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Cloud Computing Performance Evaluation Model for Open and Distance Learners in Nigeria

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ABSTRACT

The increasing need for fast, secure and dynamic processing of information has necessitated the wide scale adoption of cloud computing. The educational sector especially the open and distance learning institutions are not left out of the need for distributed technology. This study presented a model that provided insight into the pre and post usage adoption variables associated with cloud computing adoption and performance in open and distance learning (ODL) setting. Partial Least Square (PLS) was adapted to test seven hypotheses on the causal relationship between the variables. Five out of the seven hypotheses were supported. The pre-usage and satisfaction oriented constructs showed more significant contributions in determining performance impact than the task technology fit oriented constructs. The study also provided insights on user preferences for decision making by educational institutions, service providers, business owners and government.

Keywords: Cloud Computing, TUSPEM, Performance, Utilization, Cost, Ease Of Use

1. INTRODUCTION

The most widely recognized definition of cloud computing is provided by the US National Institute of Standards and Technology (NIST). According to NIST, "Cloud Computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" Mell and Grance (2011). Many organizations are fully aware of the many advantages and potential of cloud computing, which is thought to offer a revolutionary opportunity to fundamentally alter how business is done. Nevertheless, the relatively high level of customer confidence in cloud services is gradually declining considering the current wave of data breaches and leaks occurring in the cloud (Gemalto, 2018; Pandey, 2018).

User acceptance or rejection of a new technology has for a long time been cited as the greatest aid or hindrance to success of any new technology (Muhambe, 2011). Numerous technology adoption studies focusing on establishing factors that influence behavioural intention and use behaviour of various technologies have been carried out mainly in United States, Europe, Australia, China, Japan, Singapore and Malaysia. Studies on adoption and use of cloud computing services have been carried out in the same regions but it is worth noting that these regions of the world have a highly developed internet infrastructure, high levels of internet permeation and high utilization levels of internet and associated services as compared to the developing countries. A significant number of these studies have contributed immensely to the success of these technologies by enabling stakeholders to understand and take advantage of the factors that influence "behavioural intention" and the "use behaviour" (Muhambe, 2011). The success in the adoption and use of cloud computing technology depends on the ability of the movers of this technology; researchers and vendors/providers to identify and take advantage of the factors that influence behavioural intention and the use behaviour.

Several studies have focused on the adoption and usage of cloud computing services in organizations Al-Sharafi, Alzahrani, Iranmanesh, Herzallah, Al-Emran, and Jamil (2023), Ogwel et al. (2020). Others have focused on cloud computing for improving small and medium scale enterprises. Al-Sharafi et al (2023). This paper proposed a theoretical model that identified the determinants of cloud services adoption and investigated the causal relationship among the latent variables in model. This study serves as a foundation for future research and advancement of theory development in the adoption, use, and performance of cloud computing. It also provided inside information on user preferences and is crucial for service providers, business owners and government.

2. RELATED WORKS

Kandil et al. (2018) in a study identified Telecommunication infrastructure, cloud security, and Internet service providers as critical factors impacting adoption. Ming et al. (2018) investigated factors influencing cloud computing adoption in SMEs in Malaysia. The results indicated that Top management support, cost-saving, privacy, cloud security, and technology readiness influence adoption. Mugunti and Opiyo (2018) investigated the factors influencing cloud computing adoption in Kenyan companies. The study surveyed 283 software development companies. The findings revealed that top management support, right skills, worker attitudes (organizational factors), trading partner pressure, industry competition (environmental factors), compatibility, complexity, and perceived benefits (technological factors) are the factors influencing adoption. Furthermore, security concern was found to be the most critical factor that should be considered before adoption.

Al-Shura et al. (2018) examined the impact of some factors on cloud computing adoption in pharmaceutical companies in Jordan. The factors examined include relative advantage, complexity, compatibility, technology readiness, cloud security, top management support, organization size, trading partner pressure, and competitive pressure. The results indicated that all the factors had a significant influence on cloud adoption. In addition, security and privacy concern was found to be the most critical factor that should be considered before adoption. Alsmadi, and Prybutok (2018) in a study in the USA examined the factors influencing the adoption and use of cloud computing in the educational sector. The finding revealed Cloud security, Performance expectancy, effort expectancy, peer influence, and facilitating condition.

Trenz et al. (2018) in a study in Germany revealed Security, word of mouth, uncertainty, continued usage, peer use, and subjective norm as major concerns in the adoption and use of the cloud. Hsieh and Lin (2018) in a study on the health sector in Taiwan indicated the System quality, intention to use, information quality use, service quality, intention to use, resistance to use, regret avoidance, inertia, perceived value, perceived threats and system use, peer influence, security, and facilitating condition are factors of concerns in cloud adoption.

Ooi et al. (2018) investigated the factors that are of concern in the adoption and use of the cloud in the manufacturing company in Malaysia. The findings revealed that performance expectancy, effort expectancy, firm size, top management support, absorptive capacity, innovativeness, security, and firm performance are of significant concern. Stieninger et al. (2018) in a study in the IT sector in Australia revealed that in the adoption and use of the cloud, Security & Trust, Compatibility, and relative advantage, as well as a lower level of complexity are of concern. Gupta et al. (2018) in a study in the USA on the concerns of SMEs in the performance of cloud computing revealed that Data security and privacy are of significant concern.

Singh and Manstora (2019) investigated the factors that influence cloud computing adoption in Indian secondary schools. The findings revealed that compatibility, complexity, relative advantage, top management support, attitude toward change, external expertise, competitive pressure, privacy, and security have significant influences on adoption. Idoga et al. (2019) in their study investigated factors influencing cloud adoption in Nigerian health institutions. The findings showed that cloud knowledge, IT infrastructure, and performance expectancy significantly influence the intention to accept and use cloud technology. Data security concern was found to be the most critical factor that should be considered before adoption.

Ogwel et al. (2020) in their study discovered that cloud computing adoption is significantly influenced by cloud security technology readiness, service quality, expert scarcity, top management support, company size, perceived utility, perceived simplicity of use, and social impact. Qasem et al. (2020) in a study to measure the acceptance and effectiveness of cloud computing implementation in the education sector highlighted that there are almost similar factors used and the most significant factors are complexity, capability, top management support, security, privacy, computer self-efficacy, and external pressure discovered in their studies. Omar et al. (2020) investigated the cloud concerns in the government sector in Australia and the findings revealed Cloud security, Compatibility, complexity, cost, expected benefits, and organization size of significant concern. Thabit et.al. (2021) examined the concerns of SMEs in Jordan on cloud adoption and use. The study revealed Cloud security, privacy, trust, perceived ease of use, perceived usefulness, cost, and perceived risk as major concerns.

Research on behavioural determinants of information systems deployments in the health sector have focused more on usage behaviour than performance. While emphasizing the critical role played by humans and the need for human interactions based studies in the health sector from 1989 to 2017, Rahimi, Nadri, Lotfnezhad and Timpka (2018) carried out a detailed systematic review of studies in the health sector using PubMed, Scopus, and Web of Science databases. Their study identified 134 journal articles with a focus on empirical studies on the use of TAM in the health sector. The study revealed that telemedicine; electronic health records (EHR) and mobile applications were the three main technological contexts that adopted TAM in health care. The study

identified three highest geographical contexts that included different countries like Taiwan (telemedicine and mobile applications), U.S. and Iran (EHR), and Spain (telemedicine).

2.1 Theoretical Framework and Hypotheses

The technology utilization, satisfaction and performance model is a hybridized information system (IS) model that is focused on the tripartite dimensions namely: the task technology fit based dimension, the determinants of usage dimension and the satisfaction based dimension. The model maintained that for a technology to have an influence on performance, it must not only fit the task and be used; it must satisfy the users of the system Osang and Mbarika (2019). The model comprised of constructs such as ease of use, technical support, computer self-efficacy, social norms, user habit and perceived usefulness from technology acceptance model (TAM); satisfaction from information success model; utilization, Task Technology Fit and performance from the technology-to-performance theory. Figure 1 represents the TUSPEM model.

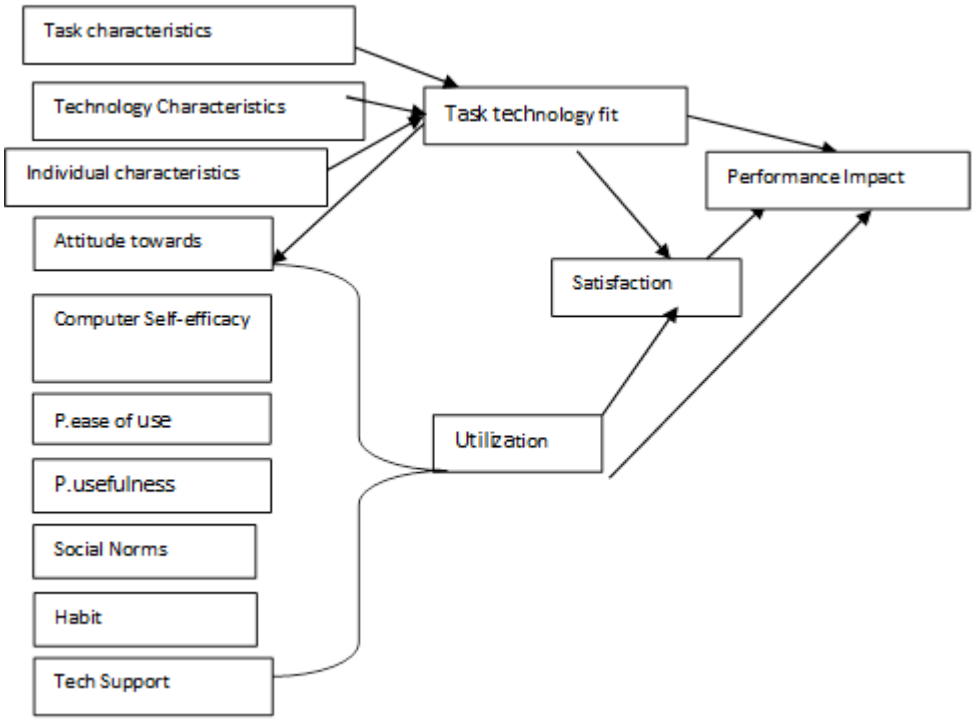

Figure 1: TUSPEM model (Source: Osang and Mbarika, 2019)

2.1.1 Task Technology Fit (TTF)

Conceptualized by Goodhue and Thompson in 1985, this construct measures the suitability of a technology for a specific task. Several works have focused on the critical role played by TTF in unraveling underlining determinants in technology adoption, usage, and success and performance indicators. Wu & Chen (2017) examined a self-reported individual-technology fit by measuring whether or not the MOOCs being used by students match their learning styles. Osang (2019) focused on the fit of open educational resources (OERs) using the TUSPEM model. The study revealed a

significant relationship between TTF and performance. Udoinyang et al 2023 concluded that the type of task performed was the most influential k-nearest neighbor (kNN) performance determinant.

The work of Chirchir, Aruasa and Chebon (2019) investigated influence of perceived usefulness and ease of use as it affect task technology fit, user performance, system quality and information quality in the health organization in Kenya. The result of the study showed that task technology fit influences performance indirectly through perceived ease of use and perceived usefulness. In the same vein, the work of Mohamed, Khalifa, Nusari, Ameen, Al-Shibami & Abu-Elhassan (2018) focused on the precursors of employee performance on organizational productivity in Health Authority in Abu Dhabi (HAAD). A sample size of 278 was adopted for analysis. The result concluded that employee performance has a positive effect on organizational productivity.

2.1.2 User Satisfaction

End user-satisfaction has been revealed as one of the key precursors to measure post-usage experiences with information systems/technologies. Determination of the level of end-user satisfaction plays a critical role in guiding software developers and vendors to redesign any technology in order to meet up with emerging needs. In a related study by El-Masril, Al-Yafi & Kamal (2023), data was collected from 300 smartwatch users in Qatar through a quantitative method. Data was analyzed using structural equation modeling (SEM) and artificial neural networks (ANN). The work reported that task-technology and technology-identity fit factors jointly explained 62% of satisfaction variance. It was also reported that post-adoption satisfaction was majorly responsible for smartwatches' ability to fit with users' identity and secondarily to its perceived fit with tasks.

2.1.3 Cost Dimension

Cost reduction is a key determinant in cloud computing services adoption in organizations. As much as possible every open and distance learning institutions as well as organizations would prefer to spend less resources for optimal results. Instead of purchasing high end servers and other hardware and network equipment, organizations results to adopting cloud services for purposes of cost-efficiency Fern´andez, Peralta, Benítez, Herrera (2014). The cloud computing model offers institutions the opportunity to make up-front payment as infrastructure acquisition cost for cloud computing services thereby leading to increased access and usage to these clouds based services by institutions that could not have the capacity to use such services Alismaili, Shen (2016). Similarly, Ali, Soar and Yong (2016) argued that the cloud computing model offers low start-up costs, low procurement of software, hardware, experimentation and implementation cost thereby resulting to increased usage.

2.1.4 Ease of Use

The ease of use of cloud computing significantly affects cloud computing usage in different ways. Users are more likely to increase usage of cloud computing services as long as the interfaces are user friendly as complicated interfaces deter users. Similarly, collaboration among team members within and outside the institution can be enhanced with user-friendly cloud applications. The work of Zhang, et al. (2018) concluded that ease of use of cloud services significantly affects usage of cloud computing technologies. In the same vein, Alhassan, et al. (2016) concluded in their study that ease of use of cloud computing services among small and medium-sized enterprises (SMEs) has a significant influence on cloud computing adoption and usage. In the work of Osang (2022), the hypothesized relationship between perceived ease of use and users decision to adopt both Android and IOS mobile internet services was supported.

2.1.5 Utilization Dimension

Past researchers have demonstrated that TTF has a significant relationship technology utilization and performance [Goodhue and Thompson, 1995; Howard & Rose, 2019] and that IS utilization will lead to positive outcomes. The work of El-Masri et al (2023) that was centered on continuous smartwatch use resulted to better performance outcomes. While determining the factors information system utilization and performance at individual level of analysis, Osang and Mbarika (2019) reported that in a mandatory usage environment, user attitude does not have any significant relationship with system usage.

Using the Technology-to-performance model, McGill, Klobas & Renzi (2011) reported that level of utilization is either not associated with performance impact or is associated with performance impact in ways that are not readily captured by simple linear modeling. While combining DeLone & McLean IT Success and TTF theories to investigate the impact of m-banking on individual performance, Tam and Oliveira (2016) found usage and satisfaction as important precedents of m-banking individual performance. Osang and Mbarika (2019) confirmed the significant relationship between task technology fit and system use as well as between TTF and performance. The work of Linus et al (2019) studied perceived usefulness (PU) and perceived ease of use (PEOU) as mediators of the effect of health information system on user performance in Kenya hospitals. The result supported the positive relationship between TTF and performance through Utilization.

2.1.6 Performance

The growing emphasis on growth and sustainable performance indicators has forced institutions to adopt and integrate different technologies including cloud computing Gupta, Meissonier, Drave and Roubaud (2020). As reported by Al-Sharafi, Alzahrani, Iranmanesh, Herzallah, Al-Emran and Jamil (2023) "in order to achieve a balance between economic and operational performance, organizations must improve their capabilities and promote sustainable performance''. Through cloud computing technology, the resources that would have been channeled into energy consumption by SMEs are rather channeled into other operational considerations for maximum output using minimal input Chang, Walters, Wills (2016); Rawai, Fathi, Abedi, Rambat (2012). Oke, Kineber, Al-Bukhari, Famakin, Kingsley , 2021) considered performance from the perspective of the remote delivery of tasks despite the functions of space and location by working online. Al-Sharaf et al (2023) posited that with the adoption of cloud computing services, costs reduction can be achieved by SMEs in terms of ICT infrastructure, maintenance and support. More resources can be redirected into sustainable employee training, corperate social responsibility, supply chain management among others.

2.2 Hypotheses

The work focused on the TTF dimension as proposed by (Goodhue and Thompson (1995) by examining the relationship between TTF and performance impacts. It also examined the causal relationship between TTF and user satisfaction. The utilization dimension emphasized the causal relationship between ease of use of cloud computing technology, cost of access of the technology influencing system use as well as system use influencing user satisfaction and job performance.

Hence, the hypotheses based on the research model in figure 2 were stated thus:

H_1: There is a significant relationship between cloud computing cost and utilization such that as cost increases, utilization decreases.

H_2: There is a significant relationship between ease of use of a cloud computing technology and its usage such that as ease of use increases, system usage also increases.

H_3: There is a significant relationship between cloud computing technology usage and performance such that as usage increases, performance also increases.

H_4: There is a significant relationship between cloud computing usage and user satisfaction such that as cloud computing usage increases, user satisfaction increases.

H_5: There is a significant relationship between cloud computing technology fit and performance such that as the technology fit increases, performance increases.

H_6: There is a significant relationship between cloud computing technology fit and user satisfaction such that as user satisfaction increases, performance increases.

H_7: There is a significant relationship between user satisfaction with cloud computing technology and performance such that as user satisfaction increases, performance increases.

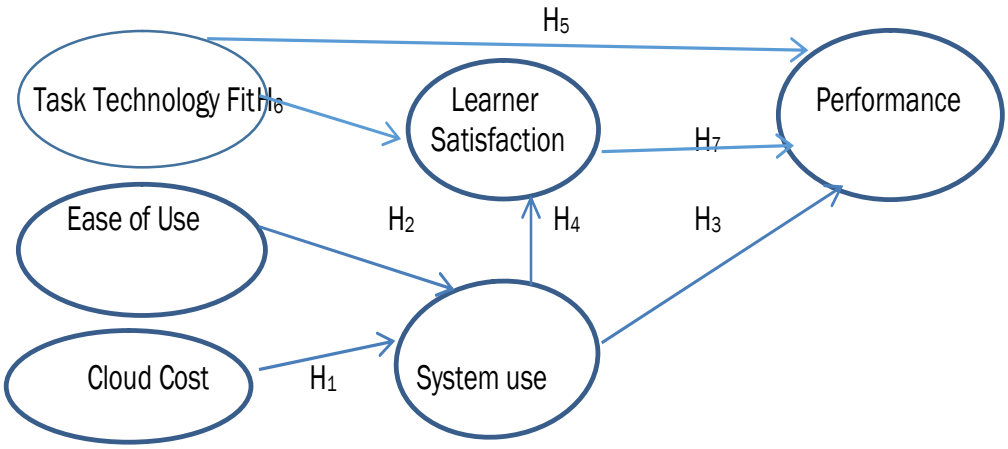

Figure 2: Research Model (Source: Author)

3. METHODOLOGY

3.1 Research Design: The study adopted a well-structured instrument to solicit views from open and distance learners that served as respondents. Questionnaires were distributed to all the participants. The strength of quantitative methods is its support for testing of theories and easy generalization. In order to verify the stated hypotheses, a survey instrument was collected from open and distance learners from the National Open University of Nigeria. The structured instrument was collected from three study centres namely Abuja Model Study Centre, Wuse II Study Centre and the National Union of Road Transport Workers Garki Study Centre in the Federal Capital Territory. The instrument was administered to them during the 2024_1 semester examinations. From the 250 questionnaire distributed to respondents that willingly took part in the study, 227 items were returned. Additional 9 were excluded as being invalid due to incomplete response. Hence, the sample size actually used for the study was 218 responses. Participants were assured that their participation was optional and information gathered would be used only for research purposes only and would not pose any threat or danger to them.

3.2 Instrumentation

The responses were organized in a close ended seven points Linkert scale ranging from strongly agree to strongly disagree from which participants had the option of choosing from. The test items were adapted and coded below:
Performance Outcome was coded as PERF with six items as PERF1.....PERF6 and was adapted from Goodhue & Thompson, (1995) + Author. Satisfaction was coded as SAT with four items SAT1.....SAT4 adapted from McLane & DeLone (2002). Task Technology Fit had seven test items and was coded as TTF with TTF1...TTF7 adapted from Goodhue & Thompson (1995), Osang & Mbarika (2019). Utilization was coded as USE with twelve test items as USE1.....USE12 from Davis et al (1989) and author. Cost of cloud computing was coded as Cost with eleven test items as Cost1.....Cost11 constructed by the authors. Ease of use was similarly coded as Ease with four test items as Ease 1....Ease 4 adapted from Verkasalo, López-Nicolás, Molina-Castillo& Bouwman (2010). The collected data was analysed using structural equation modeling (SEM). SEM is well suited for models associated with two or more latent variables. According to Byrne (2012), SEM as a statistical technique measures both the measurement and structural model while testing theoretical relationships among multiple predictors and criterion variables. This study followed a two steps approach.

3.3 Reliability and Validity

In considering the validity and reliability of the instrument, both the outer and inner models were measured. The outer model focused on the relationship between the indicators and the latent variables. The following criteria were used owing to the fact that the model in consideration is a reflective model: uni-dimensionality, internal consistency reliability, indicator reliability, convergent validity and discriminant validity since our model is a reflective model. The inner model was measured using the predictive power and the statistical significance of the estimated model coefficient.

4. RESULTS AND DISCUSSIONS

The first part of the questionnaire obtained information regarding the respondents' demographic information such as age, gender, years of experience with cloud computing technologies. Variable gender included male, female. Age was indicated in years by selecting the appropriate range. Over 95% of the respondents were between the ages of 16 to 50 years old. Only participants that had used the various types of cloud computing technologies were advised to participate in the study. The average usage experience with the technology was 4 years and all of them indicated that cloud computing technologies have assisted them immensely in their studies and workplaces.

4.1 Inner Model Analysis

The measurement (inner) model focused on (a) uni-dimensionality (b) internal consistency reliability, (c) indicator reliability (d) convergent validity and (e) discriminant validity.

4.1.1 Uni-dimensionality

As reported by Gefen and Straub (2005), for an item to significantly load on a latent variable, the loading must be above the threshold of 0.6. Based on the item loadings, all the items loaded significantly on their latent variables and were considered fit for measurement. It was concluded therefore that there was high evidence of uni-dimensionality with the six (6) constructs.

4.1.2 Internal Consistency Reliability (CR)

Using the composite reliability criteria, all the constructs in the model were above the minimum threshold of 0.70 as stated by Hair et al. (2006). It was therefore concluded that there was sufficient evidence of internal consistency reliability among the items of the variables in the model.

4.1.3 Indicator Reliability: Indicator variance was explained by the corresponding latent variables. According to Chin (1998), for any indicator to be regarded as reliable, values must be significant at a 0.5 level and higher than 0.70. Based on the item loadings, all test items had values higher than 0.7. In order to test for significance, the t-statistics of the inner model indicated that TTF to performance and TTF to satisfaction recorded values lower than 2 (0.05 and 0.25 respectively). All other constructs had t-values greater than 2. Consequently, it was concluded that there is sufficient evidence of indicator reliability.

4.1.4 Convergent Validity: The measurement criteria for convergent validity were premised on the criteria set by Fornell and Larker (1981). From the average variance extracted (AVE), values were all above the 0.50 threshold. It was equally concluded that there was sufficient evidence of convergent validity.

4.1.5 Discriminant Validity: In order to satisfy the criteria for discriminant validity, the diagonal elements was compared with other corresponding row or column entry Barclay et al., (1995). From the squared AVE values shown in table 2, there sufficient evidence of discriminant validity as all items loaded highest on their targeted constructs as showed in table 2.

Table 2: Validity and Reliability measures

Construct	Crom-bach Alfa	Rho-A	Composite reliability	AVE	1	2	3	4	5	6
Cloud Computing Cost	0.87	0.85	0.89	0.63	**0.65**					
Ease of use	0.72	0.69	0.80	0.52	0.36	**0.74**				
Performance	0.79	0.84	0.86	0.52	0.62	0.66	**0.76**			
Use	0.88	0.90	0.90	0.56	0.62	0.52	0.74	**0.86**		
TTF	0.85	0.89	0.89	0.54	0.61	0.71	0.64	0.59	**0.74**	
Satisfaction	0.88	0.89	0.92	0.75	0.51	0.53	0.72	0.61	0.78	**0.85**

4.2 The Structural Model

The inner model is majorly centered on (a) the predictive ability of the adopted model and (b) the statistical significance of the estimated model coefficient.

The result of the SEM analysis showed that 63% of performance impact was predicted by user satisfaction, system use and task technology fit. From the analysis, cloud computing system use contributed 46%, user satisfaction recorded 42% while TTF contributed 4% in the determination of performance. Similarly, the endogenous variable called usage was predicted 56% through its

precursors such as ease of use and perceived cost of cloud computing technology with each contributing 57% and 38% respectively. On the post usage satisfaction, while TTF contributed 3% to user satisfaction of cloud computing, usage on the other hand recorded 60% contribution resulting to 38% overall user satisfaction. Conversely, 37% of performance was not explained by the precursors and 44% of system use and 72% of user satisfaction were equally not explained by the independent variables as contained in the model.

It can be concluded that the model displayed a very high predictive power suitable for the study. The result of the study demonstrated that maximum performance can be enhanced through cloud computing technology utilization and user satisfaction instead of the anticipated TTF contrary to the findings of Goodhue and Thompson (1995) and proponents of the TTF construct. The SEM result is shown in figure 3.

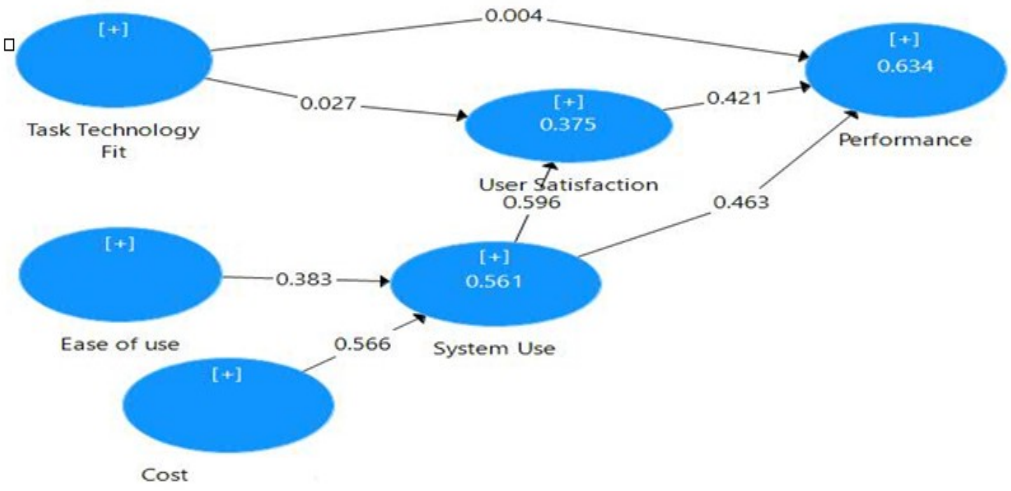

Figure 3: SEM Result

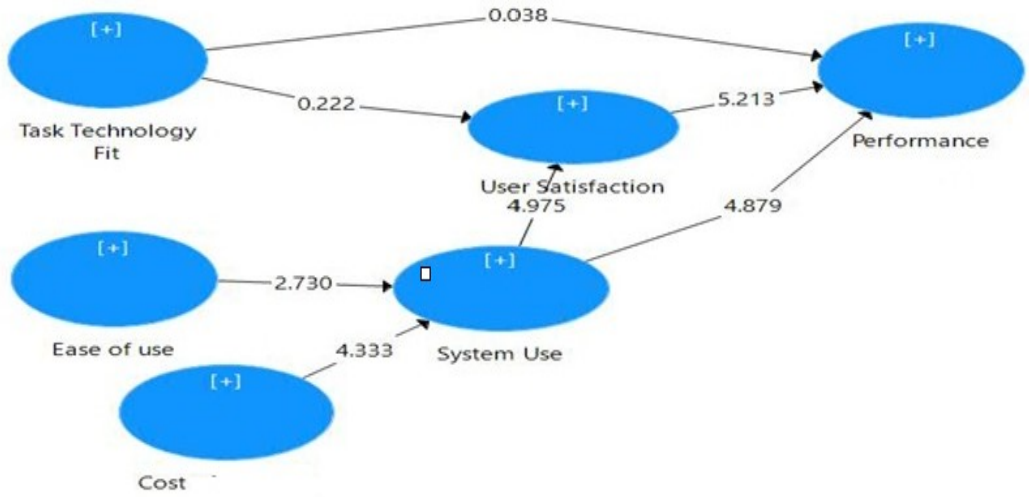

Figure 4: Bootstrapping Result

4.2.2 The statistical significance of the estimated model coefficient

Out of the three hypothesized determinant of performance, cloud computing usage recorded a significant relationship with (t-values 4.78, p>0.00) and end user satisfaction with (t-values 5.11, p>0.00).

Consequently, H_3 and H_7 hypotheses were supported as having a significant relationship with performance. The result of H_3 agreed with the work of El-Masri et al (2023) that concluded that continuous smartwatch use results to better performance outcomes. Similarly, the study agrees with the work of Howard & Rose, 2019] that equally concluded that information system usage results to positive performance outcomes. In addition, from the satisfaction based dimension, the result agrees with the work of Osang and Mbarika (2019) that confirmed that user satisfaction significantly influences performance.

The hypothesized relationships between cloud computing cost (H_1) and ease of use (H_2) as predictors of cloud computing usage were supported with t-values of 4.45, p>0.00 and t-value 2.55, p>0.00 at 0.05 level of significance. By implication, cloud computing users in open and distance learning institution considered cost implications as well as the ease of use of technologies as key determinants of usage. In other words, ODL learners consider affordability and user friendly interfaces as critical in encouraging cloud computing usage. This study agree with [Alismaili, Shen, 2016; Ali, Soar and Yong, 2016] that argued that the cloud computing model offers low start-up costs, low procurement of software, hardware, experimentation and implementation cost thereby resulting to increased usage. The findings on ease of use is in line with the work of Zhang, et al. (2018) that concluded that ease of use of cloud services significantly affects usage of cloud computing technologies. In the same vein, Alhassan, et al. (2016) concluded in their study that ease of use of cloud computing services among small and medium-sized enterprises (SMEs) has a significant influence on cloud computing adoption and usage.

The hypothesized relationship between TTF and user satisfaction (H_6) and TTF and performance (H_5) were not supported due to their low t-values of 0.25, p<0.82 and 0.87, p<0.90. This implies that ODL learners consider the difficulties in operating technologies as part of learning especially in a

compulsory learning environment. This study is not in line with the works of Wu & Chen (2017) that examined a self-reported individual-technology fit by measuring whether or not the MOOCs being used by students matches their learning styles. The study concluded that MOOCs is well fitted for the educational task and results to improved performance.

Table 3: Decision Table and Significance Level

Hypotheses	Paths	Original Sample	Sample Mean	Standard Deviation	T-Value	P-Value	Support For Hypothesis?
H_1	Cloud computing cost to Utilization	0.57	0.56	0.13	4.43	P<0.00	Yes
H_2	Ease of use to utilization	0.38	0.39	0.14	2.55	P< 0.00	Yes
H_3	Use to Performance	0.46	0.46	0.09	4.78	P<0.00	Yes
H_4	Use to Satisfaction	0.59	0.58	0.12	4.98	P< 0.00	Yes
H_5	TTF to Performance	0.04	0.02	0.09	0.87	P< 0.97	No
H_6	TTF to Satisfaction	0.03	0.05	0.09	0.25	P<0.82	No
H_7	Satisfaction to Performance	0.42	0.42	0.12	5.11	P<0.00	Yes

5. CONCLUSION

Understanding theoretical underpinnings determining human interactions and it impact on measurable outcomes remain a positive step towards it promotion and sustenance. Through the modified TUSPEM model, usage of cloud computing and satisfaction from the post-usage dimension was predicted. The methodology adopted provided reliable and analytical outcomes for decision making by ODL institution management. The adopted model showed sufficient evidence of high predictive power of the model (63%) in predicting performance impact by open and distance learners.

From the pre-adoption dimension, the significant relationship with usage serve as a call to cloud computing service providers, cloud computing services designers and administrators to pay much attention to the interface designs in terms of user-friendliness. The more users friendly the interfaces are, the easier the systems will be to be used. In a similar vein, The learners in this study were all open and distance learners from the National Open University of Nigeria. These students interact with cloud based services for their tutor marked assignment, research work and other academic activities. Results were obtained from this context and setting.

The provision of cost-effective cloud computing technologies for learners will in no small measure increase access to learners who ordinarily would not have access to quality education for all without boundaries. ODL institution's managers need to take deliberate decisions to subsidize the cost of data for learners'. This will ensure that privileged learners with internet data for continuous access will not be in an advantaged position over the have not within the same educational institution.

5.1 Further Research

Despite the increased values, the t-values of TTF failed to show significant influence in the cloud computing sector as asserted by several literatures. Further research is needed in exploring these

relationships in different sectors such as the banking, manufacturing and other sectors.

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