Information and Communication Technology Adoption: A Case study of Nigerian Tertiary Education Regulatory Agency

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Abstract - **This research study examines the factors that influence adoption of ICT in an organisation that regulates tertiary education in Nigeria based on UTAUT model. Loading factor and Kaiser-Meyer-Olkin (KMO) were used to validate the model. The results of the study show that social factors have positive significant impact on the intention to adopt ICT. The study found that organisational, economic and individual factors are not statistically significant with intention to adopt ICT. This suggests that public organisations should encourage use of social networks to perform their mandates and encourage employees to interact freely to enhance their skills.**

Keywords: Perceived usefulness, virtual networking; innovativeness, adoption, incentives, productivity

I. INTRODUCTION

Information and Communication Technology (ICT) is an indispensable tool in the twenty first century that is driving economic and social transformations leading the world to a digital society.ICT is a pervasive technology with wide spread applications, growing potentials and global impact. It has contributed immensely to enhance the capabilities of individuals and performance of organisations to achieve their goals. The future success or failure of organisations will continue to depend on whether they adopt ICTs or not. According to the World Bank, ICT is defined as "the set of activities which facilitate by electronic means, the processing, transmission and display of information" [1]. It invariably denotes the wide range of technologies that support sharing, distribution, communication and retrieval of information through computers and internetworking of computers (Internet).The combined usage of computers, smart devices and Internet has led to availability of unprecedented services to individuals, enterprises, corporations and Governments all over the world in almost all areas of human endeavours [2].

ICT adoption is reshaping, reorganising and restructuring work methods, business models and organisations. ICT adoption has been found to be instrumental to the integration of markets across different borders and increase the market size of international firms at little or no cost. It augments research and development endeavours in institutions and organisations at reduced cost and with more accurate outputs. ICT adoption is facilitating the development of different business platforms such as micro-manufacturing, innovation marketplace, e-commerce, online marketing and digital utilities are emerging to enable entrepreneurs to start their enterprises easily. These digital platforms are being used not only to match consumers with goods but increasingly to match employees with jobs. In order for private and public organisations to achieve their goals, meet the preferences of their customers, provide excellent services and innovative products, and expand their operations in line with the global best practices, there is a need for adequate adoption and diffusion of ICT within these organisations [2]-[4], [10].

Despite this aforementioned importance of ICT adoption by individuals and organisations, many of the developing countries are still having challenges of adopting and using ICT effectively to transform their socio-economic conditions of their countries. The Global Information Technology Report that rates ICT development globally using the Networked Readiness Index (NRI), ranked Nigeria as 119th among 139 countries investigated in 2016 [5].The data shows that Nigeria is not among the first 50 nations in the world that is leveraging ICTs for increased competitiveness and national prosperity. The Global IT report further shows that there is a low level of readiness to harness the huge benefits of ICTs and seize the opportunities that comes along with digital transformation. Nigeria is thus far behind among ICT developed countries.

Based on the current status of ICT development in Nigeria, it is desirable that a study be carried out to identify the factors that influence the adoption and subsequently the usage of ICT innovations in Nigeria with special focus on public organisations. Currently, not every public organisation is adopting and using ICT to perform their statutory functions. This often leads to delay in completion of assignments, poor

quality of job, inefficient service delivery, job dissatisfaction and loss of productivity. It is thus imperative to investigate the factors responsible for the adoption of ICT innovations in organisations, examine the contributions of each factor on ICT adoption and indirectly on organisational productivity.

Despite the motivations provided by Governments and practitioners to public organisations to adopt ICT innovation, very little research studies have been carried out to investigate the ICT adoption among government owned organisations in Africa. The influencing factors of ICT adoption in the public organisations in Nigeria, has not been studied extensively. Majority of the studies in Nigeria have focussed on Small and Medium Scale Enterprises (SMEs). For instance, in a study based on interviews conducted by [6] among owner-managers, heads of IT departments or IT professionals, and some other staff in 25 SMEs in Lagos, showed that the key drivers for ICT adoption amongst SMEs in Nigeria are the need for competitive advantage, customers satisfaction, and need to save time and cost. Reference [7] examined how social augmented parameters impact the adoption of ICT by small scale agribusinesses operating in Ebonyi State. The study based on focus group research method revealed that active social networks and government supports are the factors that affect ICT adoption among the agribusiness proprietors.

In [8], factors that affected the adoption of Information and Communication Technology in 17 industrial SMEs in different parts of Lagos State was carried out. Data collected using questionnaires and analyzed with logistic regression technique showed that ICT cost was the most potent factor in the adoption of ICT by SMEs in Nigeria. Availability of ICT infrastructure, Government and management supports are also important factors that determine the adoption of ICT by SMEs in Nigeria. Moreover, a study by [9] investigated how perceived usefulness, perceived ease of use, perceived cost of deploying ICT, owner, top management support and organizational readiness affect the use of ICT system amongst SMEs in Rivers State. Results obtained from the study revealed that perceived usefulness of ICT and cost of deploying ICT are the determinants of ICT adoption by SMEs.

In a related study, [12] assessed the determinants of ICT adoption for improved SMEs performance at Awka, Nnewi, Ekwolobia and Onitsha in Nigeria. The study concluded that capital base, turnover and asset values of businesses have significant influence on ICT adoption. A study by [10] investigated the determinants of ICT adoption by Micro and Small Enterprises in the Federal Capital Territory, Abuja in Nigeria. The empirical study based on multiple regression analysis identified competitive pressure, Government support, employer's skill and knowledge are the key factors that influence the adoption of ICT by these enterprises.

There is thus a limited or no research study that focuses on the factors that influence or impede the adoption of ICT innovations in the Nigerian public organisations. It is therefore imperative to perform a study to fill this gap by extending the previous work by [12] based on UTAUT model. The following hypotheses are formulated for the study:
H(1): Individual factors have no influence on ICT adoption.

H(2): Organizational factors have no impact on ICT adoption.
H(3): Social factors have no influence on ICT adoption.
H(4): Economic factors have no impact on ICT adoption.

This research study is thus undertaken to fill the existing gap in the literature, that is, to investigate the factors that influence adoption of ICT innovations in a tertiary education regulatory agency in Nigeria.

II. MATERIALS AND METHOD

A. Adoption of ICT innovations in the Nigerian Public Organisations

Public organisations are the backbone of policies and programmes implementation of the Government at the Federal or State level. In the Nigerian context, their main focus is to provide and serve as catalyst for affordable and quality service delivery to the general public. These essential services in the areas of oil and gas, power, public finance, agriculture, commerce and industry, education, defence, transportation, manufacturing, health, sport administration, communication, infrastructural and housing development among others are provided to improve the welfare and standard of living of the citizenry, and may be complemented by the private sector. In other instances, public organisations are established to regulate firms operating in a particular industry or sector of the economy.

However, the effectiveness and efficiency of public sector organisations in Nigeria and other developing countries are generally below average. It is marked with low quality and access, lack of fairness, justice and equity, discrimination, favouritism, absenteeism, lack of motivation, obsolete office equipment and operational vehicles, poor work environment, inadequate funding, poor maintenance culture, corrupt and unethical practices. Hence, there is a need to reform public sector organisations in order to improve their service to satisfy public needs, please people and firms as much as possible, favour good governance and national competitiveness [13].

Typewriters, analogue landline telephones, televisions, facsimiles, radios, telegraphy, telex, Private Automated Branch Exchange were the first set of electronic resources used in the Nigerian public organisations as far back as colonial era until the late 1980s when personal computers (PCs) became available in the Nigerian markets. Although, few mainframe computers existed in Nigeria before then, but their use were restricted to few universities, research institutes and military institutions in Nigeria. The introduction of PCs to perform word processing, desktop publishing, data processing, accounting and statistical analysis in the ministries, department and agencies (MDAs) in Nigeria marked the beginning of diffusion of ICT-based resources into the public organisations.

Furthermore, motivation for ICT adoption in the Nigerian public organisations could also be traced to the introduction of Internet service to Nigeria in 1995 through the Regional Informatics Network for Africa (RINAF) project sponsored by the United Nations Educational Scientific and Cultural Organisations (UNESCO), licensing of Global System for

Mobile Communications (GSM) operations in 2001, mandatory computer appreciation training workshops for the public service employees and massive award of contracts for ICT based resources in the last two decades in the public service. Subsequently, some MDAs has websites to establish their online presence and making their activities, reports and relevant information available to interested members of the public.

B. Conceptual Framework

The conceptual framework for this study is based on previous study on SMEs by [12]. The study was based on UTAUT model. The motivational or influencing factors for ICT adoption were grouped into three main factors:

- Individual factors: These are made up of three variables: *Perceived usefulness, Experience; and Innovativeness.*
- Organisational factors: These consist of three variables: *Training, Managerial support, and Incentives.*
- Social factors: These consist of three variables: *Virtual networking, Peers and Government's role.*
- The fourth factors that were added to the model, referred to as the economic factors. These consist of three variables: *Income, Cost, and Inflation.*

The proposed research model for this study is shown in fig. 1.

1) *Individual factors:* Perceived usefulness is defined as "degree to which an individual considers that adopting particular technological innovation would improve his or her working performance" [14]. Experience refers to the number of years an individual has being using ICT-based resources or technological innovation. Personal innovativeness is defined "as the willingness of an individual to learn and adopt any technological innovations" [15]. It relates to the positive attitudes of individuals toward adoption of technological innovation and usage [12].

2) *Organisational factors:* Training can be defined as systematic activities to improve the knowledge, attitude, competency and skills of employees in an organisation. Management support is regarded as the conscious effort of the Management to create a conducive environment and allocate greater resources to ICT infrastructure in an organisation. Incentives are integral parts of the reward and punishment systems within organisations. Incentives such as commissions, bonus, promotion, national and international recognition/awards are presented to employees who performed well to meet organisational goals while punishment or penalties such as warning, suspension and demotion are given to employees who performance woefully in the course of their duties [12].

3) *Social factors:* Virtual networking is described as community of Internet users that interact with each other through specific websites or social media networks. It offers huge opportunities for users to connect with each other irrespective of their locations [16]. Employees have important roles to play in providing encouragement, innovation and moral support to their peers within the same organisation.

They interact, communicate and work with one another. Government and its agencies are expected to be active in supporting the adoption of ICT innovation in organisations. Government has responsibility to develop comprehensive policies that will promote adoption of ICT innovation and improve organisation performance and productivity.

4) *Economic factors:* Income denotes the aggregate of all the salaries, wages, profits, interest payments, allowances, benefits, rents and other kinds of earnings received by an individual within a given period of time. Consumers' income is an important determinant of the purchasing power of individuals to consume or demand for goods and services such as ICT innovation. Cost refers to the total cost of deploying ICT based resources in an organisation. It reflects all the expenses associated with adding and integrating ICT-based resources into the workplace. Inflation is an economic condition that shows a sustained rise in the general price level of goods and service in an economy over a specified period of time. Inflation reflects a reduction in the purchasing power of a nation's currency. This means that fewer items are purchased by the monetary unit during the inflation period [8].
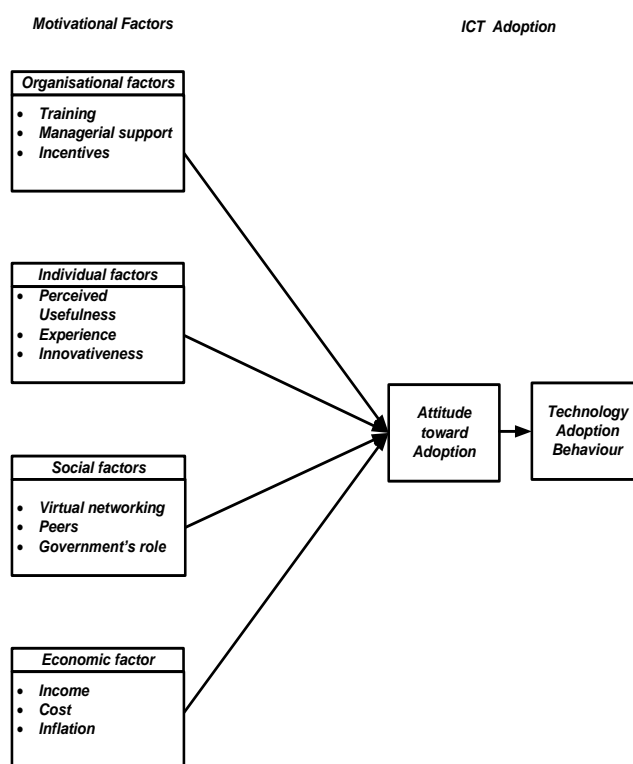

Fig. 1 Model for conceptual framework

C. Data Collection

The study involved a population of 120 respondents. The source list was obtained from the Human Resources Department of the tertiary education regulatory agency in Nigeria. The data collected from the 105 respondents out of 120 were processed, tabulated and analysed with Stata 13 statistical software package. The survey questionnaires were distributed to collect data for the research study in two phases.

The first phase was the pilot survey to test and modify the questionnaire while the second phase was the actual data survey and collection. All questions stated in the questionnaire were linked to the indicators in the conceptual framework or model proposed for the study in fig 1.The graphic rating scales were used to measure the attitudes, opinions or responses of the respondents. Each statement in the questionnaires had simple alternative or multiple choice of responses that the respondents chose from a 5-level of Likert scale of agreement or disagreement.

D. Model Specifications

ICT adoption (ICTA) is the dependent variable while the independent variables are: individual factors (IF), organisational factors (OF), social factor (SF), and economic factors (EF). The model for study is thus specified as:

$$ICTA = f\left(IF, OF, SF, EF\right) \tag{1}$$

$$ICTA_i = \beta_0 + \beta_1 IF_i + \beta_2 OF_i + \beta_3 SF_i + \beta_4 EF_i + e \tag{2}$$

Where

β_0 = model intercept or constant

$\beta_1, \beta_2, \beta_3, \beta_4$ = beta coefficients of the model

e = model error term

III. RESULTS

A. Descriptive Statistics

Table I showed the descriptive statistics for the variables of this study. The mean of individual factors was 3.720635, the minimum and maximum values were 2.5 and 4.833333, respectively. The standard deviation was .5160331. It showed that the variations of individual factor values from the mean value were small. The mean of organizational factors was 3.755556, the minimum and maximum values were 1.833333 and 4.833333, respectively. The standard deviation was .495744. It showed that the variations of organizational factor values from the mean value were small. The mean of social factor values was 4.142857, the minimum and maximum values were 1.166667 and 5, respectively. The standard deviation was .6164711. It showed that the variations of the social factor values from the mean value were small. The mean of economic factor values was 3.604762, minimum and maximum values were 1.833333 and 4.833333, respectively. The standard deviation was .5127942. It showed that the variations of economic factor values from the mean value were small. The mean of ICT adoption values was 4.093651and minimum and maximum values were 1.333333 and 5, respectively. The standard deviation was .5449476. It showed that the variations of ICT adoption values from the mean value were small.

TABLE I
DESCRIPTIVE STATISTICS OF THE VARIABLES OF THE STUDY

Variable	Obs	Mean	Standard Deviation	Minimum	Maximum
IF	105	3.721	.516	2.5	4.833
OF	105	3.755	.496	1.833	4.833
SF	105	4.142	.616	1.167	5
EF	105	3.604	.513	1.833	4.833
ICTA	105	4.093	.545	1.333	5

B. Correlation Analysis

Table II shows the results of correlation analysis of the data used for the study. A review of the correlation matrix revealed that there are significant relationship between the dependent and independent variables. The correlation coefficient between individual factors and organizational factor was 0.067. It showed a weak and positive association between the two variables. The correlation coefficient between individual factors and social factors was 0.251. It indicated a weak and positive relationship between the two variables. The correlation coefficient between individual factors and economic factors was 0.2873. It showed a weak and positive relationship between the two variables. The correlation coefficient between individual factors and ICT adoption was 0.212. It indicated a weak and positive association between the two variables.

The correlation coefficient between organizational factors and social factors was 0.556. It showed moderate and positive association between the two variables. The correlation coefficient between organizational factors and economic factors was 0.167. It showed a weak and positive association between the two variables. The correlation coefficient between organizational factors and ICT adoption was 0.455. It indicated a moderate and positive relationship between the two variables. The correlation coefficient between social factors and economic factors was 0.394. It showed a moderate and positive relationship between the two variables. The correlation coefficient between social factors and ICT adoption was 0.645. It showed a moderate and positive association between the two variables. The correlation coefficient between economic factors and ICT adoption was 0.3784. It indicated that a moderate and positive association between the two variables.

TABLE II
CORRELATION MATRIX OF THE VARIABLES FOR THE STUDY

Variable	IF	OF	SF	EF	ICTA
IF	1.000				
OF	0.0667	1.000			
SF	0.251	0.556	1.000		
EF	0.287	0.167	0.394	1.000	
ICTA	0.212	0.455	0.645	0.378	1.000

C. Multicolinearity

The results of multicollinearity test are shown in Table III. It was observed that the highest Variance Inflation Factor (VIF) and lowest tolerance were 1.73 and 0.579693respectively for individual factors and the lowest VIF and highest tolerance were 1.12 and 0.889579 respectively for economic factors. The mean value of VIF was obtained as 1.39. The results showed that all the VIF values were below 4 and tolerance values were above 0.2. The degree of multicollinearity in the data was very low (Hair et al., 2006).

Variable	VIF	1/VIF
IF	1.73	0.579693
OF	1.46	0.683636
SF	1.24	0.804753
EF	1.12	0.889579
Mean VIF	1.39	

D. Reliability

Table IV shows the Cronbach's Alpha as 0.7287. This shows that the instrument has good reliability. This is as a result of the Cronbach's Alpha value that is higher than recommended value of 0.7.

TABLE IV
RESULTS OF RELIABILITY TEST

Variables	Observations	Cronbach's Alpha
IF	105	0.7585
OF	105	0.6979
SF	105	0.5887
EF	105	0.7045
ICTA	105	0.6251
Test Scale		0.7287

E. Validity

The validity test of the model was carried out using Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and factor loading. The results of the validity test are shown in Table V. The KMO values for all the variables are more than 0.5. Factor loading of all variables are more than 0.3. This validates the model as suitable for the study.

TABLE V
RESULTS OF VALIDITY TEST

Variable	KMO	Factor loading
IF	0.7487	0.4234
OF	0.7289	0.6814
SF	0.6905	0.8677
EF	0.7793	0.6132
ICTA	0.7532	0.8225

F. Normality

The Shapiro-Wilk test was used in this study to test the normality of the data. From the results in Table VI, the W value is 0.80028. This value is high and indicates that the sample was normally distributed.

TABLE VI
RESULTS OF NORMALITY TEST

Variable	Obs	W	V	Z	Prob> z
res	105	0.800	17.18	6.325	0.000

G. Regression Analysis

The results of the regression analysis using Stata 13 package is shown in Table VII. From the results of the regression analysis, 45.1% of the variance on ICT adoption can be explained by the predictor variables of individual factors, organizational factors, economic factors and social factors.

Social factors had regression coefficient β of .4345212 with a t value of 5.05 and a p-value of .001. These indicated that as social factors increased by a unit, ICT adoption was positively influenced by 0.4345212 units. It is found that social factors with highest influence on ICT adoption in organisations. Organisational factors had regression coefficient β of .1703025 with a t value of 1.73 and a p-value of .087. These showed that as organizational factors increased by a unit, ICT adoption was positively influenced by .1703025units. This is considered as the second most influencing factors to ICT adoption in organisations.

Economic factors had regression coefficient β of .1580302 with a t value of 1.80 and a p-value of .075. These indicated that as economic factors increased by a unit, ICT adoption is positively influenced by .1580302 units. It was observed as the third most influencing factor to ICT adoption in organisations. Individual factors had regression coefficient β of .0372911 with a t value of .45 and a p-value of .654. These showed that as individual factors increased by a unit, ICT adoption was positively influenced by .0372911 units. This is found to be the least influencing factor to ICT adoption in organizations.

TABLE VII
RESULTS OF THE REGRESSION ANALYSIS

Variables	Coefficient	Standard Error	t	P(t)
IF	.0372911	.08293	0.45	0.654
OF	.1703025	.0984717	1.73	0.087
SF	.4345212	.0859943	5.05	0.000
EF	.1580302	.0877419	1.80	0.075
const	.9455031	.4432036	2.13	0.035
R-squared = 0.4514				
Adj R-squared = 0.4295				

IV. DISCUSSIONS

The results of hypothesis test showed that adoption of ICT is statistically influenced by social factors. The p-value of performance expectancy was .0001 and was less than .05. Therefore, the null hypothesis was rejected. The study showed that the respondents believed that social factors determine behavioural intention to ICT adoption. The findings of the study suggested that integrating social networks into the activities of a regulatory agency improved employees' performance as well as support from Government enhances ICT adoption. It shows that employees adopt ICT to gain new knowledge and practices when the energy they will expend to get such information from the sources within or outside their organisations are minimal. Employees also adopt ICT when they perceive it as a useful and friendly medium to communicate with other employees within organisations. It also suggests that interaction of employees with their peers that are computer proficient improve ICT adoption in the organization. The implication of this finding is that employees adopt ICT because it facilitates open and honest communication between individuals within organisations that develop strong bond and synergies. Thus, the behaviour of peers who show positive attitude towards adoption of the ICT within organisations inspires their colleagues to adopt the technologies. The interventions of Government to develop

comprehensive policies and plans to develop ICT enable employees to adopt ICT. In addition, Government supports for research and development also plays an important role in adopting ICT.

The *p*-value of organizational factors was 0.087 and greater than .05. The results supported the null hypothesis formulated for this study. The result showed that ICT adoption is not statistically influenced by organizational factors. The findings suggest that ICT adoption in the organization does not depends on elaborate training, support and motivation provided by its management. It could be deduced that employees do not depends on the organization to provide them with ICT based resources to perform their activities. They have decided to adopt ICT due to the benefits associated with it. The findings of the study further suggest that the policies, strategies, decisions and actions of the Management may not be solely responsible for employees to adopt ICT within the organisation. The finding also shows that ICT adoption does not depends on incentives such as commissions, bonus, promotion, recognition or awards presented to employees who performed well to meet organisational goals or punishment or penalties such as warning, suspension and demotion are given to employees who performance woefully in the course of their duties.

The *p*-value of economic factors was .075 and greater than .05. Therefore, the null hypothesis was support. It means that economic factors have no significant impact on ICT adoption. The findings showed that ICT adoption in the organization does not depends on the inflation and cost of the ICT-based resources, and income of the employees. The importance of ICT to employees' performance on the job usually motivates employees to adopt the technology rather than its cost or prevailing economic conditions. The implication of these finding is thatthe cost of installing new ICT systems, providing security systems, providing back-up power supply, and extending building spaces may not affect the behavioural intention to adopt ICT.

The *p*-value of individual factors was .654 and greater than .05. Therefore, the null hypothesis that individual factors have no significant influence on ICT adoption was supported. The results showed that ICT adoption does not depends on current and past experience of employees on ICT and related issues. It further suggests that ICT adoption is not related to enthusiasm of the employees to use the technology. Organizations may adopt ICT not because it improves performance and effectiveness of their employees but as a result of organizational and Government policies that require that its operations be digitalized.

V. CONCLUSION

There is a noticeable increase in the adoption of ICT in public organisations in Nigeria but no research studies have been undertaken to determine the factors that influence this development in the public organisations to the best our knowledge. The focus of this study is to investigate the factors that influence intention to adopt ICT in a tertiary education regulatory agency in Nigeria. In order to perform the study a

model is proposed and validated. The empirical results show that the social factors have direct positive effect on the adoption of ICT in a public organisation in Nigeria. The study also finds that economic factors, organisation factors and individual factors do not have significant impact on ICT adoption. This implies that Government should provide incentives and supports to organisations in order to boost ICT adoption among public organisations. Future studies may be carried out to cover a large number of public organisations in Nigeria to confirm the findings of this study.

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