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*Original Article*

# Investigating Cloud Computing Adoption: A Case Study of TVET Institutions in Nigeria

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***Abstract*** *- This paper examined the factors that influence the adoption of cloud computing technology among Technical and Vocational Education and Training (TVET) Institutions in Nigeria. Based on Technology Acceptance Model (TAM) 3, the study was carried out through survey questionnaires administered to 250 respondents from some TVET Institutions in Nigeria. Data collected was analyzed using multiple regression analysis, with results showing that the adoption of cloud computing among TVET Institutions is driven by perceived ease of use, perceived usefulness and subjective norm. Perceived ease of use is found to be the most important factor that determines the adoption of cloud computing among TVET Institutions in Nigeria. The finding suggests that the existing and prospective stakeholders of the TVET Institutions should create more awareness about the usefulness, flexibility, users' friendliness and social benefits of cloud computing in order to enhance its adoption. It is also recommended that adequate support for the adoption of cloud computing would foster the delivery of quality academic, administrative and extra-curricular services by TVET Institutions in Nigeria.*

***Keywords*** *- Cloud Computing, Technology Acceptance Model, Technical and Vocational Education and Training, Behavioural Intention*

## 1. Introduction

In recent years, cloud computing has become a trending paradigm, gaining more attention from individuals, researchers, corporate organizations, and academic institutions. Cloud computing is utilized to gain a competitive advantage and maximize opportunities associated with innovative and emerging technologies. Cloud computing is regarded as a paradigm that allows cloud service providers to house cloud services and cloud-based resources in their data centres [1]. Cloud computing helps users use software, hardware, and services on a pay-per-use model, which allows them to avoid huge capital expenditures when acquiring or deploying expensive technology. Cloud computing enables service providers to use a wide range of network connectivity to offer cloud services to their clients. Cloud computing technology provides interconnectivity among clients (computer and mobile services), distributed servers and datacenters (rooms housing a set of servers hosting the cloud services and applications). Some of the popular cloud service vendors, such as Amazon, Apple, Dropbox, Google, Microsoft, Cisco, IBM, Yahoo and Rackspace, among several others, provide cloud services to users or customers on demand and offer inexpensive or even free cloud computing services to the public [2]. The users can also use their computers to access the cloud services anywhere and anytime without having control over the location of the resources. The users can even scale up or down the cloud services and pay for only the resources required or consumed [3-6]. In academic environments, cloud computing generally enables academic and non-academic staff, as well as students and researchers, to access resources and services provided by the cloud service vendors. It allows for the virtualization of Information Technology (IT) resources and supports distance and online programmes through e-learning platforms. Cloud computing reduces management costs, offers dynamic scalability, provides high performance and storage capabilities, and remote utilization of IT resources by academic Institutions. Cloud computing technology is environment-friendly. Cloud computing enables fast development of instructional materials, course contents and curriculum design [7], [8]. Cloud computing increases efficiency and improves quality when fully adopted, implemented and used by Institutions to aid teaching, learning and non-administrative tasks. Institutions using cloud computing can reduce the costs related to IT equipment deployment, maintenance, and usage. It will also enable their staff to collaborate with their colleagues to work on the same projects or tasks from any location in the world. With cloud computing, the staff can be connected easily with each other and share relevant academic materials. Thus, the management of the academic Institutions

can concentrate their efforts on improving the quality of teaching, laboratory and workshop practical works, research and community services instead of acquiring and managing rapidly changing IT infrastructures [5]. In most developing countries where cloud computing adoption is less than 10%, educational institutions have several issues that can be addressed by cloud computing and improve the delivery of functional education and training [9]. In a real sense, utilizing cloud computing services requires high-quality ICT infrastructures for fast internet services that are not readily available. Other barriers to cloud computing adoption include lack of stable electricity supply, high cost of digital technologies, data security and privacy concerns, lack of experience and qualified cloud computing tech experts, inadequate enlightenment, complexity and compatibility of seamlessly integrating new and old systems together [4]. A survey of the previous studies on cloud computing adoption showed that factors influencing cloud computing among TVET Institutions have not been thoroughly investigated.

Most of these studies focused mainly on factors driving cloud computing adoption in Universities and organizations using different models without delving into TVET Institutions that train middle-level and skilled technical manpower required for the technological development of a nation [10-12]. In addition, most of the existing studies focused on recognizing the driving and constraining factors, deployment models, issues of merits and concerns affecting the adoption of cloud computing technology. The adoption of cloud computing among TVET Institutions is at the initial stage of development. It remains a promising technology that could drive skills development, flexible e-learning and research endeavours in this sector. The technology can provide TVET Institutions with admirable benefits that will enable them to work or operate remotely with a high degree of security and efficiency. While the quality of training offered by TVET Institutions could be enhanced by the adoption of new technological innovations such as cloud computing, the adoption rate is not highly positive. The low level of adoption of cloud computing in tertiary education has been studied [13]-[15]. Although, Nigerian TVET Institutions are exposed to ICT and its applications, the readiness of these Institutions to integrate cloud computing into their operations is far from becoming a reality. The implementation of cloud computing, like other new technologies within TVET Institutions, will become a wasted or failed project if the attitudes of the staff of TVET Institutions to adopt and utilize cloud computing are not addressed. Thus, factors that influence the adoption of cloud computing need to be examined, understood and rated. In the literature, there are several cloud computing adoption models such as Technology-Organisation Environment (TOE) framework, Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), Theory of Interpersonal Behaviour (TIB), Diffusion of Innovation, and Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and Perceived Characteristics of Innovating theory (PCIT) that have been studied, validated and extended in order to fit into various situations and contexts. Each of these models has its own strengths and limitations [6–18]. These models determine and explain the factors that influence users to either accept or reject an innovation. However, the choice of the model to be deployed depends on the suitability of the model to fit into the research studies. This study used the Technology Acceptance Model (TAM) 3 proposed by the authors of [16] to determine and explain the factors that influence the adoption of cloud computing among TVET Institutions in Nigeria. It is selected as the theoretical model for this study due to its comprehensiveness when compared to other adoption models [15]. This study is expected to contribute significantly to the body of knowledge on cloud computing adoption and inform the critical stakeholders and administrators of TVET Institutions to adopt and benefit from numerous cloud computing applications. The novel contribution of this study is to fill the gap by investigating the factors that drive the adoption of cloud computing among the staff of TVET Institutions in Nigeria using the Technology Adoption Model (TAM) 3. This differs significantly from other previous studies, which focused on universities or degree-awarding institutions and business organizations.

## 2. Materials and Methods

### *2.1. Technology Acceptance Model 3*

Technology Acceptance Model 3 was adopted in this study to identify the factors that drive the adoption of cloud computing among Nigerian TVET Institutions. The research model has 13 constructs and 2 moderators. The constructs are perceived usefulness (PUS), perceived ease of use (PEU), behavioral intention (BIN), output quality (OQT), job relevance (JRL), result demonstrability (RDY), self-efficiency (SEF), computer anxiety (ANX), perception of external control (PEC), playfulness (PLY), perceived enjoyment (PEJ), subjective norm (SJN), and image (IMG). The moderators are experience (EXP) and voluntariness (VLN), as shown in Figure 1. Each variable has been defined and explained in detail by the authors of [15],[16],[19],[21]-[26]. The hypotheses formulated for this study based on these variables are:

H1: Perceived usefulness significantly influences behavioural intention to adopt cloud computing

H2: Perceived ease of use significantly influences behavioural intention to adopt cloud computing

H3: Perceived ease of use significantly influences perceived usefulness of cloud computing

H4: Subjective norm significantly influences behavioural intention to adopt cloud computing

H5: Subjective norm significantly influences perceived usefulness of cloud computing

H6: Subjective norms significantly influences image of adopting cloud computing

H7: Image significantly influences perceived usefulness of cloud computing

H8: Job relevance significantly influences perceived usefulness of cloud computing
H9: Output quality significantly influences perceived usefulness of cloud computing
H10: Output quality will moderate the relationship between job relevance significantly influence perceived usefulness
H11: Result demonstrability significantly influences perceived usefulness of cloud computing
H12: Self-efficacy significantly influences perceived ease of use of cloud computing
H13: Perception of external control significantly influences perceived ease of use of cloud computing
H14: Anxiety does not significantly influence perceived ease of use of cloud computing
H15: Playfulness significantly influences perceived ease of use of cloud computing
H16: Perceived enjoyment significantly influences perceived ease of use of cloud computing
H17a: There is a significant relationship between perceived ease of use and perceived usefulness of cloud computing when moderated by experience
H17b: There is a significant relationship between perceived ease of use and behavioral intention of cloud computing when moderated by experience
H17c: There is a significant relationship between subjective norms on the perceived usefulness of cloud computing when moderated by experience
H17d: There is a significant relationship between subjective norms on the behavioural intention of cloud computing when moderated by experience
H17e: There is a significant relationship between anxiety on perceived ease of use of cloud computing when moderated by experience
H17f: There is a significant relationship between playfulness and perceived ease of use of cloud computing when moderated by experience
H17g: There is a significant relationship between perceived enjoyment and perceived ease of use of cloud computing when moderated by experience
H17h: There is a significant relationship between objective usability and perceived ease of use of cloud computing when moderated by experience
H18: There is a significant relationship between subjective norm and behavioural intention of cloud computing when moderated by voluntariness

### *2.2. Data Collection*

Quantitative research was conducted to investigate the factors that influence the adoption of cloud computing applications among staff of TVET Institutions in Nigeria using a survey questionnaire technique. TVET Institutions provide learning, knowledge, scientific principles and work-related skills to learners and prepare them for formal employment or to be self-employed. A total of 250 questionnaires were shared with respondents, but only 200 were appropriately administered and returned.

**Table 1. Demographic profile of the respondents**

| Variable | | Frequency | Percentage (%) |
|---|---|---|---|
| **Gender** | Male | 152 | 76 |
| | Female | 48 | 24 |
| **Number of years of using Computer** | < 1 year | 13 | 6.5 |
| | 1 – 5 years | 46 | 23 |
| | 6 - 10 years | 105 | 52.5 |
| | > 10 years | 36 | 18 |
| **Level of Internet proficiency and programming skills** | Fair | 35 | 17.5 |
| | Good | 85 | 42.5 |
| | Very Good | 42 | 21 |
| | Excellent | 33 | 16.5 |

## 3. Results and Discussions

### *3.1. Descriptive Statistics*

The descriptive statistics provide the analysis of the demographic information of the respondents. The statistical analysis was performed on the 200 responses received using Stata 13 software. Table 1 shows the characteristics of the respondents. The demographic profile of the respondents reveals that more than half are males, 152 (76%) and the remaining are females, 48 (24%). Furthermore, the number of the respondents who used the computer in less than one year, between one and five years, between six and ten years and more than 10 years are 13 (6.5%), 46 (23%), 105 (52.5%) and 36 (18%) respectively. It was found that 35 (17.5%), 85 (42.5%), 42 (21%) and 33 (16.5%) of the respondents have fair, good, very good and excellent Internet proficiency and programming skills, respectively.

### *3.2. Normality Assessment*

Skewness and kurtosis were used to determine the normality of the data distribution of this study. When skewness is less than or equal to ± 3 and kurtosis is less than ±10, then data distribution is considered normal. The results of skewness and kurtosis in Table 2 show that each variable is within the appropriate range.

### *3.3. Multicollinearity Test*

Before multiple regression analysis was performed, the absence of multicollinearity in the data distribution was checked. This was determined by examining the correlation between the independent variables. Multicollinearity is assumed to exist when there is a high correlation between the independent variables (r = 0.9 or above) [27]. Table 3 shows the results of correlation analysis of the data distribution for this study. The highest correlation value is 0.85. This is less than the recommended value of 0.9. It is inferred that the multicollinearity problem is not likely to be present in the data distribution. In addition, a multicollinearity test was further performed on the data distribution using variance inflation factor (VIF) and tolerance (1/VIF). A VIF value greater than

10 and a tolerance value of less than 0.10 indicated the possibility of a multicollinearity problem. The results of the VIF and tolerance values for the data distribution are presented in Table 4. It is observed that the VIF and tolerance for all constructs are both below 10 and above 0.1, respectively. It can be inferred that the data distribution is suitable for regression analysis since the tolerance and VIF values have not exceeded the recommended threshold.

### *3.4. Reliability Assessment*

Reliability is undertaken to ensure that the scale consistently produces similar and meaningful results. Cronbach's Alpha values are used to determine the reliability of the measuring instrument and scale of the study. As a rule of thumb, Cronbach's Alpha should not be below 0.70. Cronbach's Alpha values for the constructs are presented in Table 5, which show good values above 0.9. Hence, the measurement scales are consistent since they show adequate evidence of reliability.

### *3.5. Multiple Regression Analysis*

The results of multiple regression analysis are shown in Tables 6, 7, 8 and 9. It is observed that the perceived usefulness had a significant effect on behavioural intention to adopt cloud computing (β = .2844595, significance level: 0.001 < 0.05). The hypothesis (H1) was thus supported. Perceived ease of use has a significant influence on behavioural intention to adopt cloud computing (β = .5290778, significance level: 0.000 < 0.05). The hypothesis (H2) was supported by the study. Perceived ease of use had no significant effect on the perceived usefulness of cloud computing adoption (β = -.0423234, significance level, 0.546 > 0.05). The hypothesis (H3) was not supported. Subjective norm had a significant influence on behavioural intention to adopt cloud computing (β = .2369028, significance level: 0.002 < 0.05). The hypothesis (H4) was supported. Subjective norm had a significant influence on the perceived usefulness of cloud computing (β = .1014179, significance level: 0.030 < 0.05). The hypothesis (H5) was supported. Subjective norm had a significant influence on image of users adopting cloud computing (β = .4426443, significance level: 0.000 < 0.05). The hypothesis (H6) was thus supported. The image had a significant influence on the perceived usefulness of cloud computing (β = .3760547, significance level: 0.000 < 0.05). The hypothesis (H7) was supported. Job relevance had a significant influence on the perceived usefulness of cloud computing (β = .3851336, significance level: 0.000 < 0.05). The hypothesis (H8) was supported. Output quality had no significant effect on the perceived usefulness of cloud computing applications (β = .004036, significance level: 0.931 > 0.05). The hypothesis (H9) was not supported. Result demonstrability had no significant effect on the perceived usefulness of cloud computing (β = -.02127, significance level: 0.662 > 0.05). The hypothesis (H11) was not supported. Self-efficacy had a significant influence on perceived ease of use of cloud computing (β = .2100388, significance level: 0.000 < 0.05). The hypothesis (H12) was supported. Perception of external control had no significant influence on the perceived ease of use of cloud computing (β = .0702885, significance level: 0.245 > 0.05). The hypothesis (H13) was not supported. Anxiety had no significant influence on the perceived ease of use of cloud computing (β = .0702885, significance level: 0.000 < 0.05). The null hypothesis (H14) was not supported. Playfulness had a significant influence on perceived ease of use of cloud computing applications (β = .4239282, significance level: 0.000 < 0.05). The hypothesis (H15) was supported. Perceived enjoyment had a significant influence on the perceived ease of use of cloud computing (β = -.0557616, significance level: 0.284 > 0.05). The hypothesis (H16) was not supported. From the regression analysis, perceived ease of use is regarded as the most important factor that determines the adoption of cloud computing among staff of TVET institutions in Nigeria. Perceived usefulness is the next important factor that determines cloud computing adoption. At the same time, the subjective norm is the least important factor that determines the adoption of cloud computing in this study. Moreover, the moderating variables were experience and voluntariness. After creating interaction terms, these terms were regressed to the subjective norm, perceived ease of use, perceived usefulness, and behavioural intention. The analysis of the influence of output quality on the path from job relevance to perceived usefulness was carried out, as shown in Table 10. The hypothesis (H10) that assumed that the output quality has a significant moderating influence on the relationship between job relevance and perceived usefulness was tested. This study supported the hypothesis. Seven hypotheses, H17a, H17b, H17c, H17d, H17e, H17f and H17g, were tested to determine the effect of experience on the path from: perceived ease of use to perceived usefulness, perceived ease of use to behavioural intention; subjective norm to perceived usefulness; subjective norm to behavioral intention; anxiety to perceived ease of use; playfulness to perceived ease of use; perceived enjoyment to perceived ease of use. Thus, the results show that the experience of the users has a moderating effect on the relationship between subjective norm and behavioural intention, between subjective norm and perceived usefulness, between anxiety and perceived ease of use, between playfulness and perceived ease of use, between perceived enjoyment and perceived ease of use, between perceived ease of use and perceived usefulness, and between perceived ease of use and behavioural intention. In addition, the analysis of the influence of voluntariness on the path from subjective norm to behavioural intention to adopt cloud computing was carried out. The hypothesis (H18), which assumed that voluntariness has a significant moderating influence on the relationship between subjective norm and behavioural intention, was not supported by this study. It implied that voluntariness does not have a significant moderating influence on the relationship between subjective norms and behavioural intention to adopt cloud computing applications by the staff of TVET institutions.

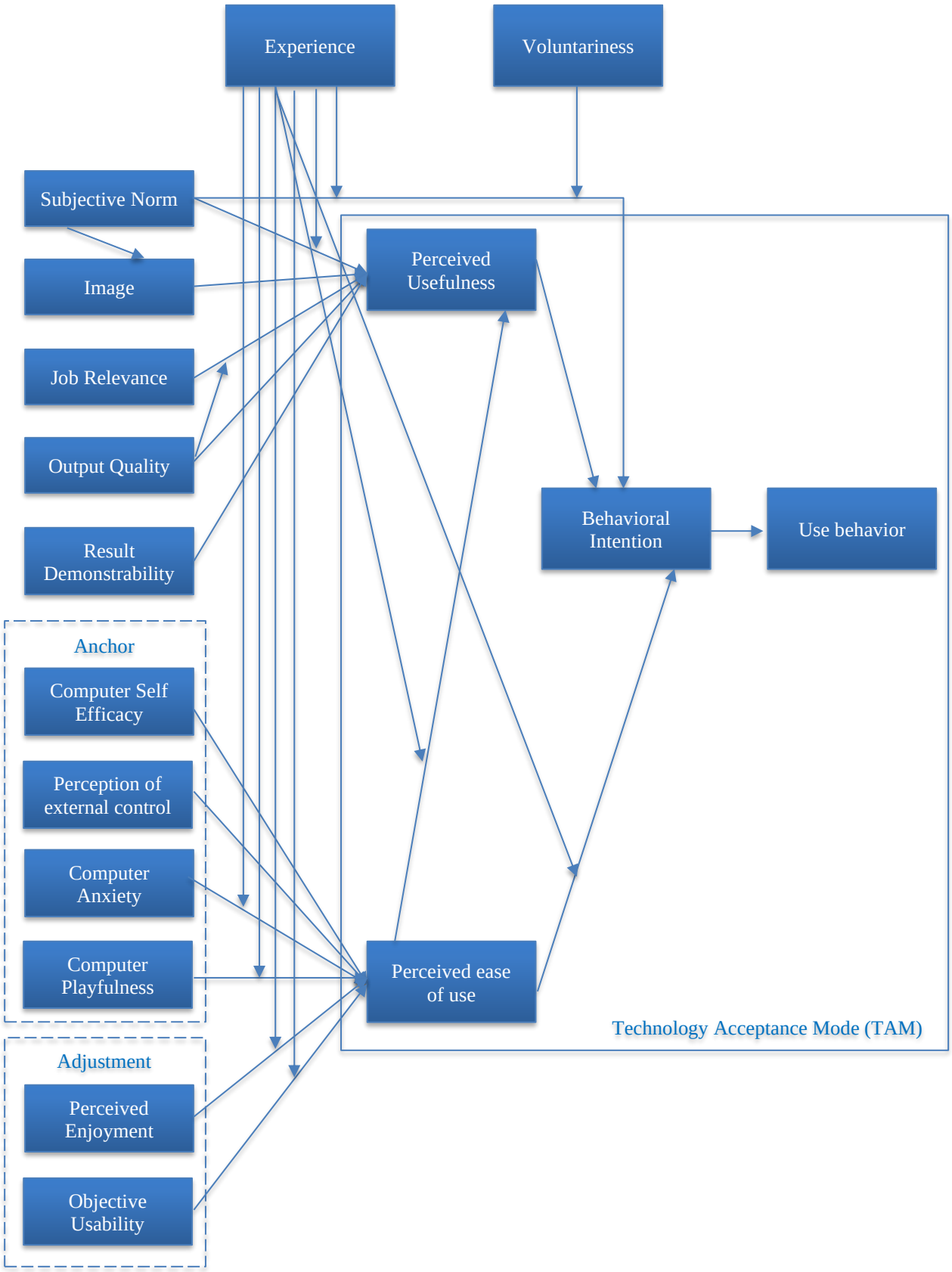


**Fig. 1 Technology Acceptance Model 3 (TAM3) [16]**

**Table 2. Skewness and Kurtosis results**

| Variables | Observation | Mean | Std. Deviation | Skewness | Kurtosis |
|---|---|---|---|---|---|
| PUS | 200 | 3.759167 | .5102789 | -.6875756 | 3.555044 |
| PEU | 200 | 3.734167 | .5182589 | -.9614258 | 4.060027 |
| SEF | 200 | 3.85 | .5701979 | -1.131375 | 4.445267 |
| PEC | 200 | 4.018 | .5941727 | .5941727 | 4.077772 |
| PLY | 200 | 3.87 | .5357566 | -.9214348 | 3.990733 |
| ANX | 200 | 4.0175 | .6002041 | -1.030599 | 4.142566 |
| PEJ | 200 | 4.145 | .5889144 | -.5938479 | 2.965907 |
| SJN | 200 | 3.828333 | .6061084 | -.5590347 | 3.33911 |
| IMG | 200 | 4.026667 | .6439687 | -.754821 | 3.504209 |
| JRL | 200 | 3.975 | .6115741 | -.6233443 | 3.010759 |
| OQT | 200 | 3.788333 | .6190513 | -.6404244 | 3.319018 |
| RDY | 200 | 3.65 | .590025 | -.3819222 | 2.989336 |
| BIN | 200 | 3.981667 | .6906874 | -1.217485 | 4.453342 |

**Table 3. Correlation analysis results**

| | PUS | PEU | SEF | PEC | PLY | ANX | PEJ | SJN | IMG | JRL | OQT | RDY | BIN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PUS | 1.000 | | | | | | | | | | | | |
| PEU | 0.392 | 1.000 | | | | | | | | | | | |
| SEF | 0.474 | 0.593 | 1.000 | | | | | | | | | | |
| PEC | 0.606 | 0.463 | 0.511 | 1.000 | | | | | | | | | |
| PLY | 0.371 | 0.658 | 0.482 | 0.452 | 1.000 | | | | | | | | |
| ANX | 0.677 | 0.552 | 0.595 | 0.479 | 0.398 | 1.000 | | | | | | | |
| PEJ | 0.432 | 0.210 | 0.313 | 0.597 | 0.231 | 0.239 | 1.000 | | | | | | |
| SJN | 0.452 | 0.529 | 0.851 | 0.434 | 0.433 | 0.508 | 0.118 | 1.000 | | | | | |
| IMG | 0.630 | 0.430 | 0.534 | 0.824 | 0.426 | 0.485 | 0.052 | 0.417 | 1.000 | | | | |
| JRL | 0.615 | 0.387 | 0.391 | 0.457 | 0.239 | 0.743 | -0.106 | 0.351 | 0.280 | 1.000 | | | |
| OQT | 0.327 | 0.583 | 0.527 | 0.346 | 0.418 | 0.553 | 0.067 | 0.391 | 0.367 | 0.288 | 1.000 | | |
| RDY | 0.257 | 0.595 | 0.408 | 0.397 | 0.662 | 0.338 | 0.141 | 0.329 | 0.304 | 0.265 | 0.276 | 1.000 | |
| BIN | 0.456 | 0.589 | 0.801 | 0.658 | 0.481 | 0.553 | 0.0386 | 0.513 | 0.564 | 0.405 | 0.475 | 0.477 | 1.000 |

**Table 4. Multicollinearity test results**

| Constrict | VIF | Tolerance |
|---|---|---|
| IMG | 7.91 | 0.126 |
| SEF | 5.12 | 0.195 |
| PEC | 4.39 | 0.228 |
| ANX | 4.27 | 0.234 |
| SJN | 4.00 | 0.250 |
| JRL | 3.33 | 0.300 |
| PEJ | 3.14 | 0.318 |
| PUS | 2.83 | 0.353 |
| PEU | 2.79 | 0.358 |
| PLY | 2.42 | 0.412 |
| RDY | 2.11 | 0.472 |
| OQT | 1.96 | 0.509 |
| Mean VIF | 3.69 | |

**Table 5. Cronbach's Alpha values of the research constructs**

| Variables | Number of items | Cronbach's Alpha (α) |
|---|---|---|
| PUS | 6 | 0.9078 |
| PEU | 6 | 0.9066 |
| SEF | 4 | 0.9034 |
| PEC | 4 | 0.9045 |
| PLY | 4 | 0.9099 |

| | | |
|---|---|---|
| ANX | 4 | 0.9053 |
| PEJ | 3 | 0.9162 |
| SJN | 3 | 0.9090 |
| IMG | 3 | 0.9055 |
| JRL | 3 | 0.9137 |
| OQT | 3 | 0.9125 |
| RDY | 4 | 0.9136 |
| BIN | 3 | 0.9038 |

**Table 6. Regression analysis results of BI = *f* (PUS, PEU, SJN)**

| Variables | Coefficient | Std. Err | t | P > \| t \| |
|---|---|---|---|---|
| PUS | .2844595 | .0830102 | 3.43 | 0.001 |
| PEU | .5290778 | .085909 | 6.16 | 0.000 |
| SJN | .2369028 | .0757476 | 3.13 | 0.002 |
| Const | .0297281 | .3300622 | 0.09 | 0.928 |
| **R-squared** | | | | 0.4370 |

**Table 7. Regression analysis results of PUS = *f* (PEU, SJN, IMG, JRL, OQT, RDY)**

| Variables | Coefficient | Std. Err | t | P > \| t \| |
|---|---|---|---|---|
| PEU | -.0423234 | .0700048 | -0.60 | 0.546 |
| SJN | .1014179 | .0464154 | 2.19 | 0.030 |
| IMG | .3760547 | .0410728 | 9.16 | 0.000 |
| JRL | .3851336 | .0413957 | 9.30 | 0.000 |
| OQT | .004036 | .0464641 | 0.09 | 0.931 |
| RDY | -.02127 | .0485612 | -0.44 | 0.662 |
| Const | .5461405 | .2131851 | 2.56 | 0.011 |
| **R-squared** | | | | 0.6154 |

**Table 8. Regression analysis results of PEU = *f* (SEF, PEC, ANX, PLY, PEJ)**

| Variables | Coefficient | Std. Err | t | P > \| t \| |
|---|---|---|---|---|
| SEF | .2100388 | .0583074 | 3.60 | 0.000 |
| PEC | .0702885 | .0602523 | 1.17 | 0.245 |
| ANX | .1872936 | .0527342 | 3.55 | 0.000 |
| PLY | .4239282 | .0544166 | 7.79 | 0.000 |
| PEJ | -.0557616 | .0519339 | -1.07 | 0.284 |
| Const | .4811757 | .2389678 | 2.01 | 0.045 |
| **R-squared** | | | | 0.5689 |

**Table 9. Regression analysis results of IMG = *f* (SJN)**

| Variables | Coefficient | Std. Err | t | P > \| t \| |
|---|---|---|---|---|
| SJN | .4426443 | .0686411 | 6.45 | 0.000 |
| Const | 2.332077 | .2660378 | 8.77 | 0.000 |
| **R-squared** | | | | 0.1736 |

**Table 10. Regression analysis results of moderating variables**

| Variables | Coefficient | Std. Err | t | P > \| t \| |
|---|---|---|---|---|
| OQT*JRL → PUS | .0766149 | .0082202 | 9.32 | 0.000 |
| EXP*PEU →PUS | .1308414 | .0209572 | 6.24 | 0.000 |
| EXP*PEU → BIN | .1567883 | .028964 | 5.41 | 0.000 |
| EXP*SJN → PUS | .1288139 | .0199441 | 6.46 | 0.000 |
| EXP*SJN → BIN | .1485368 | .0277642 | 5.35 | 0.000 |
| EXP*ANX → PEU | .0620921 | .020861 | 2.98 | 0.003 |
| EXP*PLY → PEU | .0719604 | .021857 | 3.29 | 0.001 |
| EXP*PEJ → PEU | .0430628 | .0205748 | 2.09 | 0.038 |
| VLN*SJN → BIN | .0063421 | .0257144 | 0.25 | 0.805 |

## 4. Discussion of Findings

The summary of the findings of this study is shown in Table 11. The study postulated that perceived usefulness has a significant effect on the behavioural intention to adopt cloud computing, H1. The study supported the hypothesis that perceived usefulness significantly influenced behavioural intention to adopt cloud computing. This implies that the adoption of cloud computing is based on TVET Institutions' perception of the usefulness of the technology. This means that the staff of TVET Institutions perceived that the adoption of cloud computing would enable them to complete their academic, administrative, and routine tasks more quickly than conventional approaches. It could be deduced that cloud computing was adopted because they believed that it would increase their productivity and effectiveness in their jobs. Also, the staff likely perceived that cloud computing would improve their performance and make their jobs easier to accomplish. Perceived ease of use was hypothesized in this study to predict behavioural intention and perceived usefulness of adopting cloud computing. The hypothesis, H2, was supported. These findings confirmed the assumption that TVET Institutions adopted cloud computing applications because they perceived that cloud computing technology was easy for them to use and simple enough to perform the tasks they wanted it to do for them. In addition, cloud computing was adopted because they found that interactions with it were clear, understandable, and easy to deploy. However, hypothesis H3, which states that perceived ease of use has a significant influence on perceived usefulness, was not supported.

Moreover, this study hypothesized that the subjective norm has a significant influence on behavioural intention, perceived usefulness and image. The influence of subjective norms on these three constructs was found to be significant. This implies that hypotheses H4, H5 and H6 are supported. It is deduced that the adoption of cloud computing among TVET Institutions depends on the contributions and opinions of people who are influencers, which are important and valuable to the staff of these Institutions. This suggests that part of the decision to adopt cloud computing was a result of suggestions, advice, and recommendations from the main stakeholders of these TVET Institutions. In this study, it was postulated that image significantly influences perceived usefulness. The results showed that image has a significant effect on perceived usefulness. The hypothesis, H7, that assumed a significant influence of image on perceived usefulness was supported. The essence of this finding is that the belief that cloud computing would improve the performance of the staff of TVET Institutions is directly proportional to the prestige and status symbol associated with the use of cloud computing. This study hypothesized that job relevance has a significant effect on perceived usefulness. The test of this hypothesis showed that the influence of job relevance on perceived usefulness was significant. This supported the hypothesis, H8. This finding implies that the usage of cloud computing was important, relevant, and pertinent to the performance of TVET Institutions' activities. The study hypothesized that the output quality has a significant influence on the perceived usefulness of cloud computing. The results of the regression analysis, however, showed that the hypothesis, H9, was not supported. The finding of the study suggests that the quality of output does not influence the usefulness of cloud computing among the staff of TVET Institutions. In addition, the IT industry's rating of cloud computing did not influence the performance of the activities of TVET Institutions using cloud computing. The finding is consistent with similar findings reported in [16]. In this study, the demonstrability of the results was hypothesized to significantly affect the perceived usefulness of cloud computing. The hypothesis, H11, was not supported by this study. It shows that result demonstrability did not have an impact on perceived usefulness. The insignificant effect of result demonstrability on perceived usefulness suggests that TVET Institutions had difficulties explaining or communicating the results or consequences of using cloud computing applications to others. This contrasts the findings in [16, 18, 22] but was similar to the studies by [19]. Furthermore, it is assumed that self-efficacy has a significant influence on the ease of using cloud computing among TVET institutions. In addition, it was found that the hypothesis, H12, was strongly supported. The significant effect indicated that the ease of using cloud computing applications by TVET Institutions depended on the availability of mentors, time, built-in help facility and prior experience.

It is hypothesized that the perception of external control significantly affects perceived ease of use. After testing the hypothesis, it was found that hypothesis H13 was not supported. This finding implies that the ease of use of cloud computing by TVET Institutions might be unconnected with the desire to have control over opportunities, knowledge, resources and compatible systems but on the determination and resolutions to use cloud computing applications by these Institutions. The study implies that TVET Institutions should create more awareness of cloud computing with little emphasis on control of its facilities, technical resources and equipment. Anxiety is assumed in this study to have no significant influence on the perceived ease of use of cloud computing. The results of the multiple regression analysis showed that there is no significant influence of anxiety on perceived ease of use of cloud computing; hence, the hypothesis, H14, was not supported. It is recommended that staff of TVET Institutions should pay less attention to anxiety when planning and implementing cloud computing because it is found to be less significant. In this study, playfulness is postulated to have a significant influence on perceived ease of use of cloud computing. The results of this study supported the hypothesis, H15, since a significant impact of playfulness on perceived ease of use was observed. The implication of the effect of playfulness on the perceived ease of use of cloud computing is that individuals increase their use of cloud computing when they have feelings of originality, creativity,

excitement and fun as users. It is suggested that TVET Institutions should encourage users to feel excited and creative when adopting or using cloud computing. This study also assumed that perceived enjoyment significantly influences perceived ease of use of cloud computing. From the regression analysis of the data distribution, the hypothesis, H16, was not supported. That is, perceived enjoyment had no significant effect on perceived ease of use. This implies that the perceived ease of use of cloud computing by staff of TVET Institutions cannot be attributed to the fact that cloud computing was enjoyable and pleasant to use. It is, however, suggested that providers of cloud computing should improve quality of service, flexibility, user-friendliness and affordability, which are more important than perceived enjoyment.

**Table 11. Summary of hypothesis testing results**

| Path | Hypothesis | Result of hypothesis test |
|---|---|---|
| PUS →BI | H1 | Supported |
| PEU →BI | H2 | Supported |
| PEU → PUS | H3 | Not supported |
| SJN → BI | H4 | Supported |
| SJN → PUS | H5 | Supported |
| SJN → IMG | H6 | Supported |
| IMG → PUS | H7 | Supported |
| JRL → PUS | H8 | Supported |
| OQT → PUS | H9 | Not supported |
| OQT*JRL → PUS | H10 | Supported |
| RDY → PUS | H11 | Not supported |
| SEF → PEU | H12 | Supported |
| PEC → PEU | H13 | Not supported |
| ANX → PEU | H14 | Not supported |
| PLY → PEU | H15 | Supported |
| PEJ → PEU | H16 | Not supported |
| EXP*PEU →PUS | H17a | Supported |
| EXP*PEU → BIN | H17b | Supported |
| EXP*SJN → PUS | H17c | Supported |
| EXP*SJN → BIN | H17d | Supported |
| EXP*ANX → PEU | H17e | Supported |
| EXP*PLY → PEU | H17f | Supported |
| EXP*PEJ → PEU | H17g | Supported |
| VLN*SJN → BIN | H18 | Not supported |

Furthermore, output quality is assumed to significantly moderate the relationship between perceived usefulness and job relevance. The study found that hypothesis H10 was supported. This shows that the output quality of the works and activities of TVET Institutions moderates the influence of job relevance on the perceived usefulness of cloud computing. This finding was in line with the previous finding that suggested that output quality was the moderator of the relationship between the two constructs [16], [19]. Experience is included in TAM3 as a moderator, as shown in Fig. 1. It was found that experience had a significant moderating effect on the relationship between the seven relationships. Therefore, the hypotheses, H17a, H17b, H17c, H17d, H17e, H17f, and H17g, were all supported. Lastly, voluntariness is assumed to significantly moderate the relationship between subjective norms and behavioural intention to adopt cloud computing. The study found that hypothesis H18 was not supported. This implies that the influence of subjective norms on behavioural intention to adopt cloud computing is not moderated by voluntariness among the staff of TVET Institutions. In essence, the decision-makers in the TVET Institutions in Nigeria should not just mandate individuals to use cloud computing, but they should motivate, train them and create more awareness of the capabilities of cloud computing to improve employees' productivity, quality education and training, and effective service delivery.

## 5. Conclusion

Cloud computing is a versatile technology capable of handling simple tasks such as word processing, spreadsheet, presentation, and e-mail communications to complex tasks ranging from the development of software packages, virtualization, and storage and analysis of big data. This study examined the factors that influence cloud computing adoption among the staff of Nigerian TVET Institutions. The study found that perceived usefulness, perceived ease of use, and subjective norms have a significant influence on the behavioural intention to adopt cloud computing among TVET Institutions. Similarly, image and job relevance have significant effects on the perceived usefulness of cloud computing, while perceived ease of use, output quality and result demonstrability have insignificant influences on perceived usefulness. The study also showed that self-efficacy and playfulness have a significant effect on perceived ease of use, while perception of external control, anxiety and perceived enjoyment have no significant effect on perceived ease of use. The experience was found to have a significant influence on the relationship between subjective norm and behavioural intention, but voluntariness has an insignificant moderating influence on the relationship. Cloud computing is one of the novel innovations in ICT that has huge potential to transform the TVET sector and solve challenges that are related to the high cost of IT infrastructure deployment and maintenance, flexibility, space constraints, outdated curricula and instructional materials, low-quality training and education, among others. The study recommends that the decision-makers and administrators of TVET Institutions in developing countries enhance the performance, efficiency, effectiveness, productivity, and collaboration among their staff when emphasis is placed on the flexibility, simplicity and social impact associated with cloud computing. Future studies would compare different models of technological adoption of cloud computing or frontier technologies in the TVET Institutions to identify factors driving their acceptance.

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