African Journal of Social and Behavioural Sciences (AJSBS)
Volume 14, Number 8 (2024) ISSN: 2141-209X

ENHANCING THE ADOPTION OF ICT IN TEACHING AND LEARNING: EXPLORING KEY FACTORS IN NIGERIAN UNIVERSITIES

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ABSTRACT: This study investigates the factors influencing the successful adoption of Information and Communication Technology (ICT) in teaching and learning at Nigerian universities. Using Partial Least Square-Structural Equation Modelling (PLS-SEM), we analysed data from 3,218 respondents across 12 Nigerian universities to examine the relationship between key constructs—such as attitude, infrastructure, ICT training, usage, professional development, and quality of ICT resources—and ICT adoption. The results reveal that a positive attitude toward ICT, its active usage, and the quality of technological resources significantly impact successful ICT adoption, with beta values of 0.076, 0.422, and 0.046, respectively. However, organisational factors such as infrastructure, ICT training, and professional development were not found to be significant contributors. These findings underscore the importance of fostering a positive attitude, enhancing ICT engagement, and ensuring the availability of high-quality technological resources to drive successful ICT adoption in Nigerian higher education. The study concludes that while technical factors are critical, further research is needed to explore how organisational support can be improved to bolster the adoption process.

Keywords: ICT Adoption, PLS-SEM, Nigerian Universities, Technological Resources, Organisational Support, Higher Education.

INTRODUCTION

In today's fast-paced technological landscape, the integration of Information and Communications Technology (ICT) into education has become essential. Governments around the world recognise the importance of investing in technology to enhance educational systems (Palvia et al., 2021). This study explores the key drivers behind the successful adoption of ICT in teaching and learning. Additionally, it presents a conceptual framework that considers critical factors influencing the acceptance and use of ICT.

The framework aims to offer valuable insights to policymakers, helping them identify the factors that encourage educators to adopt ICT in their teaching practices. By effectively integrating ICT, teaching methodologies can be transformed, student engagement enhanced, and dynamic learning environments cultivated. Understanding the motivators and barriers to ICT adoption is crucial for developing strategies and policies that foster a technology-driven educational ecosystem.

Moreover, this study examines the challenges students and educators in Nigerian universities faced during the COVID-19 pandemic. Many students lacked reliable internet access and

necessary technological resources, limiting their participation in digital learning. Addressing these issues is essential for ensuring equitable access to digital learning opportunities.

By identifying these motivators and barriers, this research contributes to the development of strategies that address infrastructure gaps and bridge the digital divide. With reliable internet, access to technology, and supportive policies, Nigerian universities can create an inclusive learning environment that maximises the potential of ICT. This will empower students with the digital skills needed to thrive in a technology-driven society.

The findings of this study aim to offer valuable recommendations for enhancing technology-enabled education in Nigerian universities, emphasising the role of technological advancements as a catalyst for educational growth and transformation.

Objectives of the Study

The primary objective of this study is to develop a model for the successful adoption of ICT by linking two factors—technological and organisational—and assessing their impact on ICT adoption in Nigerian universities. Specifically, the study aims to:

1. Assess the impact of technological factors on the successful adoption of ICT in teaching and learning.
2. Determine the influence of organisational factors on the adoption of ICT in Nigerian universities.
3. Identify the challenges faced by students and educators during the COVID-19 pandemic.

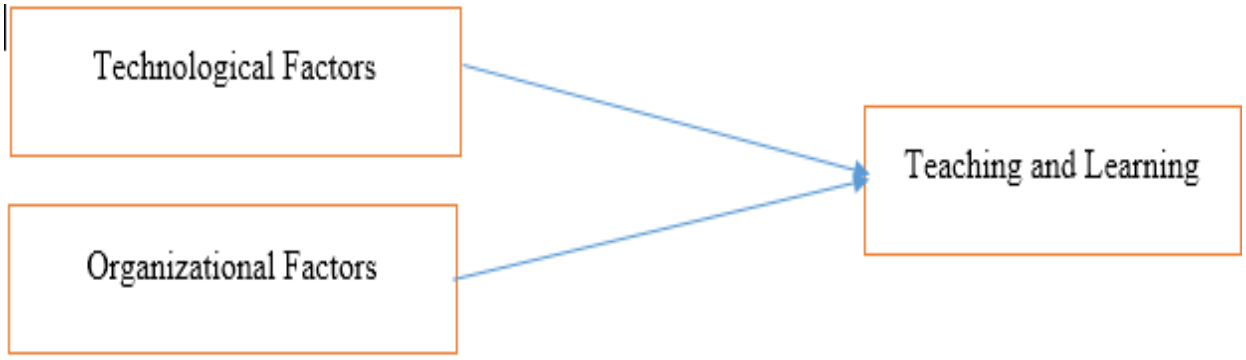

Fig. 1: Research Conceptual Framework

LITERATURE REVIEW

The integration of ICT in education has evolved significantly over time. Prior to 1979, computers were primarily used in higher education institutions. However, with the advent of microcomputers, their adoption expanded across governmental and commercial institutions. In the mid-1990s, ICT integration in schools grew rapidly in industrialised nations, transforming traditional teaching and learning methods (Sultana & Shahabul, 2018).

Both developed and emerging economies now recognise the importance of ICT as a driver of national development (Buabeng-Andoh & Issifu, 2015). In these countries, technology is no longer a novelty but an integral part of education. This has made the adoption of ICT imperative to stay current with global educational advancements.

Over the past two decades, ICT has transformed how organisations, including educational institutions, operate (Agarwal et al., 2021). Traditionally, education thrived on direct communication between teachers and students. However, ICT has expanded learning options, creating new possibilities for both students and educators. The role of ICT in education is expected to continue evolving, driving further improvements in teaching and learning processes.

To further understand the impact of ICT in education, this study will conduct a quantitative analysis using primary data collected via questionnaires. Advanced statistical tools, such as SmartPLS 4, were used to evaluate the data, allowing for a robust analysis of the research questions. The findings will help identify opportunities and challenges in ICT adoption, inform policy, and enhance educational practices.

METHODOLOGY

This study will focus on federal and state universities in Nigeria's Northeast region, specifically Borno, Yobe, Adamawa, Taraba, Bauchi, and Gombe. It will employ a quantitative approach, using questionnaires as the primary data collection tool. The Likert scale, ranging from "Strongly Disagree" (1) to "Strongly Agree" (5), will be used to measure respondents' perceptions and attitudes toward ICT adoption.

Structural Equation Modelling (SEM) will be utilised to analyse the relationships between variables, with SmartPLS 4 employed for statistical analysis. By examining the current state of ICT adoption, this study aims to provide insights into the factors influencing ICT integration in teaching and learning and offer recommendations for policy and practice improvement.

This quantitative approach aims to generate empirical evidence about the state of ICT adoption in North-East Nigerian universities. The results will inform strategies to enhance the effective utilisation of ICT in higher education institutions.

RESULT AND DISCUSSION

Data Analysis and Findings

We conducted data analysis using SPSS and PLS-SEM (v.4.0.8), applying Partial Least Squares-Structural Equation Modelling (PLS-SEM) to examine the relationships between independent and dependent variables. SEM is widely used in social sciences for its ability to model complex relationships between constructs (Hair et al., 2018). This approach allows for the simultaneous evaluation of multiple variables and their causal relationships. SEM is recognised for providing in-depth and precise analysis, particularly in studies involving latent constructs (Tarka, 2018).

Table 1: Demographic Data

S/N	Demographic Variables	Scale	Frequency	Percent
1	Gender	Male	1928	59.9
		Female	1290	40.1
		Total	3218	100
2	Age	Under 20	366	11.4
		20-29	1048	32.6
		30-39	948	29.5
		40-49	856	26.6
		Total	3218	100
3	Program	Undergraduate (UG)	1963	61
		Postgraduate (PG)	1255	39
		Total	3218	100
4	University Affiliation	University of Maiduguri	1128	35.1
		Taraba State University, Jalingo	377	11.7
		Adamawa State University, Mubi	372	11.6
		Other universities	Various	~42%
		Total	3218	100

Source: Field Survey

The demographic data highlights that the majority of participants were male (59.9%) and aged 20-29 (32.6%). Undergraduates constituted 61% of the sample, while postgraduates made up 39%. The University of Maiduguri had the largest representation (35.1%).

Assessing Model Fit

We evaluated the model's internal consistency, indicator reliability, and convergent validity using Composite Reliability (CR) and Average Variance Extracted (AVE). All constructs had CR values between 0.723 and 0.839, which exceeds the recommended threshold of 0.60 (Hair et al., 2019). The AVE values ranged from 0.500 to 0.615, indicating acceptable convergent validity (Gefen et al., 2000).

Cronbach's Alpha values were also satisfactory, with all constructs scoring above 0.60. Discriminant validity was tested using the Fornell-Larcker criterion, ensuring the constructs were distinct.

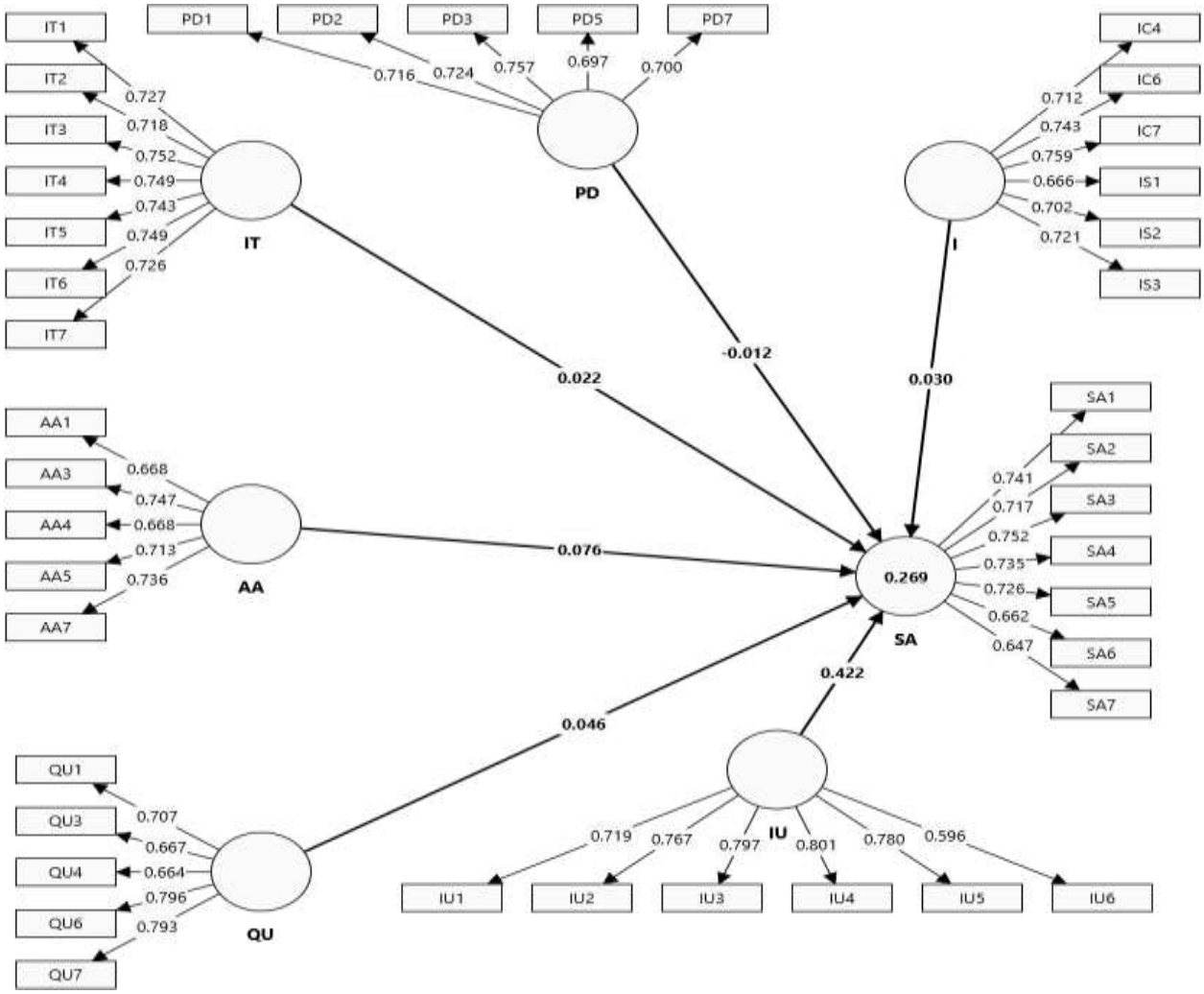

Figure 2: Measurement Model

We evaluated the reliability of the individual indicators through factor loadings. In this way, we found high loadings to be those above 0.60, which is regarded as a meaningful loading (Hair et al., 2018). However, the item did not qualify above the suggested value of 0.60 (Hair et al., 2018). Therefore, the items were excluded from further consideration. The composite reliability of the rest of the constructs was between 0.723 and 0.839, in other words, above the recommended value (0.60) (Gefen et al., 2000; Kline, 2010). Similarly, to gauge an identical measure of constructs, we observed the average variance extracted (AVE) values. We found these values to be between 0.500 and 0.615 for Every construct (>0.50) (Hairetal., 2018). Furthermore, Cronbach's alpha values for all the variables were also satisfactory, as all were above 0.60 (Hair et al., 2018). Consequently, all indicators for convergent validity had satisfactory values using the above parameters

Note: AVE represents Average Variance Extracted; CR represents Composite Reliability; CA represents Cronbach's Alpha. All constructs have a Cronbach's Alpha coefficient above .65. A construct having a Cronbach's Alpha coefficient of less than 0.65 can be ignored for tested data provided. Other constructs in the model have a Cronbach's Alpha coefficient greater than 0.65 (Hair et al., 2019). All constructs met the minimum benchmark for both composite reliability and AVE, respectively. Factor loadings should not be below 0.60 (Hair et al., 2019). All items loaded above 0.65 were retained. Also, the CA and composite reliability of each variable is

above 0.60 and 0.70, respectively, which serves as the minimum threshold for CA and CR. Subsequently, discriminant validity was tested to examine how the items discriminated between constructs (Fornell & Larcker, 1981).

Structural Model and Hypothesis Testing

PLS-SEM was used to analyse the structural relationships between variables. Bootstrapping with 5000 subsamples was performed to test the hypotheses. The results of the hypotheses tests are summarised in Table 2.

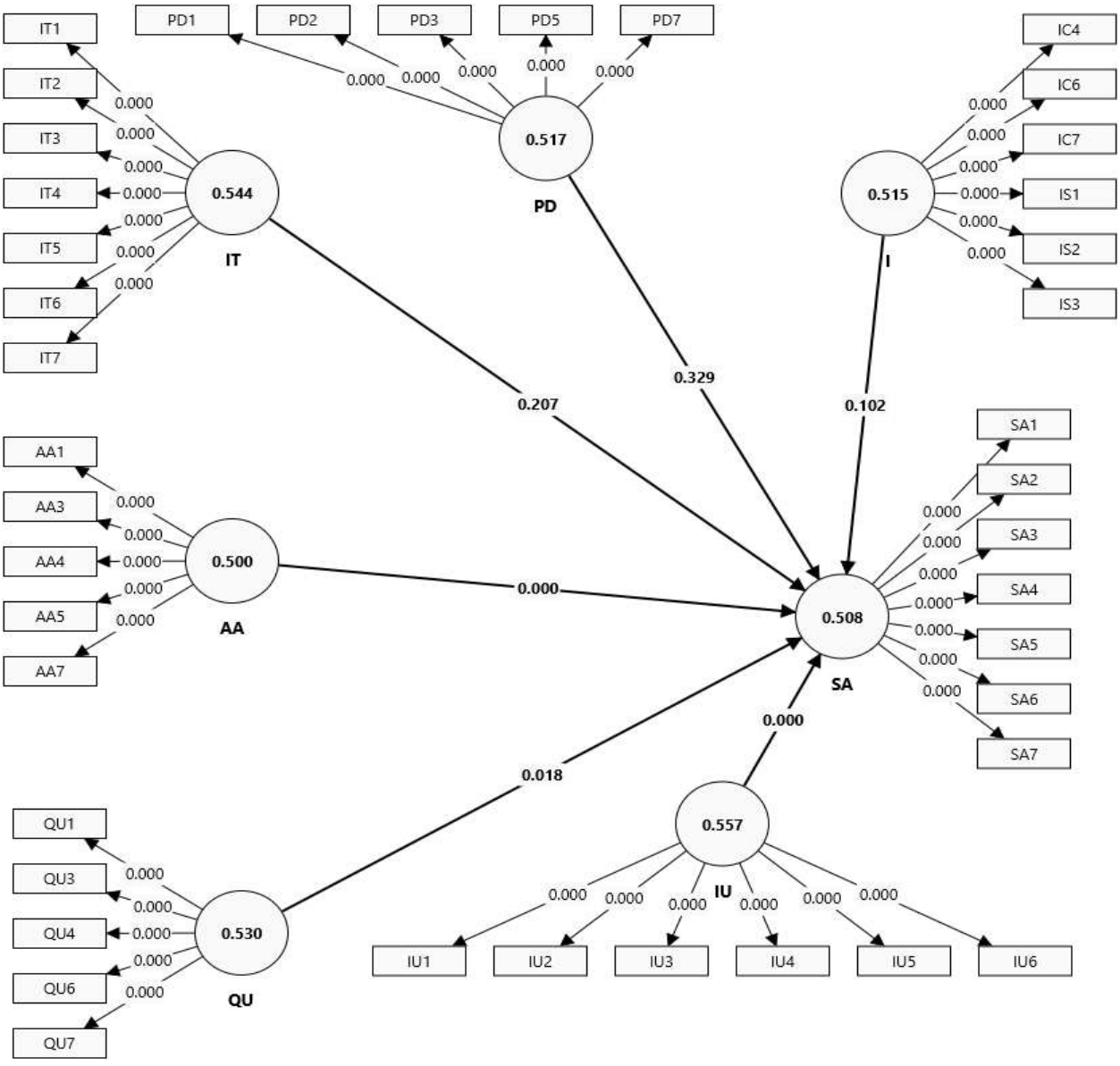

Figure 2: Structural Equation Model

Figure 2 above was used to estimate the path model to view the sampling distribution and determine the standard error and standard deviation of the estimated coefficients distribution in the population.

Table 2: Hypothesis Testing Results

Paths	Beta Value	T statistics	P values	Decision
HO1: AA -> SA	0.076	3.485	0.000	Supported
HO2: I -> SA	0.030	1.271	0.102	Not Supported
HO3: IT -> SA	0.022	0.817	0.207	Not Supported
HO4: IU -> SA	0.422	21.543	0.000	Supported
HO5: PD -> SA	-0.012	0.444	0.329	Not Supported
HO6: QU -> SA	0.046	2.110	0.018	Supported

- **HO1**: Attitude towards Adoption (AA) significantly impacts Successful Adoption (SA) with a positive relationship ($\beta = 0.076$, $p = 0.000$).
- **HO2**: Infrastructure (I) does not significantly affect SA ($p = 0.102$).
- **HO3**: ICT Training (IT) also shows no significant impact on SA ($p = 0.207$).
- **HO4**: ICT Usage (IU) strongly correlates with SA ($\beta = 0.422$, $p = 0.000$).
- **HO5**: Professional Development (PD) shows no significant relationship with SA ($p = 0.329$).
- **HO6**: Quality of ICT (QU) positively influences SA ($\beta = 0.046$, $p = 0.018$).

DISCUSSION OF FINDINGS

The study developed a model that captures the key factors influencing ICT adoption in Nigerian universities. Supported hypotheses—HO1 (Attitude), HO4 (ICT Usage), and HO6 (Quality of ICT)—reveal that these variables play critical roles in the successful adoption of ICT. This suggests that positive attitudes, active usage, and high-quality resources are pivotal for ICT integration in teaching and learning.

Interestingly, organisational factors like Infrastructure, Training, and Professional Development did not significantly influence adoption, indicating that the mere availability of resources is insufficient. Instead, how technology is perceived and utilised by students and educators is more crucial. These findings highlight the need for universities to invest not just in ICT infrastructure but also in fostering positive attitudes and ensuring the quality of ICT tools.

Future research could explore how to enhance organisational support mechanisms to create a more comprehensive ICT adoption framework. Addressing the identified gaps in infrastructure and training could further improve adoption rates.

Conclusions

This study has provided valuable insights into the factors influencing the successful adoption of Information and Communication Technology (ICT) in Nigerian universities. Through the use of Partial Least Square-Structural Equation Modelling (PLS-SEM), we found that individual factors, particularly positive attitudes toward ICT, actual usage, and the quality of available ICT resources, play a significant role in driving adoption. Organisational factors such as infrastructure, ICT training, and professional development, although essential, did not have a significant direct impact on ICT adoption in this study.

The findings suggest that while access to quality technology is important, the attitudes and behaviours of users, along with consistent engagement with ICT, are crucial for successful integration into teaching and learning processes. However, the study also highlights the need for further investigation into how organisational and structural factors can be optimised to support ICT adoption, particularly in resource-constrained environments like Nigerian universities.

Recommendations

1. Enhance User Engagement and Positive Attitude**:** Universities should prioritise fostering positive attitudes toward ICT among both staff and students. This can be achieved through awareness campaigns, success stories, and demonstrations of ICT's benefits in improving educational outcomes.
2. Improve the Quality of ICT Resources**:** Ensuring access to reliable, high-quality technological tools is essential. Universities should invest in upgrading existing ICT infrastructure, focusing on the latest educational technologies that align with modern pedagogical practices.
3. Focus on Practical ICT Usage**:** Rather than solely providing ICT training, universities should encourage consistent, practical use of ICT in teaching and learning. Integrating ICT usage into regular academic activities will reinforce its adoption.
4. Tailored Professional Development**:** Although professional development and training did not significantly affect ICT adoption in this study, it remains essential. Training programs should be tailored to meet the specific needs of academic staff, focusing on practical skills and real-world applications of ICT in education.
5. Strengthen Organizational Support Systems**:** Universities should review their internal policies and structures to provide adequate support for ICT adoption. This includes establishing dedicated ICT support teams and ensuring that faculty members have continuous access to technical assistance.
6. Further Research**:** Given this study's limitations, future research should explore the indirect effects of organisational factors, including infrastructure and policy interventions, to determine how they can better contribute to ICT adoption. Moreover, cross-sectional studies across different regions and types of institutions would provide broader perspectives.

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