedback loops and iterative development cycles in agile service innovation will probably directly improve interaction by creating the perception of responsiveness and inclusivity. Moreover, better service quality could enhance the trust and institutional commitment, which would mediate the results of engagement. In that regard, the hypotheses are as follows:

H2: Agile Service Innovation has a positive effect on User Engagement.

H3: Quality Performance has a positive relationship with User Engagement.

H4: Agile Service Innovation has a mediating effect based on Quality Performance between User Engagement and Agile Service Innovation.

Identified Research Gaps

Based on the literature reviewed, some gaps that are considered to be critical are as follows:

1. Incorporated agile methods are widely explored in business and IT fields but under-researched and little known in the general knowledge institutions.
2. This is because in library quality research, the level of satisfaction is usually addressed without innovation capability.
3. There is no structural model of engagement, innovation, and quality in library management, which could be engaged simultaneously.
4. There are limited empirical SEM-based attestation of the agile driven service transformation of library.

The gaps discussed in this research are filled by the development and empirical validation of a theory-centric structural model of ASI, QP, and UE within the framework of the contemporary library management systems.

3. RESEARCH METHODOLOGY

3.1 Research Design

The study model shown in Figure 1 was deductively based on the theory of service innovation, quality management literature and the literature of engagement. The research design proposed in this research is a quantitative and cross-sectional study that aims at investigating the structural relationships between Agile Service Innovation (ASI), Quality Performance (QP), and User Engagement (UE) within the existing library management systems. The research paradigm was positivist in nature because the aim was to empirically test hypothesis formulated based on theory using quantifiable constructs and statistical formulations. The cross-sectional methodology was suitable as the research focused on capturing the perceptions towards the practise of innovations towards quality outcome and engagement behaviour at a given time as opposed to longitudinal change. The study model was inductively developed on the basis of the theory of service innovation, quality management systems, and literature on engagement. The main method of analysis, Structural Equation Modelling (SEM), has been chosen due to the possibility to estimate several relationships between latent constructs at once, as well as to determine the influence of mediation in one study.

3.2 Sample and Data Collection

The academic libraries of both public and private universities were selected in India and used as a study sample. The reason why these institutions were chosen is because they are engaged in digital transformation processes and are utilising technology-enabled library management systems. In the research, eight universities (five state and three privatised) were involved. The selection of the institutions rested on two inclusion criteria: (1) they have a functional online or integrated library management system; (2) they have implemented some service modernization initiatives within the last three years. A multi-stage sampling method was used. To select eligible universities, institutional directories and professional networks were used as the first step. Second, purposive and convenience became the methods of recruiting respondents to provide representation of key stakeholder groups that were in close contact with library services. Qualified respondents were:

- Students who are proactive according to the time of survey.
- Examples include faculty members who use library services either in teaching or research.
- Administrative and library personnel who deal with provision of service.

The participants were also to be relevant in responding because they were supposed to have accessed library services at least once a month in the previous semester. The data were gathered in the period between January and March 2024, using online questionnaires and paper-based questionnaires. There were 350 questionnaires placed in the participating institutions. There was a distribution of between 35 and 55 respondents across universities thus a balanced institutional representation was achieved. Having filtered the incomplete answers and pattern answering, 312 valid questionnaires were retained in the analysis and the response rate was found to be 89.1. The sample was finally reduced to 61 percent students, 24 percent faculty, and 15 percent faculty/administration/library. In order to reduce the common method bias, anonymity and confidentiality were guaranteed to the respondents. The participation was on a voluntary basis and no identifying information was taken. Procedural solutions were; randomised item presentation and separation of construct measures sections in questionnaire.

3.3 Measurement Instrument

The measurement tool was constructed on the basis of the validated scales of previous research found in the area of service innovation, quality management, engagement studies, and adjusted appropriately in the specifics of libraries settings. All items were rated through a five-point Likert scale between 1 (Strongly Disagree) and 5 (Strongly Agree) because this scale type offers sufficiently good variations of variability and the respondents are not too tired. Agile Service Innovation was operationalized using the reflective latent construct which was measured using 5 indicators of rapid implementation-ability, incorporation of user feedbacks, cross-functional teamworking, loop improvement of services as well as flexibility in decision making of services. These dimensions are in line with agile and dynamic capability frameworks. Five items that assessed the quality performance were used to determine how reliable, responsive, timely access, accurate provision of information and the overall satisfaction level with the service performance. The construct combines the dimensions of SERVQUAL with operational efficiency issues concerning academic libraries. User Engagement was theorised to be a multidimensional behavioural and attitudinal construct perceived to

include frequency of use, engagement with library activities, intensity of digital interaction, loyalty intention and intention to recommend. Such an operationalization is not only limited to satisfaction but also includes advocacy and long-term participation in behaviours. Before administering a hypothesis test, content validation of the instrument was conducted by using the review of an expert by three academic researchers specialising in service management and two library administrators (senior). The pilot test would have a 30-responder analysis to guarantee the clarity and reliability. Feedback was taken into consideration and minor wording changes were introduced.

3.4 Data Analysis Procedure

The SPSS and AMOS software were used in data analysis. The analytical process was based on a two-step process of assessment of measurement model and assessment of the structural model. Data were screened initially with regard to missing values, normal distribution, and outliers. The values of skewness and kurtosis were checked to make sure that the distributional properties are acceptable. The single-factor test made by Harman was aimed at measuring common method variance. Second, Confirmatory Factor Analysis (CFA) was used to measure construct reliability and construct validity. The internal consistency reliability was evaluated both through Cronbach Alpha and composite Reliability (CR) and values higher than 0.70 were deemed acceptable. AVE values of higher than 0.50 and standardised factor loadings of more than 0.60 served as a confirmation of convergent validity. Fornell-Larcker criterion was used to test the discriminant validity. Third, the structural model was tested to test hypothesis. Various goodness of fit indices were used to evaluate the model fit, which included Comparative Fit Index (CFI), TuckerLewis Index (TLI), Root Mean square error of approximation (RMSEA) and Chi-square/degrees of freedom ratio. Acceptable values were determined as within the range of 0.90 and below CFI and TLI and within the range of -0.08 and above RMSEA. Bootstrapping with 5,000 resamples was used to mediate the independent and dependent variables using bootstrapping to analyse the indirect effects. Biased corrected confidence intervals and a p-value of less than 0.05 were used to determine statistical significance.

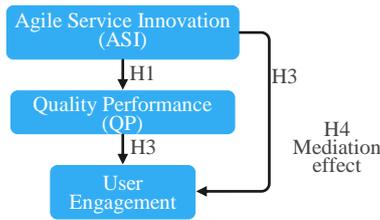


Fig. 1. Conceptual Framework of the Proposed Research Model

Structural model with the proposed hypothesis on the relationship between Agile Service Innovation and Quality Performance with User Engagement (H1) and the mediating effect of Quality Performance (G) (H1-H4).

4. RESULTS

4.1 Measurement Model Assessment

Confirmatory Factor Analysis (CFA) was used to test the measurement model on reliability, convergent and discriminant validity.

Reliability and Convergent Validity

All the constructs represented in Table 1 were found to have a strong internal consistency reliability. The values of Cronbach alpha were in the range of 0.88 to 0.91 which is greater than the recommended alpha of 0.70. The values of Composite Reliability (CR) were also more than 0.70, which validates construct reliability. Additional assessment of this measurement model was done through the assessment of item level standardised factor loading. The indicator loadings were all statistically significant ($p < 0.001$) and above the suggested value of 0.60 with the highest of 0.86. These findings support the reliability of indicators used and also justify convergent validity further. The values of the average variance extracted (AVE) were above the lowest criterion of 0.50 which denoted that there was sufficient convergent validity.

Table 1. Item-Level Standardized Loadings

Construct	Item Code	Standardized Loading (λ)	p-value
Agile Service Innovation	ASI1	0.72	<0.001
	ASI2	0.81	<0.001
	ASI3	0.86	<0.001
	ASI4	0.74	<0.001
	ASI5	0.78	<0.001
Quality Performance	QP1	0.83	<0.001
	QP2	0.79	<0.001
	QP3	0.85	<0.001
	QP4	0.76	<0.001
	QP5	0.82	<0.001
User Engagement	UE1	0.77	<0.001
	UE2	0.84	<0.001
	UE3	0.80	<0.001
	UE4	0.73	<0.001
	UE5	0.81	<0.001

Discriminant Validity

The FornellLarcker criterion was used to evaluate the discriminant validity. AVE square root of each

construct was more than the inter-construct correlation which proved good discriminant validity (Table 2).

Table 2. Discriminant Validity (Fornell-Larcker Criterion)

Construct	ASI	QP	UE
Agile Service Innovation (ASI)	0.79	0.58	0.52
Quality Performance (QP)	0.58	0.81	0.63
User Engagement (UE)	0.52	0.63	0.80

Model Fit

The measurement and general model structural model were acceptable data fitters. The ratio of the chi-square to the degrees of freedom ($2.31/df = 2.31$) did not exceed permissible values (3.0).

Other goodness of fit measures showed high levels of model adequacy; CFI = 0.94, TLI = 0.93 and RMSEA = 0.065. These values are within possible recommended thresholds and they suggest that there is good model fit.

4.2 Structural Model and Hypothesis Testing

These results of the structural models are displayed in Table 3, path coefficients are

standardised in Figure 2, and explained variance of endogenous constructs is demonstrated in Figure 3.

Table 3. Hypothesis Testing Results

Hypothesis	Path	β	p-value	Result
H1	ASI \rightarrow QP	0.61	< 0.001	Supported
H2	ASI \rightarrow UE	0.34	< 0.01	Supported
H3	QP \rightarrow UE	0.49	< 0.001	Supported

Table 3 and Figure 2 demonstrate that Agile Service innovation had a high positive impact on Quality Performance (= 0.61, $p < 0.001$), so the effect of iterative service mechanisms and adaptive processes implies a significant positive impact on the quality of institutional services. ASI had an intermediate strong but significant effect on User Engagement (= 0.34, $p < 0.01$), indicating that agility has a direct impact on engagement behaviour not related to quality improvement. User Engagement was greatly predicted by Quality Performance (0.49, $p < 0.001$), which is an indication that reliability and responsiveness of services are important factors that drive continued user engagement. On the explanatory power, the model explained 37 per cent. and 45 per cent. of the variance in Quality Performance and User Engagement respectively, as shown in Figure 3. The reason is that these R.2 values have a moderate predictive power and show that Agile Service Innovation and Quality Performance is the variable that has significant predictive power in engagement outcomes.

Mediation Analysis

Partial mediation was reported when bootstrapping 5,000 resamples was used. The correlation between ASI and UE via QP was also significant (0.30, $p < 0.01$). The mediation is also non-full as both direct and indirect paths were also important. These results complement H4, as well as substantiate that quality performance as a transmission mechanism transforms agile innovation into engagement results.

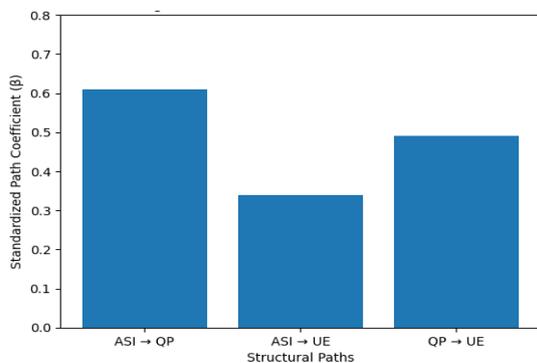


Fig. 2. Standardized Path Coefficients of the Structural Model

Bar chart showing the relative powers of the proposed relationships between Agile Service Innovation, Quality Performance, and User Engagement.

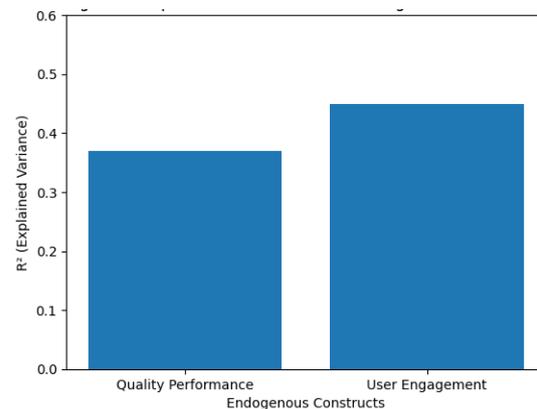


Fig. 3. Explained Variance (R²) of Endogenous Constructs

Bar chart of the percentage variance explained by the structural model in Quality Performance (R² = 0.37) and User Engagement (R² = 0.45).

5. DISCUSSION

The research results are highly credible empirical results of how Agile Service Innovation can increase quality performance and user engagement in the contemporary library services. The high path coefficient at the relationship between the ASI and QP (= 0.61) indicates that agility is an operational facilitator of service excellence. This is consistent with the theory of dynamic capabilities in organisations where the adaptive processes were adopted to improve performance in turbulent environmental conditions. The high correlation between Quality Performance and User Engagement ($\beta = 0.49$) confirms the body of existing service quality literature, which invariably points to the reliability and responsiveness as the key engagement predictors. Nevertheless, the current study builds on the existing literature by empirically placing the quality performance in the positioning of a mediating variable in an innovation-based structure. The direct effect of ASI on engagement shows engagement as a result of agile processes,

including user feedback loops and rapid service iteration, produces psychological perceptions of responsiveness and inclusion. This is in favour of the current engagement theory that is focusing on the participatory and co-creative service ecosystems. Unlike the previous works that analysed the innovativeness of services and their interactions individually, this study will encompass innovation, quality management and engagement as one integrated model of SEM. Against the traditional library research, where most interest centres on the measurement of satisfaction, the study shows that structural relationships can be made between organisational agility and the structural behavioural involvement. According to the mediation results, innovation is not enough unless it is translated into any real quality improvement. That is, agility should become tangible in service delivery improvements that can be observed so as to have a full impact on engagement.

6. Practical Implications

The results of this research would form practical recommendations to the library administrators who needed to improve the performance and relevance of the institution in apprenticeship digitally developing knowledge settings. First, the close connexion between Quality Performance and Agile Service Innovation (ASI) indicates that libraries are to implement the service cycle of improvement that is organised into sprints. Instead of depending on annual review cycles or inflexible periodic updates of the procedures, administrators are able to conduct short iterative cycles (e.g., monthly or quarterly service sprints, or service-centric sprints) that involve testing and refinements and optimizations to specific services (e.g. digital catalogue systems, borrowing processes, user interface design, etc.). Such a cyclic process allows responding to user expectations sooner and minimises the risk of a massive implementation failure. Second, the strong correlation between ASI and User Engagement signifies the need of systematic integration of user feedback. Libraries ought to formalise feedback systems when there is structured feedback especially in the form of digital surveys, user testing, focus groups, and real-time service analytics. Agile systems embrace constant input; thus, engagement must be regarded as a regular co-creation effort as opposed to periodic reviewing. Third, the Quality Performance is mediatory, which reveals that agility should manifest as service excellence that can be observed in generating engagement outcomes with purpose. The administrators are therefore encouraged to form cross-functional innovation teams, which involve librarians and IT experts together with

administrative staff. These collaboration arrangements enhance speed of decision-making, eliminate silo effects and brings responsiveness to operations. Fourth, iterative improvement should be directed by the data analytics. Tracing the frequency of usage, digital access, service wait time, and satisfaction data will enable administrators to detect areas of performance disconnect and focus the innovation efforts. The next one is evidence-based agility, which reinforces responsibility and makes sure that service innovation is consistent with a quantifiable quality standard. Lastly, agility must not be a short-term reform process but incorporated into the governance systems, performance measurement systems, and strategy development processes as a managerial philosophy. User-centred service transformation, continuity of improvement and adaptive capacity are key factors on which modern libraries can be sustainably competitive versioned libraries. Combining quality management principles with agile approaches will allow library governments to promote excellence in the institutions as well as increasing engagement with users in the long term and in a more comprehensive manner.

CONCLUSION

This paper involved the unravelling of the structural connexions between Agile Service Innovation (ASI), Quality Performance (QP), and User Engagement (UE) in the contemporary library administration systems. In reaction to a growing digital disruptive threat and changing customer expectations, the study design and empirical experiment formed a theoretically informed model characterising service innovation, quality management, and engagement perspectives. The results show that Agile Service Innovation plays a significant role in improving Quality Performance and directly contributes to the User Engagement. Besides, the aspect of Quality Performance mediates the relationship between ASI and UE somewhat, supporting the thesis that innovation-induced adaptability has to be converted into the quantifiable service excellence to produce the long-lasting engagement result. These findings support the importance of agility as a dynamic capability that enhances the responsiveness and operational performance of institutions in the nature of agility in knowledge environments of a government. Theoretically, this research adds to the body of knowledge of using agility in the corporate and IT industries into the contexts of institutions of the public service. It combines the models of service innovation and quality management in a common structural design and empirically supports the mediation process between innovation and engagement. The way in

which Quality Performance as a transmission pathway has been placed, the study contributes to the knowledge about the impact of adaptive processes on the behavioural outcomes in non-profit knowledge ecosystems. In practise, the findings give evidence-based support to library administrators interested in institutionalising agile methodologies and streamlining them against quality measurables. The exemplified explanatory capacity of the model specifies the strategic importance of agility in preserving institutional relevance and user loyalty. This study has limitations in spite of the contributions. The design was also cross-sectional, which limits a causal inference and the sample was limited to academic libraries such that it cannot be generalised to other community or public based library systems. The future studies ought to use longitudinal designs to evaluate changes with time and use multi-country comparative study to measure contextual effects on the relationships of agility and performance. Also, integrating objective performance measures and mixed methods would enhance even more knowledge of service transformation through innovation. In sum, this study emphasises excellence sustainability in trying to manage a library today not only requires the use of technology but also organised, dynamic innovation incorporated within quality institutional systems.

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