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Paperless Libraries Actualization: The Needs and Roles of Some Selected 21st Century Trend Technologies

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Abstract

Modern technology enhances service delivery in many fields including libraries, but its integrations and roles are not fully ascertained especially in the Nigerian context. This research, therefore, aims to investigate the need for technology integration and its roles in the actualization of the paperless library. Survey research design is used for this research and questionnaires are used as instruments for data collection. Total enumeration is used in drawing the population of the research from Abubakar Tafawa Balewa University, Bauchi and Modibbo Adama University, Yola. 98 usable responses are obtained and analysed using descriptive and inferential statistics with the help of the Social Science Statistical Package (SPSS). Findings revealed that five out of the seven hypotheses are statistically significant and have contributed on various degrees toward the actualization of paperless libraries. Based on the findings of this research, it is recommended that libraries should intensify efforts and integrate such modern technologies in order to actualize paperless libraries which is the trend of this 21st century. Furthermore, relevant laws and policies should be enacted by the relevant authorities and technology services providers in order to ease the integration of the technologies and have a paperless library that can offer better and more efficient services to users.

Keywords: Library, Modern technology, Computing services, Paperless library, Technology integration, 21st century.

INTRODUCTION

The need to simplify services in many human endeavours including libraries necessitates the high demand for modern technologies in order to turn dreams into realities. Technologies have been in existence since time immemorial, however 21st century brought the most sophisticated ones that can handle the needs of this current dispensation (Hayani et al., 2021; Kalu & Ochepa, 2021). 21st century technologies refer to innovations and advancements that have significantly shaped the modern world since the year 2000 which include but are not limited to artificial intelligence, cloud computing, blockchain technology, internet of things big data analytics and 5G network (Farrokhnia et al., 2023). Many fields of endeavours such as hospitals, airports, hotels, industries and many more have integrated technologies in an attempt to ease their service delivery (Dahri et al., 2024). Ali et al., (2020) acknowledge the roles of modern technologies such as Artificial Intelligence, cloud computing, robotic technologies, and surveillance technologies in enhancing services

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in both service and manufacturing industries. Likewise, modern technologies have been identified as the most adaptive technology in this 21st century compared to other past centuries (Makori, 2016).

Libraries been the custodian of knowledge-based information resources may find it difficult to discharge their primary responsibilities due to the information explosion and overloads resulted from the advancement in technologies such as social media handles, cloud-based technologies, among others. To actualize the dreams of information acquisition, storage, management and dissemination, the need to fully integrate 21st century technologies in places such as libraries is of paramount importance (Sambo & Oyovwe-Tinuoye, 2023). This will in no small measure improve efficiency and effectiveness of the services provided. Library mandates such as acquisition of collection, cataloguing, registering new users, charging and discharging requires modern technologies for them to be effective and efficient.

Kalu and Ochepa, (2021) reiterates that the 21st century has witnessed a rapid evolution in technology, transforming various sectors, including education and information management. Libraries, traditionally seen as repositories of physical books and documents, are undergoing a paradigm shift towards digital and paperless operations, giving rise to the concept of "smart libraries." A smart library integrates advanced 21st-century technologies to provide seamless, efficient, and user-centric services while reducing reliance on paper-based systems (Chan et al., 2022). The adoption of such systems not only improves operational efficiency but also enables libraries to cater to the evolving needs of tech-savvy users.

Despite the roles of 21st-century technologies in many fields, their adoption and use by libraries seems to be ineffective and downsizes the expectation of the library's service from the user's perspective. Moreover, investigation into the impact of such technologies is scarce (González-pérez & Ramírez-montoya, 2022). Ascertaining the suitability of each of the modern technologies in the library is still in the crawling stage (Idahosa & Eireyi-Edewede, 2023). Additionally Sambo and Oyovwe-Tinuoye, (2023) acknowledged that future research should explore the long-term implications of these technologies on library services and their role in fostering equitable access to information. These have aroused serious concerns that need to be addressed in order to ascertain which technology should be adopted and integrated into libraries and how it can benefit the libraries and users thereby improving a better and more effective service delivery.

Based on the aforementioned, this research aims to investigate and analyse the needs and roles of some selected 21st-century technologies which include artificial intelligence, big data analytics, cloud computing, robotic technology, internet of things, blockchain technology and 5G technology in actualizing paperless libraries. By identifying key technologies, this research will seek to provide actionable insights for policymakers, library administrators, and technology providers to facilitate the successful implementation of paperless libraries.

Research Question

1. What is the librarian perception on the need to integrate modern technology in library for actualization of paperless library?
2. What is the influence of modern technologies in actualization of a paperless library?

Hypothesis

21st-century technologies have a positive significance influence on library service toward actualizing paperless library.

RELATED WORKS

This research to some extent reviews current, relevant and related literature in order to have more knowledge and guidance on the topic under investigation. The literature is

reviewed in line with the stated objectives and problem statement, thus shedding more light on the trend of the topic under investigation.

The Needs for Technology Integration in Library Service

Population growth and demands for easy accessibility of services across the world point to a serious signal toward the need for a way out. Technology is defined as the application of scientific know-how in solving and simplifying a problem (Martinuzzi et al., 2007). Technology has been identified as the tool that aims at improving efficiency, reducing cost implications and minimising time-consumption when compared with the manual approach to doing things (González-pérez & Ramírez-montoya, 2022). This therefore implies that technology should be the best alternative in this 21st-century. For instance, Olukayode et al., (2022) affirmed that for libraries to be effective and efficient in discharging their duties nowadays, integrating technology is necessary. Likewise Kalu and Ochepa, (2021) acknowledged that the acquisition of library information resources become simpler and easier as a result of technological advancement and integration in libraries. Moreover Idahosa and Eireyi-Edewede, (2023) asserts that many libraries nowadays want to utilize technology in their services due to information availability in many forms which resulted in information overload. Therefore, without integrating modern technology such as cloud computing, artificial intelligence, data mining, big data analytics, robotic technology, cyber security mechanisms and many more, the actualization of paperless library may be difficult and inefficient. Advanced countries' libraries in the 21st century have embraced a range of innovative technologies to meet the evolving needs of their users, enhance operational efficiency, and expand their role as community hubs for learning and engagement (Yakubu et al., 2023). These technologies, including cloud computing, artificial intelligence, Internet of Things, blockchain technology, 5G technology and big data analytics, have been instrumental in enabling libraries to streamline operations, improve resource accessibility, and enhance user engagement. Additionally, Sambo and Oyovwe-Tinuoye, (2023) reiterated that technologies such as cloud computing, artificial intelligence, the Internet of Things, big data analytics, robotic technology and blockchain technology are at the forefront of this time transition. For instance, various studies have affirmed that these 21st-century technologies have not only enhanced the functionality of libraries but also enable them to cater for the diverse needs of users in an increasingly digital society.

Moreover, the information needs of users nowadays also contribute to the need for integrating modern technology into library services, for instance (Yakubu et al., 2023) stated that many library users prepare to access library collections through electronic means rather than visiting the library physically. Tella and Odunola, (2021) asserted that electronic library materials are the most accessed materials when compared with the hard copies arranged on the shelves, this however looks simpler and more accessible from anywhere and anytime by the library patrons. Findings also revealed that the majority of library users use digital devices to solve their information needs rather than visiting the library to consult physical materials (Ajani et al., 2022; Kayode et al., 2020). This therefore highlights how important it is for libraries to integrate m21st-century technologies in their library in order to enhance service that will meet the demands of their patrons.

The Roles of Some Selected 21st-Century Technologies in the Library

The Libraries have been transforming with the advent of technology, reshaping their services, resources, and interactions with patrons. Digitalization has enabled libraries to convert physical materials into electronic formats, making them more accessible to a global audience (Ifijeh, 2014). According to Anna and Mannan, (2020), digital libraries have improved access to information, especially for

remote users, while reducing physical storage requirements. Likewise, Ogwo et al., (2020) highlight the role of digitization in preserving rare manuscripts and archival materials, ensuring their availability for future generations.

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are designed to think, learn, and act like humans (Dahri et al., 2024). AI has been pivotal in automating processes, enhancing user experiences, and supporting decision-making. Tiwari et al., (2023) discussed how AI-powered chatbots, provide 24/7 assistance, improving patron support without increasing staff workload. Additionally, Ajani et al., (2022) and Bakrin et al., (2020) highlighted how AI improve cataloguing services, where predictive tools help classify and recommend materials based on user preferences. To this extent, it is hypotheses that:

H1: *Artificial intelligence will positively influences the actualization of paperless library*

Cloud computing refers to the delivery of computing services-such as servers, storage, databases, networking, software, and analytics-over the internet ("the cloud") (Bakrin et al., 2020). Cloud technologies have transformed libraries by providing scalable storage, collaborative tools, and remote access to resources. Telukdarie and Shisane, (2018) emphasized the role of cloud-based Integrated Library Systems (ILS) in facilitating inter-library collaborations and reducing operational costs. Tella et al., (2020) noted that cloud storage ensures data security, enabling libraries to handle large-scale digital collections efficiently. Mobile technology has enhanced accessibility and user engagement, making library services available at users' fingertips. Chan et al., (2022) also revealed that mobile applications enable users to search catalogues, reserve materials, and receive personalized notifications. Riad et al., (2020) highlighted the role of mobile-responsive websites in ensuring seamless access to library resources on smartphones and tablets. To this extent, it is hypotheses that:

H2: *Cloud computing will positively influences the actualization of paperless library.*

Internet of Things (IoT) refers to a network of interconnected physical devices, vehicles, appliances, and other objects embedded with sensors, software, and connectivity that enable them to collect, exchange, and act on data over the Internet (Kumar et al., 2022). IoT technologies are enabling "smart libraries" by integrating connected devices to streamline operations and enhance the user experience. Masenya and Chisita (2022) describe how IoT sensors improve inventory management by tracking books and other materials in real time. To this extent, it is hypotheses that:

H4: *Internet of Things will positively influences the actualization of paperless library.*

Big Data Analytics refers to the process of examining large, complex datasets (known as "big data") to uncover hidden patterns, correlations, trends, and insights (Anna & Mannan, 2020). These insights help libraries make data-driven decisions, optimize processes, and innovate in various fields (Kairigo, 2019). Similarly, Big data analytics enables libraries to gain insights into user behaviour, optimize collections, and improve decision-making (Kairigo, 2019). Tella, (2021) explained how libraries analyse user data to predict trends and develop user-centric services. Again, Anna and Mannan, (2020) emphasized the role of analytics in evaluating resource usage and guiding budget allocation. To this extent, it is hypotheses that:

H3: *Big data analytic will positively influences the actualization of paperless library.*

Robotics technology involves the design, construction, operation, and use of robots — automated machines capable of performing tasks traditionally carried out by humans

(Owolabi et al., 2022). Moreover, robotics integrates various fields such as mechanical engineering, electronics, computer science, and artificial intelligence (AI) to create intelligent systems capable of interacting with their environment (Hayani et al., 2021). In line with the aforementioned, Sambo and Oyovwe-Tinuoye, (2023) stated that robotics is revolutionizing industries and daily life, bridging the gap between humans and machines to create a more automated and efficient world. Additionally, robotics technology is transforming library services by automating repetitive tasks, enhancing user experience, and improving operational efficiency (Tella & Odunola, 2021). It is still believed that robots handle the sorting and reshelving of returned books thereby freeing librarians to focus on user engagement and specialized tasks (Sambo & Oyovwe-Tinuoye, 2023). To this extent, it is hypotheses that:

H5: *Robotic technology will positively influences the actualization of paperless library.*

Blockchain technology is a decentralized, distributed ledger system that records transactions across multiple computers in a secure, transparent, and tamper-resistant manner (Kamble et al., 2019). It eliminates the need for a central authority by allowing participants in a network to agree on the state of the ledger through a consensus mechanism. Unlike traditional systems where a central entity controls data, blockchain distributes data across multiple nodes (computers) in the network (Masenya & Chisita, 2022). Blockchain offers the potential for secure record-keeping and decentralized management of library resources (Gui et al., 2021). Masenya and Chisita, (2022) examined the roles of blockchain in creating tamper - proof records of borrowing history and resource usage. Their findings revealed that the borrowing system is significantly improved and provide more convinient service delivery that before. Furthermore, Deepa et al., (2022) highlighted the roles of blockchain in decentralizing digital rights management for e-resources, their findings revealed that with the use of block technology, more vasitle service is achieved all the services is centralized. To this extent, it is hypotheses that:

H6: *Blockchain technology will positively influences the actualization of paperless library.*

5G provides ultra-fast internet connectivity, allowing users to download large files, stream high-definition videos, and access online resources instantly (Arooj et al., 2020). Additionally, Ram et al., (2023) acknowledge that accessing e-books, research articles, and multimedia resources without delays is very possible when 5G is used in libraries. By adopting 5G technology, libraries can transform into dynamic, tech-driven hubs of learning, collaboration, and innovation, meeting the needs of the digital age (Muhammad, 2021). To this extent, it is hypotheses that:

H7: *5G technology will positively influences the actualization of paperless library*.

The adoption of 21st-century technologies has revolutionized libraries, enabling them to remain relevant in a rapidly changing information landscape. These technologies have expanded access, improved efficiency, and enhanced user experiences. Therefore, this research summarises the following hypotheses as follows:

H1: Artificial intelligence will positively influence the actualization of paperless library.

H2: Cloud computing will positively influence the actualization of paperless library.

H3: Internet of Things will positively influence the actualization of paperless library.

H4: Big data analytics will positively influence the actualization of paperless library.

H5: Robotic technology will positively influence the actualization of paperless library.

H6: Blockchain technology will positively influences the actualization of paperless library'.

H7: 5G technology positively will influences the actualization of paperless library.

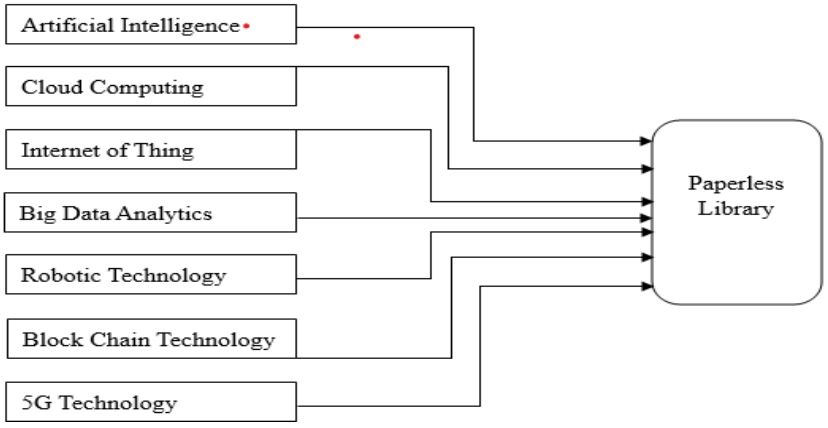

Figure 1. Conceptual Framework.

METHODOLOGY

A survey design is adopted for this research. This design enables the collection of information from a pool of respondents by asking multiple survey questions. The total population for this research is 107 librarians drawn from 2 selected federal universities which include Abubakar Tafawa Balewa University (ATBU), Bauchi and Modibbo Adama University (MAU), Yola. The reason for selecting these two universities is that they are part of the second-generation universities in North-eastern Nigeria and they have more experience in technology compared to many other universities in the region. Total enumeration is used in drawing the population sample of the research. This is because the population is not much and can be managed by this research. 107 professionals and paraprofessionals librarians are considered as the respondents of the research and out of the 107 questionnaires distributed to the respondents, only 98 are returned and found usable representing 91 percent (91%).

The instrument for data collection is a questionnaire, which is developed using previously used scales and then administered to the respondents in the selected libraries after obtaining permission from the library authorities. Furthermore, 52 valid questionnaires representing 50.96% were obtained from ATAB Bauchi while 46 represented by 49.04% were obtained from MAU Yola. The administration and retrieval of the questionnaires take 2 weeks. Furthermore, the Special Package for Social Sciences (SPSS) is used for both descriptive and inferential statistics. For descriptive statistics, frequency count, mean, standard deviation and percentages are used to analyse the results. For inferential statistics, regression analysis is used where measurement and structural model evaluation are considered. Finally, the results are presented in tabular and graphical representation.

RESULTS AND DISCUSSION

Descriptive Analysis

Results

Table 1. Demographic Variable of Respondent Results.

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	62	64.72
	female	36	35.28
Rank	Deputy librarian	8	8.17
	Principal librarian	14	14.28
	senior librarian	26	26.54
	Librarian 1	27	27.55
	Assistant Librarian	13	13.26
	others	10	10.20
Years of experience	1 – 5	21	21.43
	5 – 10	26	26.53
	11 – 15	33	33.67
	16 and above	18	18.37

Demographic variables of this research demonstrate the characteristics of respondents which clearly tell the reader the type of respondents involved in this research. Male respondents constituted the majority while their female counterparts constituted the minority as represented by 62 and 36 respectively. This is in line with the findings of Yakubu et al., (2023) who equally found that the majority of librarians in their study were male. In terms of rank, 8 respondents are Deputy Librarians, 14 respondents are Principal librarians, 26 respondents are Senior librarians, 27 respondents are librarians 1 & 2, 13 respondents are Assistant librarians and 10 respondents form other categories of rank in the library. This signifies that the majority of respondents are librarians 1 & 2, followed by Senior librarians and Principal librarians. While the minority are Deputy Librarians followed by other ranks and then the Assistant librarians. Similarly, respondents with 11 – 15 years of experience are 26, followed by those who had 5 – 10 years of experience which are 26, then those who have 1 – 5 years of experience are 21 and finally, those who have 16 and above years of experience are 18 which equally constituted the minority.

Table 2. Research: Question 1. What is the librarian perception on the need to integrate modern technology in library for actualization of paperless library?

Question	SA	AG	UD	DA	SD
Actualization of paperless library needs modern technology integration	49 (50%)	36 (36.7%)	5 (5.1%)	6 (6.1%)	3 (3.06%)

Note: S A: Strongly Agree, A G: Agree, U D: Undecided, D A: Disagree and S D = Strongly Disagree

This research has investigated the need for technology integration in library services. Results from the respondents revealed that there is a high need for technology integration in the library. 49 respondents strongly agree that there is a serious need to integrate technology in library services, followed by 36 respondents who equally agree that integration of technology in the library is

needed. While a minority of them represented by 6 and 3 respondents agree and disagree that technology integration in the library is needed. From a forgoing, it is evident that technology integration in library service is needed as portrayed by the majority of respondents. To this extent, this finding address research question 1.

Inferential Analysis

Normality

According to Hair et al., (2019) normality refers to the - shape of data distribution for an individual metric variable and its correspondence to the normal distribution. One of the ways to trace the normality assumptions is by observing histogram residual plots. For the normality assumptions to be satisfied, the distribution of the plot needs to appear normally distributed. Figure 2 presented the graphical normality test of the study variables using skewness and kurtosis values. Mishra et al., (2019)maintained that normality can be checked by observing the histograms of the standardized residuals. Therefore, from the study histogram, the residuals histogram shows a fairly normal distribution. Thus, based on this result, the normality of the residuals assumption is satisfied. So, there is no significant violation of this basic assumption.

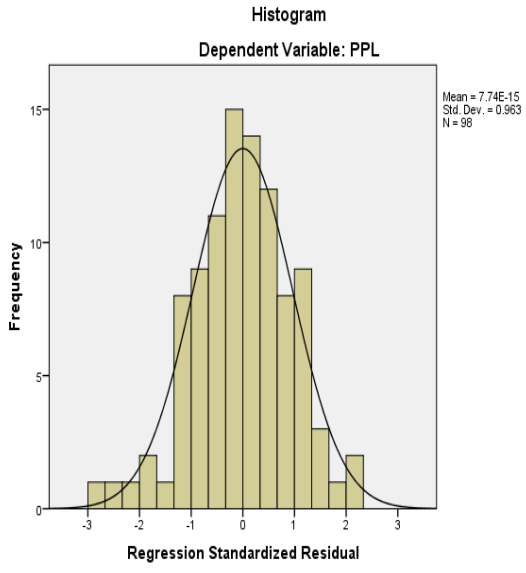

Figure 2. Multicollinearity.

Multicollinearity is another assumption of multiple regression which requires the attention of the researcher. Multicollinearity occurs when a researcher has two or more indigenous variables that are closely correlated with each other (Pallant, 2011). This situation mostly creates confusion and leads to problems with regard to clearly understanding which indigenous variable contributes to the variance explained in the exogenous variable. Furthermore, variance inflation factor (VIF) and tolerance value are also identified as major scientific methods used to check and trace multicollinearity. The researcher also used these methods and found that multicollinearity does not exist as VIF values are all less than 10 and tolerance values are more than 0.01. Leguina, (2015)acknowledged that it is generally believed that any VIF above 10 and tolerance value below 0.10 indicates a potential problem of multicollinearity. Table 3 shows the Tolerance and VIF values for indigenous variables of his study.

Table 3. Variance Inflation Factor (VIF) and Tolerance Value

Variables	Tolerance	VIF
AI	0.944	1.059
CLC	0.905	1.105
IoT	0.759	1.317
BDA	0.932	1.073
RT	0.849	1.179
BCT	0.833	1.201
FG	0.881	1.135

Note: AI = Artificial intelligence, BDA = Big data analytics, CLC = Cloud computing, RB = Robotic technology, IoT = Internet of thing, BCT = Blockchain technology, FG = 5G technology and PPL = Paperless library.

Reliability and Validity Tests

Reliability and validity of this research constructs are accessed using factor loadings and Cronbach alpha. Convergent validity measures the degree to which an item is positively correlated with an alternative item of the same construct (Hair et al., 2014). To assess the convergent validity of this study construct, indicators' outer loadings are carefully examined as suggested by (Hair et al., 2017). The size of the indicator outer loading should be 0.708 and above for it to be statistically significant and satisfy the requirements. This study analysis revealed that most of the constructs have their indicator outer

loadings above 0.708 indicating the attainment of minimum requirement. Similarly, the Cronbach alpha values of all the constructs attain the value of 0.7 and above which is the threshold recommended by (Hair et al., 2014; Henseler et al., 2015). Table 4 presents the results of Cronbach alpha and factor loadings.

Table 4. Factor Loadings and Cronbach Alpha Values for Reliability and Validity Tests.

Constructs	Indicators	Loadings	Cronbach Alpha
AI	AI1	0.786	0.681
	AI2	0.848	
	AI3	0.919	
	AI4	0.919	
	AI5	0.809	
CLC	CLC1	0.770	0.692
	CLC2	0.857	
	CLC3	0.935	
	CLC4	0.935	
	CLC5	0.870	
IoT	IoT1	0.989	0.814
	IoT2	0.712	
	IoT3	0.763	
	IoT4	0.721	
	IoT5	0.794	
BDA	BDA1	0.705	0.797
	BDA2	0.812	
	BDA3	0.727	
	BDA4	0.899	
	BDA5	0.799	
RT	RT1	0.881	0.731
	RT2	0.773	
	RT3	0.837	
	RT4	0.786	
	RT5	0.762	
BCT	BCT1	0.782	0.735
	BCT2	0.943	
	BCT3	0.961	
	BCT4	0.708	
	BCT5	0.961	
FG	FG1	0.881	0.776
	FG2	0.799	
	FG3	0.793	

	FG4	0.851	
	FG5	0.781	
PPL	PPL1	0.744	0.607
	PPL2	0.852	
	PPL3	0.711	
	PPL4	0.710	
	PPL5	0.719	

Note: AI = Artificial intelligence, BDA = Big data analytics, CLC = Cloud computing, RB = Robotic technology, IoT = Internet of thing, BCT = Blockchain technology, FG = 5G technology and PPL = Paperless library

Multiple Regression

(a) Model Evaluation

The first table of interest here is the model summary Table. This Table provides the R, R^2, adjusted R^2 and the standard error of the estimate, which can be used to determine how well a regression model fits the data. R-square is also known as the coefficient of determination (Hair et al., 2019). The coefficient of determination which tries to explain the contributions of all exogenous variables to the endogenous variable is carefully examined in this study. The analysis here revealed that the seven indigenous variables (Artificial Intelligence, Big data analytics, Cloud computing, Robotic technology, Internet of things, Blockchain technology and 5G technology) explained 0.737 variance in the endogenous variable (Paperless library). Meaning, 73.7% variances in the endogenous variable have been explained by the exogenous variables. The rule of thumb given by (Chin, 1998; Hair et al., 2011; Henseler et al., 2009) propounded that the R^2 value of 0.75, 0.50 and 0.25 are considered as high, moderate and weak respectively. Therefore, the R^2 value of 0.737 revealed in this study is high and adequate. Table 5 presents the R^2 values for this study.

Table 5. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.859[a]	.737	.717	.51207
a. *Predictors: (Constant), FG, AI, BDA, CLC, BCT, RT, IoT*				

Table 6 is Analysis of Varia nce (ANOVA), which tests whether the overall regression model is a good fit for the data. The table shows that the indigenous variables significantly predicted the exogenous variable (paperless library), which is a clear indication that the regression model is a good fit for the data. This can be proved by having F-value of 36.087; meaning that the F- test is statistically significant, thus we assumed that there is a linear relationship between the variables in the model under study.

Table 6. Analysis of Variance (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	66.240	7	9.463	36.087	0.000[b]
	Residual	23.600	90	0.262		
	Total	89.840	97			

a. Dependent (exogenous) Variable: PPL

b. Predictors: (Constant - Indigenous), FG, AI, BDA, CLC, BCT, RT, IoT

(b) Hypothesis Testing and Indigenous Variables' Evaluation

Based on the R^2 value in Table 5, it has been known that the variables jointly explained a 73.7% variance in paperless library actualization. The next stage is to evaluate the individual indigenous variables using the t value, P value and beta value to find out the effect of each of them. Therefore, both t values, P values and beta values are evaluated. Based on the t and P values, 5 indigenous variables (AI - Artificial intelligence, CLC - Cloud computing, RT - Robotic technology, IoT - Internet of thing, and BCT - Blockchain technology) are statistically significant while 2 are not statistically significant (FG- 5G technology and BDA- big data analytics). (Hair et al., 2017) stated that for a variable to be statistically significant, its t values must be 1.65 and above using one-tailed and 1.96 and above using two-tailed. Similarly, its P values must be equal to or less than 0.05 (<= 0.05). This therefore signifies that those 5 hypotheses (H1, H2, H3, H5 and H6) are accepted since their t values are all above 1.65 and P values are less than or equal to 0.05; while the two hypotheses (H4 and H7) are rejected since their t values are less than 1.65 and P values are greater than 0.05.

Apart from examining the statistical significance of the variables, individual Indigenous variables' contributions (beta values) are also examined in order to find the extent to which each of them contributes to the exogenous variable. Based on the beta value results, each of the indigenous variables contributes to the actualization of the paperless library. Table 7 presents the t values, P values and beta values.

Table 7. Coefficients' Table Showing the T Values, P Values and Beta Values.

Model		Unstandardized Coefficients		Standardized Coefficients	t values	Sig. P values	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-1.035	0.432		-2.396	0.019		
	AI	0.170	0.051	0.187	3.366	0.001	0.944	1.059
	CLC	.098	0.048	0.117	2.057	0.043	0.905	1.105
	IoT	0.369	0.053	0.429	6.922	0.000	0.759	1.317
	BDA	0.035	0.043	0.045	0.807	0.422	0.932	1.073
	RT	0.267	0.047	0.336	5.729	0.000	0.849	1.179
	BCT	0.241	0.050	0.284	4.803	0.000	0.833	1.201
	FG	0.002	0.041	0.003	0.054	0.957	0.881	1.135

a. Dependent (exogenous) Variable: PPL.

Note: AI = Artificial intelligence, BDA = Big data analytics, CLC = Cloud computing, RB = Robotic technology, IoT = Internet of thing, BCT = Blockchain technology, FG = 5G technology and PPL = Paperless library.

Research question 2: What is the influence of modern technologies in actualization of a paperless library?

This research question aims to find the influence of modern technologies on the actualization of paperless library. Hypothesis testing between the selected modern technologies and actualization of paperless library revealed that Artificial intelligence, Cloud computing, Internet of Things, Robotic technology and Blockchain technology have positive significance influence on the actualization of paperless library. This signifies that they play important roles in actualization of the paperless library, thus the need to give them serious priority when making paperless library is necessary.

On the other hand, Big data analytics and 5g technology did not significantly influence the actualization of paperless library, indicating that they are less relevant. To this extent, this finding address research question 2.

DISCUSSION OF FINDINGS

Based on the findings of this research, discussions in line with the previous findings are presented.

H1: which hypothesizes that artificial intelligence positively influences the actualization of the paperless library is found to be statistically significant by having a t value of 3.336, P value of 0.001 and beta value of 0.817, thus providing an 18.7% contribution to the actualization of paperless library. This finding implies that by integrating artificial intelligence in libraries, the realization of a paperless library will be achieved. Wheatley and Hervieux, (2019) found that artificial intelligence plays role in modernizing libraries by making daily routines smarter and smoother. Likewise Alam et al., (2024) emphasized that the deployment of artificial intelligence is making the libraries to be physically smaller but bigger in delivering service to users. However, Farrokhnia et al., (2023) criticizes the use of artificial intelligence in library services claiming that the services must not necessarily be accurate and correct compared to human operations in the library.

H2: which hypothesizes that cloud computing positively influences the actualization of the paperless library is found to be statistically significant by having a t value of 2.057, P value of 0.043 and beta value of 0.117, thus providing a contribution of 11.7% toward the actualization of paperless library. A study by Yakubu et al., (2023) revealed that cloud computing improves the efficient services of the libraries by making it more robust and less congested as many users can access the libraries through cloud-based services. Similarly Yakubu et al., (2024) emphasized that the deployment of cloud computing makes library collections to be more electronic resources than papers as the majority of the collections are stored electronically in cloud-based storage. However, a study by Salamh et al., (2018) revealed that cloud computing is less relevant in delivering better services in libraries as some users are still afraid of modern technology and some libraries are not willing to store their collections with cloud service providers.

H3: which hypothesizes that the Internet of things positively influences the actualization of the paperless library is found to be statistically significant by having a t value of 6.922, P value of 0.000 and beta value of 0.429 thus providing a 42.9% contribution to the actualization of the paperless library. Previous studies found that the internet of things significantly avoids the use of too many hardcopies of library collections by making the majority of the collections electronic thereby fostering the initiation of the paperless library (Masenya & Chisita, 2022; Yusuf et al., 2019). Moreover, Yin et al., (2020) revealed that the internet of things changes all humanly related activities to be internet aligns, which equally makes library services and operations more of internet-based, thus ensuring less use of papers and encouraging more use of electronic resources. However, other studies such as (Razaque et al., 2022) found that the internet of things is less relevant in modernizing libraries and can have an insignificant effect on the actualization of paperless libraries.

H5: Which hypothesizes that robotic technology positively influences the actualization of paperless libraries is found to be statistically significant by having a t value of 5.729, P value of 0.000 and beta value of 0.336 thus providing a 33.6% contribution to the actualization of paperless library. This implies that employing robotic technology will have a significant role to play in the actualization of a paperless library. It has been revealed that robotic technology plays a role in ensuring maximal library services are attained through virtual means which entails less paperwork and much electronic means of work (Owolabi et al., 2022). Similarly Sambo and Oyovwe-Tinuoye, (2023) found that robotic technology helps in minimizing the involvement of humans in carrying out library many library housekeeping operations thereby supporting the modernization of the library service that aims at ensuring virtual library structure. Contrarily, other studies which include that of Hayani et al., (2021) revealed that robotic technology does not support library service as certain errors are realized due to technical faults by the robotic machines.

H6: Blockchain technology is found to be positively related to the actualization of the paperless library by having a t value of 4.803, P value of 0.000 and beta value of 2.084, thus supporting the proposed hypothesis. This implies that integrating blockchain technology in library system will burst the library services toward being paperless since many of the library activities will be electronically related rather than manually related. Masenya and Chisita, (2022) revealed that once blockchain technology is integrated into library operation a lot of enhancement and efficiency will be achieved thus helping in transforming the operation. Similarly, other findings which include that of Sivankalai, (2021) propounded that paperless libraries need the inclusion of certain technologies such as blockchain technology which aims at ensuring that parallel transactions from users are centrally coordinated. Contrarily, blockchain technology is found to be unsuitable for library operation as it does not fit in some certain library housekeeping operations as revealed by (Masenya & Chisita, 2022).

H4: found that big data analytics which recorded a t value of 0.807, P value of 0.422 and beta value of 0.045 thus contributing 4.5% toward the actualization of the paperless library has an insignificant influence on the actualization of the paperless library. This implies that big data analytics will not support the realization of a paperless library. This finding supports other findings such as Hussain and Shahid, (2022) which equally argued that big data analytics are not suitable for library operations, especially in an African context where many libraries are still battling with the manual way of delivering services. However other studies such as Aliyu et al., (2023) agreed that big data analytics is important and can actualize a paperless library since it ensures the management and maintenance of a large volume of information resources in the library and nowadays many library collections are in electronic format. Possible reasons for the big data analytics to be insignificant in the actualization of paperless libraries is that many libraries in Nigeria have not subscribed to the world's best databases and thus have less collection at their disposal.

H7: revealed that 5G technology which recorded a t value of 0.054, P value of 0.957 and a beta value of 0.003 indicating the contribution of only 0.03% has an insignificant influence on the actualization of the paperless library, signifying that the 5G technology will not encourage the realization of the paperless library. This finding is in line with the finding of Arooj et al., (2020) who equally found that 5G technology is less important in many fields that may include libraries, especially in an African context where their collections is not as large as those of advanced countries. However other studies Arlitsch and Newell, (2017) found that with the inclusion of 5G technology library services have been enhanced and helped toward ensuring more digitized library services that are more electronic than manual which entails much physical paperwork. Possible reasons why 5G technology will not influence the actualization of paperless libraries is that, looking at the collections of many libraries in Nigeria, even 4G and 3G internet technology will be adequate to ensure smooth paperless libraries where collections will be accessed and uploaded electronically.

CONCLUSION

The 21st century has brought about a paradigm shift in library services, driven by the integration of emerging technologies. Libraries are no longer just repositories of books but dynamic hubs of digital innovation, providing diverse services to meet the evolving needs of their users. This research explores key technologies that can transform library services, focusing on their applications to turn library services into more paperless. Future research should focus on sustainable implementation strategies and the long-term impacts of these technologies on library services and user engagement.

RECOMMENDATIONS

Based on the findings of this research, it is recommended that libraries should engage the examined technologies in their operation in order to modernize their services to be more paperless than physical papers. Additionally, it is

recommended that the government should enact laws that can provide backup for the use of such examined technologies. Moreover, it is recommended that technology manufacturers should simplify the operational needs of their technologies so that all categories of users find it easy to use.

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