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DIGITAL INNOVATION AND SERVICE DELIVERY EFFECTIVENESS IN OPEN DISTANCE LEARNING UNIVERSITIES: A STUDY OF THE NATIONAL OPEN UNIVERSITY, NIGERIA

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ABSTRACT

This study examined the effect of digital service innovation on service delivery effectiveness in open distance learning (ODL) universities in Nigeria within a global context. Drawing on the service-dominant logic perspective, the study conceptualised digital service innovation along three dimensions. A quantitative cross-sectional survey design was adopted, and primary data were collected from 341 NOUN students. Multiple regression analysis was employed to test the hypothesised relationships between dimensions of digital service innovation and service delivery effectiveness. The findings indicate that LMS and process automation exert positive and statistically significant effects on service delivery effectiveness; data-driven personalised learning exhibits a positive but statistically insignificant effect, which suggests that personalisation technologies are not yet sufficiently institutionalised to yield measurable service delivery gains in the sampled institution. The study concluded that strengthening core digital service infrastructures and automating service processes should be prioritised in ODL universities, while targeted investments in learning analytics and staff capacity are required to realise the potential of personalised digital services.

Keywords: Digital innovation, LMS, ODL, service delivery.

Introduction

Service delivery effectiveness is a central concern for higher education institutions as universities increasingly operate within digitally mediated learning environments (Keržič et al., 2021; Sudrajat et al., 2024). In open and distance learning (ODL) universities, where physical interaction between learners and institutions is minimal, the quality-of-service delivery is largely determined by some factors such as efficiency, accessibility, and reliability of

digital platforms and support systems (Shabani and Maboe, 2021; Singh, 2021). Service delivery in this context extends beyond instructional content to include student support services (Nsamba and Makoe, 2017), administrative responsiveness, learning management systems (Swart, 2015), assessment processes, and communication infrastructure (Ochionuoha, 2023). Consequently, the ability of ODL institutions to design and implement digital service innovations has become a strategic requirement for sustaining academic quality and competitiveness.

Digital service innovation here pertains to the deployment of improved digital technologies, platforms, and processes that enhance service value and user experience (Vargo et al., 2924). In the education sector, this includes the integration of learning management systems, virtual classrooms, mobile learning applications, cloud-based academic records, and automated student support services (Gryzun and Tokariev, 2023; Kovalevskaia et al., 2021). Such innovations are not merely technological upgrades; they enhance learning processes, redefine staff roles, and alter how students engage and interact with their tutors. When effectively implemented, digital service innovations have the potential to improve service speed, reduce operational bottlenecks, enhance accessibility for geographically dispersed students, and promote personalised learning experiences for them.

Service delivery effectiveness in ODL universities is increasingly shaped by three interrelated digital service innovation dimensions: learning management systems (LMS), automated institutional processes, and data-driven personalised learning. LMS platforms function as the core digital interface through which teaching, assessment, communication, and learning resources are coordinated, thereby determining the accessibility, continuity, and pedagogical consistency of online education (Swart, 2015; Keržič et al., 2021). Alongside this, the automation of academic and administrative processes such as admissions, registration, fee payments, course enrolment, results processing, and student support workflows reduces manual bottlenecks, improves response time, enhances data accuracy, and strengthens institutional reliability, which are critical service delivery indicators in large-scale distance education systems (Gryzun and Tokariev, 2023). More recently, the integration of learning analytics and artificial intelligence has enabled data-driven personalisation of learning experiences, allowing institutions to adapt content delivery, assessment pathways, and learner support based on students' behavioural and performance data (Sudrajat et al., 2024; Kovalevskaia et al., 2021). These dimensions shift tertiary institutions from static structures toward adaptive and service-oriented digital ecosystems, positioning digital service innovation as a central mechanism through which ODL universities enhance operational efficiency, learner engagement, and service delivery effectiveness.

Despite the recognised potential of digital service innovations to transform ODL, their actual impact on service delivery effectiveness remains inconsistent in the context of developing nations. This ambiguity gives rise to several critical research problems. First, there is a significant knowledge gap regarding the causal mechanisms through which specific digital innovation indicators translate into measurable improvements in service effectiveness for students. While technologies like learning management systems are widely adopted, empirical evidence on how they directly enhance core metrics such as student retention or support quality is often anecdotal (Nsamba and Makoe, 2017).

In addition, the implementation of these digital innovation tools by ODL institutions in Nigeria frequently outpaces the development of evaluative frameworks. Consequently, institutions struggle to systematically assess whether a new digital tool genuinely adds value to the students. This research, therefore, addresses the central problem of assessing the contingent relationship between digital service innovation and service delivery effectiveness in ODL universities to identify the conditions under which such innovations truly add value to service effectiveness. Based on the foregoing discussion, the specific objectives of this study include the following:

i. Examine the effect of learning management systems on service delivery effectiveness in open and distance learning universities;
ii. Assess the influence of process automation on service delivery effectiveness in open and distance learning universities; and
iii. Evaluate the effect of data-driven personalised learning on service delivery effectiveness in open and distance learning universities.

Hypotheses of the study

In line with the study objectives, the following hypotheses are formulated:

H_{01}: Learning management system has no significant effect on service delivery effectiveness in open distance learning universities.

H_{02}: Process automation has no significant effect on service delivery effectiveness in open distance learning universities.

H_{03}: Data-driven personalised Learning has no significant effect on service delivery effectiveness in open distance learning universities.

Literature Review

Concept and Dimensions of Digital Service Innovation

Digitization is disruptive force that is changing how services are produced, distributed and consumed across several economic sectors. Within this transformation, Digital Service Innovation (DSI) is conceptualized as the creation of new service, the improvement of existing service processes, or the reconfiguration of business models through the strategic integration of digital technologies and organizational resources to enhance value co-creation among stakeholders (Lusch and Nambisan, 2015; Jaakkola et al., 2024). In

the education sector, DSI includes the redesign of service architecture, pedagogical practices, and student engagement mechanisms around digitally mediated interactions (Kompella, 2024).

In educational contexts, particularly within open and distance learning institutions, DSI involves the deployment of digital platforms that support teaching, learning, assessment, and administrative services (Culcasi et al., 2023). These include learning management systems, virtual learning environments, mobile learning applications, artificial intelligence–driven tutoring systems, and automated student support services (Nsamba and Makoe, 2017). Such innovations enable universities to transcend geographical barriers, expand access to education, and deliver learning solutions to diverse student populations. The transformation of service delivery through digital channels also alters the nature of interaction between educators and learners and shift education from traditional instructor-centered models toward more interactive, learner-centered, and data-driven educational experiences.

Within the scope of this study, DSI is operationalized as the extent to which open and distance learning universities adopt and integrate digital technologies to redesign academic, administrative, and support services in ways that enhance accessibility, responsiveness, reliability, and user experience. This operational framing provides the basis for examining how DSI influences service delivery effectiveness in ODL institutions. Extant literature indicates that three dimensions are particularly critical within DSI framework which include the development of learning management system, the implementation of Process Automation, and the use of Data-Driven Personalization.

Learning Management System

The Learning Management System (LMS) represents the core digital infrastructure through which teaching, learning, assessment, and academic administration are coordinated in open and distance learning institutions. Conceptually, an LMS refers to an integrated digital platform that enables course content delivery, learner interaction, assessment management, progress tracking, and feedback exchange within a unified virtual environment. Rather than functioning as a standalone software application, contemporary LMS architecture increasingly operates as part of a digital learning ecosystem that incorporates virtual classrooms, content repositories, student information systems, and collaborative tools. This integrated configuration supports continuity of learning processes and enhances the coherence of institutional service delivery. Previous research has emphasized the strategic role of LMS in reshaping educational service delivery. Al-Fraihat et al. (2025) argued that LMS effectiveness is closely linked to system quality, information quality, and user satisfaction, noting that well-designed platforms improve student engagement and academic performance outcomes. Similarly, Martin and Ndoye (2016) observed that LMS platforms enhance instructional flexibility

by enabling fast learning, real-time feedback, and interactive multimedia content which improve learner participation in virtual environments. Rashid and Asghar (2016) further suggested that LMS adoption promotes self-regulated learning behaviors among students by providing structured learning pathways, progress monitoring tools, and adaptive learning resources. Collectively, these perspectives indicate that LMS adoption extends beyond technological deployment to influence pedagogical practices, learner autonomy, and responsiveness.

In advanced economies, the impact of LMS on open and distance learning delivery has been particularly significant due to the availability of robust digital infrastructure and institutional investment capacity. Universities in these contexts leverage high-speed broadband connectivity and interoperable digital systems to deliver seamless learning experiences (Al-Fraihat et al., 2025). However, the effectiveness of LMS deployment in ODL institutions is not solely determined by technology. According to Keržič et al. (2021), organizational readiness, staff digital competence, instructional design capacity, and student digital literacy significantly affect outcomes. Even in technologically advanced countries, poor platform design, limited pedagogical integration, and weak support structures can undermine LMS performance. This suggests that LMS effectiveness operates as a socio-technical construct where technological infrastructure must align with institutional strategy and service delivery objectives.

Process Automation

Process automation within the context of this study refers to the application of digital technologies to redesign and streamline workflows by minimizing manual intervention, and improving service reliability (Oluwajana et al., 2019). In the context of open and distance learning universities, process automation includes digital enrollment systems, online course registration, automated fee payment platforms, electronic examination processing, learning analytics dashboards, administrative inquiries among others (Kovalevskaia et al., 2021). These systems function as operational backbones that support large student populations by ensuring timely service delivery and consistent process execution across academic cycles.
Existing studies have highlighted the operational value of automation in educational service environments. Sivarajah et al. (2019) observed that digital process automation improves institutional efficiency by shortening service turnaround time and reducing administrative bottlenecks. Similarly, Amin et al. (2025) reported that automated academic workflows enhance transparency and accountability by minimizing human errors associated with manual data processing and record management. Wamba et al. (2020) further suggested that automation technologies strengthen organizational responsiveness by enabling real-time monitoring of service requests and performance metrics, which supports

proactive decision-making. These empirical evidence shows that automation contributes not only to operational efficiency but also to institutional credibility and service quality perception. In advanced economies, process automation is a defining feature of digital university service models. Well-funded open and distance learning institutions use integrated digital systems, cloud technology, and reliable internet networks to provide academic and administrative services around the clock. Through automated platforms, students can register for courses, access their academic records, submit assignments, and receive feedback without needing to visit the campus physically. However, in Nigeria, the adoption of process automation is still at an early stage. Limited digital infrastructure, unstable electricity supply, and weak internet connectivity often slow down system performance and reduce the reliability of automated services. As a result, many institutions continue to rely on manual processes alongside digital platforms, which affects service efficiency and student experience.

Data-Driven Personalized Learning

Data-driven personalized Learning refers to the use of learner data which may include academic performance, engagement patterns and assessment results to tailor educational content, instructional strategies, and support services to the individual needs, pace, and preferences of each student (Liu et al., 2017; Mashile et al., 2023). This dimension of digital service innovation transforms raw data into actionable data points to enable the customization of learning pathways, the provision of targeted interventions, and the proactive enhancement of the student experience (Mashile et al., 2023).

According to Pardo et al. (2019) students learning analytics which is a core component of this DSI, allow institutions to shift from reactive to proactive support, identify low performing students before they disengage. Similarly, Daniel (2019) argued that data-driven learning systems can diagnose knowledge gaps in real-time and serve curated resources to personalize the instructional process at scale. However, critical voices caution against this technology determinism. Selwyn (2019) and Williamson (2017) warned of the ethical and practical challenges which include data privacy concerns, algorithmic bias that may reinforce inequalities, and the risk of reducing education to a narrowly defined set of quantifiable metrics, potentially undermining broader pedagogical goals.

In advanced economies with mature digital education ecosystems, such as Canada, data-driven personalization is increasingly sophisticated. Institutions leverage integrated data warehouses, robust learning analytics platforms, and AI to provide nuanced support. For example, predictive models can trigger personalized academic advising sessions, while adaptive courseware adjusts difficulty based on continuous assessment. This is supported by strong data governance frameworks, widespread digital literacy, and reliable

infrastructure, allowing innovation to focus on enhancing pedagogical depth and equity of outcomes (Ferguson et al., 2019). Conversely, in the Nigerian ODL context, implementation faces some constraints. While the aspiration for personalized learning exists, challenges such as fragmented data systems, limited bandwidth and unstable electricity are still common within the campuses. Personalized interventions often rely on simpler, manual methods, and the full potential of data-driven innovation is hindered. This creates a significant gap between the conceptual promise of hyper-personalized digital education and the on-ground reality of scalable implementation.

Theoretical Framework

This study is anchored on Service-Dominant Logic, which provides a useful perspective for understanding the relationship between digital service innovation and service delivery effectiveness in open and distance learning universities. The theory which was developed by Vargo and Lusch (2008), shifts attention away from traditional product-centered thinking toward a service-oriented view of value creation. It explains that value does not exist automatically in what an institution provides. Instead, value emerges when users apply what they receive through experience, interaction, and personal use. Universities therefore do not deliver value directly. They offer service propositions that only become meaningful when students engage with digital platforms, academic resources, and institutional support systems. The theory also offers a lens for understanding of service delivery effectiveness. Effectiveness is not only about system availability or speed of service. It also relates to how well institutional systems help students achieve meaningful learning outcomes and positive service experiences. From this perspective, effective service delivery in open and distance learning should be reflected in improved student satisfaction, engagement, perceived service quality, and reduced barriers in academic and administrative processes.

The framework further explains how digital service innovation influences service outcomes. A functional Learning Management System provides the main digital space where teaching, learning, and interaction take place. It connects students, instructors, and learning materials in a structured environment. Process Automation reduces delays in registration, assessment handling, and student support services, allowing both staff and students to focus more on academic activities rather than administrative procedures. Data-Driven Personalization supports tailored learning experiences by using student data to identify learning needs, predict academic risks, and provide targeted academic support.

Empirical Review

Riyath and Rijah (2022) examined the factors influencing educators' adoption of learning management systems in Advanced Technological Institutes implementing open and distance learning programmes.

The study applied an extended Technology Acceptance Model and employed Partial Least Squares Structural Equation Modelling on survey data collected from academic staff. The findings indicated that perceived self-efficacy and job relevance significantly influenced both perceived usefulness and perceived ease of use of LMS platforms. These perceptions subsequently shaped educators' attitudes, which in turn determined behavioural intention and actual system usage. The study suggested that digital service innovation through LMS deployment contributes to service delivery effectiveness when institutions provide adequate training, align platform features with instructional tasks, and maintain high system reliability.

Alzahrani and Seth (2021) investigated the determinants of students' satisfaction with continued LMS usage during the COVID-19 transition to fully online learning. Using a combined framework based on social cognitive theory, expectation confirmation theory, and the information systems success model, the authors analyzed survey responses from 181 university students. The results showed that information quality and self-efficacy had significant positive effects on student satisfaction, while service quality did not exert a direct influence under emergency remote learning conditions. In addition, students' outcome expectations were shaped more by prior experience and social influence than by satisfaction alone. These findings indicate that LMS-based digital service innovation that prioritizes content clarity, instructional relevance, and user competence may be more critical to service delivery effectiveness in crisis-driven online learning environments than traditional service quality attributes.

Alam et al. (2021) developed and tested a comprehensive e-learning service performance framework using data from 397 LMS users across five public universities that had expanded online learning delivery. The study employed Partial Least Squares analysis to examine the relationships between system quality, information quality, learner quality, instructor quality, and institutional quality. The results revealed that these factors jointly explained a substantial proportion of variance in perceived usefulness and actual LMS usage. Furthermore, perceived usefulness and system usage together accounted for a large share of the variation in students' academic performance and learning outcomes. The findings shows that high-quality LMS implementation strengthens instructional effectiveness and institutional service performance, reinforcing the role of digital service innovation as a central driver of sustainable service delivery effectiveness in distance education settings.

Habib et al. (2020) examined the impact of institution-wide process automation at City University of Science and Information Technology in Pakistan using a mixed-methods case study approach. The university implemented integrated Management Information Systems and Learning Management Systems to

automate admissions, fee processing, academic reporting, digital libraries, and student support services. The findings showed that automation reduced manual paperwork, improved data security, and strengthened coordination across academic and administrative units. Students benefited from continuous access to learning resources and academic records, which improved transparency and service responsiveness.

Martins et al. (2019) evaluated the role of Education Management Information Systems as automated service platforms in higher education institutions. Using an information systems success model, the study found that system quality, information quality, and service quality significantly influenced student satisfaction and continued system use. These factors also predicted perceived benefits such as improved access to academic information, efficient service interaction, and better academic planning. The findings suggest that effective automation of academic and administrative processes enhances service delivery effectiveness, particularly in open and distance learning environments that serve large and geographically dispersed student populations.

Al-Zahrani and Alasmari (2023) investigated how learning analytics supports instructional personalization and student engagement in fully online university courses. Using LMS log data, the study analyzed patterns of student interaction, content access, assessment activity, and time spent on learning tasks. The findings showed that engagement indicators such as course interaction, content access, and assessment activity were strong predictors of student participation. The authors demonstrated that these analytics can be used to adjust instructional strategies and learning resources in real time. The study provides evidence that data-driven personalization enhances student engagement and improves the responsiveness of digital learning services in ODL environments.

Naseer et al. (2024) examined the effectiveness of an AI-driven adaptive learning platform that generated personalized learning pathways based on student performance and engagement data. In a controlled experimental study involving 300 university students, learners who used the adaptive platform achieved significantly higher academic performance and engagement levels compared to those in traditional learning settings. Student feedback also indicated improved satisfaction due to personalized content pacing and learning recommendations. The findings confirm that data-driven personalization improves learning outcomes and service experience which an indication of its relevance as a scalable digital service innovation for open and distance learning university.

Methodology

This study examines the effect of digital service innovation on service delivery effectiveness in open and distance learning universities using a cross-sectional survey research design. The cross-sectional approach was considered appropriate

because it enables the collection of data from a large population at a single point in time and supports the empirical examination of relationships among study variables. The target population comprised undergraduate and postgraduate students of the National Open University of Nigeria (NOUN), as the institution represents the largest and most structured ODL system in Nigeria.

A stratified sampling technique was adopted to ensure adequate representation of students across different administrative contexts within the NOUN system. Three study centres were purposively selected as the sampling strata based on their student enrolment size, geographic distribution, and operational activity levels. These centres collectively constitute the study sample frame and have a combined student population of 11,735. When the Taro Yanne formulae for a known population were applied, 386 sample size was derived. Within each selected centre, respondents were proportionately allocated and randomly selected to minimise sampling bias and enhance the generalisability of the findings.

Data were collected using a structured questionnaire designed to capture students' perceptions of digital service innovation dimensions as well as indicators of service delivery effectiveness. The instrument employed a Likert-scale format to ensure consistency and comparability of responses. Inferential statistical techniques were used for data analysis, with regression analysis applied to examine the significance of the relationship between digital service innovation and service delivery effectiveness proxies.

Data Presentation and Result Discussion

A total of 386 questionnaires were distributed across the three study centres in Abuja. From this distribution, 341 copies were retrieved which is a response rate of 88.3%. After thorough screening for completeness and consistency, 322 questionnaires were deemed suitable for analysis which represent 94.4% of the retrieved copies and 83.4 percent of the total distributed. The demographic characteristics of these 322 valid respondents are presented in Table 4.1 as shown below.

Table 4.1: Respondents Demographic

Variable	Category	Frequency	Percentage (%)
Gender	Female	200	62.1
	Male	122	37.9
Marital Status	Married	137	42.5
	Single	159	49.4
	Separated	26	8.1
Study Centre	Dei-Dei	109	33.9
	Wuse	17	5.3
	Dutse Model	196	60.9
	Total	**322**	**100.0**

Source: Author, 2026

The demographic profile presented in Table 4.1 shows that females constitute 62.1%, while males account for 37.9%. This distribution confirms the growing trend of female dominance in student enrolment within Nigerian higher education, reflecting wider improvements in female participation and access to tertiary education. With respect to marital status, single respondents constitute 49.4%, followed by married respondents at 42.5%, while those separated from their spouse represent 8.1% respondents. These statistics show a heterogeneous student population which spans different life stages. The distribution across study centres shows the Dutse Model Centre accounted for the highest proportion of respondents (60.9%) due to its enhanced facilities resembling a conventional university campus capable of accommodating larger student populations, followed by the Dei-Dei Centre (33.9%) and the Wuse Centre (5.3%).

Inferential Analysis

This section presents the inferential statistical procedures used to examine the relationships between the independent and the dependent variable, which was measured using student satisfaction. Prior to regression analysis, diagnostic tests were conducted to ensure the suitability of the data and the adequacy of the measurement instruments for parametric analysis. First, the reliability of the measurement scales was assessed using Cronbach's alpha to determine the internal consistency of the items measuring each construct, and the result presented in Table 4.2 indicated that all variables exceeded the recommended threshold of 0.7 (Hair et al., 2020), meaning that the survey instrument reliably captures the constructs of interest.

In addition, the assumption of homoscedasticity was examined to verify that the variance of residuals remains constant across levels of the independent variables. Homoscedasticity is a core assumption of regression; violation of this assumption can produce inefficient parameter estimates and misleading standard errors. Checks were conducted to ensure the data met other regression assumptions, including linearity and independence of errors. The results, presented in Table 4.3, indicate that the null hypothesis of homoscedasticity cannot be rejected across all tests conducted. The Breusch-Pagan test (LM = 5.272, p = 0.384), White test (LM = 17.085, p = 0.647), and Goldfeld-Quandt test (GQ = 1.003, p = 0.961) all confirm that residual variance remains constant to validate the appropriateness of regression for this study.

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Diagnostics Test

Table 4.2: Reliability test result

Construct / Scale	Cronbach's Alpha
Learning management system	0.893
Process automation	0.943
Data-Driven personalized learning	0.971
Student Satisfaction	0.970

Source: Author, 2026

Table 4.3 Homoscedasticity Tests

Test	LM / F Statistic	p-Value	Alt. Statistic	Alt. p-Value	Decision (α = 0.05)
Breusch-Pagan	LM = 5.272	0.384	F = 1.054	0.384	Accept H0 (homoscedasticity)
White	LM = 17.085	0.647	F = 0.852	0.650	Accept H0 (homoscedasticity)
Goldfeld-Quandt (two-sided)	GQ = 1.003	0.961			Accept H0 (homoscedasticity)

Source: Author, 2026

Hypotheses testing

Three hypotheses were formulated to examine the effect of digital service innovation dimensions on service delivery effectiveness in open distance learning universities. The hypotheses were tested using the standardized beta coefficients (β), t-statistics, and significance (p-values) from the regression results presented in Table 4.4.

Table 4.4: Regression Result

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	7.762	1.851		4.195	.000		
	LMS	.107	.081	.588	3.726	.000	.525	1.904
	PRA	.508	.077	.444	6.581	.000	.511	1.959
	DDPL	.226	.055	.294	3.593	.121	.774	1.292

a. Dependent Variable: SA

Source: Author, 2026

H_{01}: Learning Management System has no significant effect on service delivery effectiveness in open distance learning universities. The regression results show that LMS has a positive and statistically significant effect on service delivery effectiveness (β = 0.588, t = 3.726, p = 0.000). The null hypothesis (H_{01}) is therefore rejected.

H_{02}: Process automation has no significant effect on service delivery effectiveness in open distance learning universities. Process automation exhibits a positive and statistically significant effect on service

delivery effectiveness (β = 0.444, t = 6.581, p = 0.000). The null hypothesis (H_{02}) is therefore rejected.

H_{03}: Data-Driven Personalized Learning has no significant effect on service delivery effectiveness in open distance learning universities. Data-Driven Personalized Learning shows a positive but statistically insignificant effect on service delivery effectiveness (β = 0.294, t = 3.593, p = 0.121). The null hypothesis (H_{03}) is accepted.

The regression model summary presented in Table 4.5 below indicates a moderately strong relationship between the digital service innovation variables and service delivery effectiveness in open distance learning universities. The multiple correlation coefficient (R = 0.644) suggests that variables jointly exhibit a meaningful linear association with student satisfaction. This implies that variations in service delivery effectiveness are systematically linked to changes in these digital service innovation dimensions rather than occurring randomly. The coefficient of determination (R^2 = 0.414) shows that approximately 41.4% of the variation in service delivery effectiveness is explained by the combined influence of LMS, process automation, and data-driven personalized learning. It means that while digital service innovation explains a substantial portion of service delivery effectiveness, other institutional, pedagogical, and contextual factors not captured in the model also affect student satisfaction outcomes.

Table 4.5 Regression Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.644[a]	.414	.407	5.83144	1.292

a. Predictors: (Constant), LMS, PRA, DDPL
b. Dependent Variable: SA

Source: Author, 2026

Discussion of Results

The aim of this study was to examine the effect of digital service innovation on service delivery effectiveness in open distance learning universities, with specific focus on learning management systems, process automation, and data-driven personalised learning as key innovation dimensions. The first finding reveals that a learning management system has a positive and statistically significant effect on service delivery effectiveness (β = 0.588, t = 3.726, p = 0.000). This result implies that investments in robust LMS platforms enhance the quality, accessibility, and responsiveness of academic and administrative services provided to distance learners. The finding aligns with Service-Dominant Logic, which posits that value emerges when students actively engage with institutional service platforms, suggesting that LMS serves as a critical touchpoint where service propositions are

transformed into meaningful educational experiences through user interaction. This result is consistent with the empirical work of Riyath and Rijah (2022), who found that educator adoption of LMS platforms significantly influences service delivery when platforms are reliable and aligned with instructional tasks.

The second finding shows that process automation exhibits a positive and statistically significant effect on service delivery effectiveness ($\beta = 0.444$, $t = 6.581$, $p = 0.000$). This finding indicates that automating routine academic and administrative processes such as admissions, fee processing, academic record management, and student support services enhances operational efficiency and reduces service delivery bottlenecks. Through the lens of Service-Dominant Logic, automation eliminates friction in service interactions, enabling students to co-create value more effectively by accessing resources and completing transactions with minimal procedural barriers. The implication is that open distance learning universities serving geographically dispersed populations benefit substantially from automation, which improves transparency, service responsiveness, and overall student experience. This finding corroborates the work of Habib et al. (2020), who documented that institution-wide automation at City University of Science and Information Technology reduced manual paperwork, strengthened coordination across academic units, and improved students' continuous access to learning resources. It also aligns with Martins et al. (2019), who established that system quality and service quality in automated Education Management Information Systems significantly predict student satisfaction and continued system use in higher education contexts. The third finding reveals that data-driven personalized learning shows a positive but statistically insignificant effect on service delivery effectiveness ($\beta = 0.294$, $t = 3.593$, $p = 0.121$). Although the relationship is positive, the lack of statistical significance suggests that personalised learning interventions, while conceptually valuable, may not yet be sufficiently embedded or mature within the sampled institutions to produce measurable improvements in service delivery effectiveness. This finding contrasts with the experimental evidence of Naseer et al. (2024), who found that AI-driven adaptive learning platforms significantly improved academic performance and student satisfaction in controlled settings. However, it aligns with Al-Zahrani and Alasmari (2023), who found that while learning analytics can predict engagement patterns, translation into improved service outcomes depends heavily on instructors' capacity to adjust instructional strategies in real time. The implication is that data-driven personalisation, though promising, requires more intentional institutional investment in both technological infrastructure and human capacity development before its full potential for enhancing service delivery effectiveness can be realised in open distance learning contexts.

Conclusion

This study examined the effect of digital service innovation on service delivery effectiveness in open distance learning (ODL) universities in Nigeria, with specific attention to learning management systems (LMS), process automation, and data-driven personalised learning. The empirical results show that digital service innovation matters for service delivery outcomes, although its effects are uneven across dimensions. LMS and process automation exerted positive and statistically significant effects on service delivery effectiveness, while data-driven personalised learning, though positive, did not attain statistical significance. The model further indicates that digital service innovation explains a meaningful share of variations in service delivery effectiveness, which confirms that service outcomes in ODL contexts are systematically affected by digital infrastructure and institutional service processes rather than by chance. These findings support the view that effective service delivery in distance education is increasingly contingent on the quality and maturity of digital service systems that mediate institutional–student interactions.

Recommendations

Based on these findings, recommendations are provided as follows. First, ODL universities should prioritise continuous upgrading and integration of LMS platforms, with emphasis on usability, system reliability, mobile compatibility, and seamless linkage with administrative systems. Second, institutions should accelerate end-to-end process automation across student-facing services, particularly in admissions, registration, fee processing, academic records management, and learner support, to reduce service delivery frictions. Third, targeted capacity-building programmes should be implemented to equip academic and administrative staff with skills in digital service management and learning analytics, thereby enabling the gradual institutionalisation of data-driven personalisation. Fourth, national regulatory and quality assurance bodies should develop minimum digital service delivery standards for ODL institutions to promote consistency in service quality and protect student interests.

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