Adoption of E-Voting Systems: A case study of Independent National Electoral Commission (INEC), Nigeria: A Preliminary Study

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ABSTRACT

The trend in the technological development has made the use of computer and its supporting technologies mandatory in virtually all aspects of life. This is never an exception in the conventional voting process. Several issues have been revealed associated with the manual voting system which makes it inappropriate in the emerging technology-driven society. Several countries have successfully implemented an electronic voting technology. Considering Nigeria as a developing nation with quite a number of constraints regarding technological innovations, there is therefore the need to investigate the readiness on the part of the organization empowered to conduct elections in the country (INEC) so as to pave ways for its successful implementation. In this paper, the relationship among the variables of adoption evidenced from the previous literature was investigated using correlation coefficients and multiple linear regressions. As a pilot study, only 47 responses were captured from senior staffs of INEC. The results show that there is strong relationship between the variables examined.

Keywords: Readiness, electronic voting, adoption, technology-driven.

I INTRODUCTION

Elections allow the populace to choose their representatives and express their preferences for how they will be governed. Naturally, the integrity of the election process is fundamental to the integrity of democracy itself. The election system must be sufficiently robust to withstand a variety of fraudulent behaviors and must be sufficiently transparent and comprehensible that voters and candidates can accept the results of an election. Unsurprisingly, history is littered with examples of elections being manipulated in order to influence their outcome (Kohno, Stubblefield, Rubin & Wallach, 2004).

The problems with manual voting and voting system has led some countries of the world to adopt the use of Electronic Voting (E-Voting) Technology (System) which is considered as a better and cost effective voting systems (Ezegwu, 2006). A good E-Voting system must ensures that: only person with the right to vote are able to cast a vote; every vote is counted but only once; maintain voter's right to express his or her opinion without any undue influence; protect the secrecy of vote at every stage of voting process; guarantee accessibility to all voters, especially persons with disabilities and to increase voter's confidence by maximizing transparency of information on the functions of each system (ACE Electoral Knowledge Network, 2011).

Successful adoptions and implementation of E-Voting in India, Brazil, Estonia and pilot projects in Australia, Austria, Belgium, United Kingdom, Germany, Canada, France, Norway, Ireland, Portugal, Spain and Switzerland shows that E-voting technology is reliable and secure and can be adopted by other countries, most specially developing democracies such as Nigeria, Ghana and State of Qatar (ACE Electoral Knowledge Network, 2011;AlJa'am, Alkhelaifi, Al-Khinji& Al-Sayrafi, 2009; Umonbong, 2006; Selorem, 2010). This shows that the proposed research is in the recent trend of global technological innovation.

Some research findings, however caution against the adoption of E-Voting technology as an alternative to manual voting systems due to software challenges, insider threats (abuse), network vulnerabilities and the challenges of auditing (Mercuri, 2010; Blanc, 2007).

Prasad et al., 2010 carried out security analysis of India's E-Voting machines and concluded that "despite the machines' simplicity and minimal software trusted computing base, they are vulnerable to serious attacks that can alter election results and violates the secrecy of the ballot". The analysis of U.S. E-Voting System by Kohno et al., 2004 shows that the E-Voting System analyzed is unsuitable for use in a

general election due to several problems such as unauthorized privilege escalation, incorrect use of cryptography, vulnerabilities to network threats, poor software development processes and insiders threat (i.e. votes modifications, violation of voters privacy and matching votes with voters). They suggested a voting system that has a "voter-verifiable audit trail".

Nigeria has over the years used the manual system of voter registration and paper ballot for its registration and voting processes. The successes of the system in terms of the transparency, freeness and fairness of elections have been a mixed bag. Elections in Nigeria have been fiercely contested and disputed and this has sometimes moved Nigeria towards lawlessness, deaths, destruction of properties, detention of opponents, and civil war. In each election, the political class improves on their modes and methods of electoral manipulations (Okoye, 2010). Nigeria joined other countries with the recommendation of the 2005 National Political Reform Conference, and eventual adoption of E-Voting system by the Independent National Electoral Commission (INEC) in 2005 (Ezegwu, 2006). This notwithstanding, the technology is yet to be implemented in Nigeria. Thus, doing this requires an adoption study for its successful implementation.

A communiqué jointly signed by Independent National Electoral Commission(INEC) of Nigeria and Nigeria Computer Society identified mass thumb printing of balloting papers; ballot stuffing; snatching of ballot boxes; impersonation of voters; multiple registration and errors due to manual collation of results as some of the challenges faced by the current voting system. That this challenges can be overcome with the adoption of E-Voting system (Adepetun & Orimisan, 2009). This serves as one of the sources of motivation for this research.

Voting is central to the change in political reigns in virtually all countries of the world. Various issues associated with the conventional manual voting have paved ways for the emergence of E-voting system in most developed nations (ACE Electoral Knowledge Network, 2011;AlJa'am, Alkhelaifi, Al-Khinji & Al-Sayrafi, 2009; Umonbong, 2006; Selorem, 2010). Research findings suggest that Nigeria's political problems revolve around the context of conducting free, fair, credible and acceptable elections (Iteshi, 2006; Nkanga, 2006; Eze, 2011). Nigeria has a history of hotly contested elections: 1959, 1964/65, 1979, 1983, 1999, and 2003 (Obi, 2007). The 2007 and of recent 2011 elections did not fare better either. What has failed is the electoral system (Clark, 2007). Major challenges associated with the failed electoral system are man-made and it includes; mass thumb printing of balloting papers; ballot stuffing; ballot boxes snatching; voters impersonation; multiple registration and inflation of results figures during collation. These Challenges can be overcome by adopting E-Voting system (Adepetun & Orimisan, 2009; Waturuocha, 2009; Iteshi, 2006; Aghwotu, 2006; Umonbong, 2006; Ayo, Adeniyi & Fatudimu, 2008).

The research findings by Ayo et al. (2008) shows majority of respondents (voters) supporting the adoption and implementation of E-Voting system due to its capability to solve some of the problems associated with paper balloting. There is therefore the need to study or investigate the adoption of this technology within Nigerian context from organizational perspective since there is an acceptable level of readiness on the part of users (Ayo et al., 2008) but still, there are bottlenecks towards its implementation. The researcher is therefore interested in determining the factors that can predict INEC readiness to adopt and implement E-Voting system. In carrying out this study, the researcher explores the beauty of combining the joint predictive of the two models used as the basis.

II Research Model

Although, there are many theories in Information Systems used to study technology adoption, Oliveira and Martins (2011) considered Diffusion on Innovations (DOI) and Technology-Organization-Environment (TOE) prominent within the organizational context. They argued that for more complex new technology adoption, it is important to combine more than one theoretical model to achieve a better understanding of the technology (IT) adoption. This study proposed an underlying model of E-Voting Systems adoption refer to as EVS Adoption Model (EVSAM) which combined DOI, TOE, and Lacovou et al (1995) models to identify technological, organizational, environmental, and benefits factors that affect decisions to adopt E-Voting Systems by Independent National Electoral Commission (INEC), Nigeria. Four constructs: Technological Readiness (TR), Organizational Readiness (OR), Perceived Benefits (PB), and Environmental

Factors (EF) were identified for the model. *Organizational readiness* was derived from the three frameworks of Rogers (1995), Tornatzky & Fleischer (1990), and Lacovou et al. (1995) . The *Perceived benefits* construct came from Lacovou et al (1995) model, while *Technological readiness and Environmental factors* is a combination of TOE from Tornatzky & Fleischer (1990) model. This is as shown in figure 1 below.

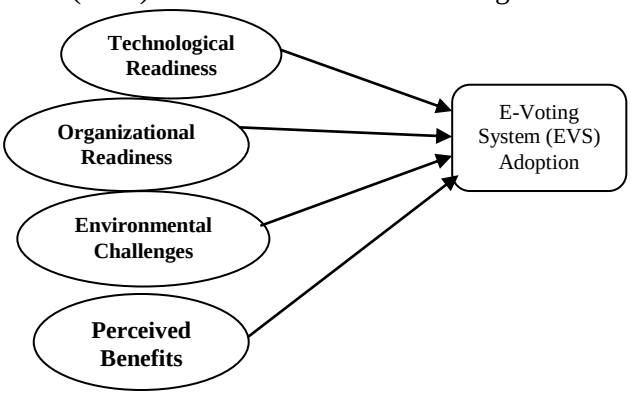

Figure 1. Proposed E-Voting Systems Adoption Model (EVSAM)

(a) *Technological Readiness* describes two variables: Technology Evaluation Metrics and Technological Resources. (b) *Organizational Readiness* defines variables such as Centralization, Compatibility, Public education, Attitude to change, Slack, Size, interconnectedness , Corporate governance, Awareness. (c) *Perceived Benefits* describes Accuracy of vote count, Multiple voting, Ballot stuffing, Multiple registration, Ease of use, and Vote manipulation. (d) *Environmental Factors* defines Infrastructures, Government regulations, Legal framework, Organizational independence, Voters attitude, Political Parties support.

III Results and Discussion

A. Demographic Variables

WorkingExperience: Among the sampled respondents, 6.4% which make up 3 individuals were under 5 years of Working Experience, 26 individuals who make up 55.3% of respondents were between 5 and 10 years of Working Experience, 10 individuals who make up 21.3% of respondents were between 10 and 20 years of Working Experience while only 8 individuals who correspond to 17.0%% of respondents were above 20 years of Working Experience. This is as shown in table 1 below.

Table 1: Working Experience

		Frequency	Percent
Valid	Less than 5 years	3	6.4
	5-10 years	26	55.3
	10-20 years	10	21.3
	Above 20 years	8	17.0
	Total	47	100.0

Qualification. A total number of 9 respondents which accounted for 19.1% of the respondents were Diploma holder, a total of 34 respondents which accounted for 72.3% of the respondents were first degree (B.Sc.) or Higher National Diploma (HND) holder while a total of 4 respondents which accounted for 8.5% of the respondents were Master holder. See Table 2 below.

Table 2: Qualification

		Frequency	Percent
Valid	Diploma	9	19.1
	B.Sc./HND	34	72.3
	Master	4	8.5
	Total	47	100.0

B. Reliability of Research Constructs

*Technological Readiness (TR).***TR** is a construct under this quantitative instrument (questionnaire) and it has twenty-one items whose reliability was measured with Cronbach's alpha (α). Items under this construct (dimension) are considered reliable with average Cronbach's alpha (α) 0f 0.817 which is greater than 0.7 (Pallant, 2001) as shown in Table 3.

Table 3: Reliability Analysis

Variable	Cronbach's Alpha (α)	No of Items
TR	0.817	21
PB	0.769	15
OR	0.882	20
EF	0.762	10
EAD	0.853	5

*Perceived Benefits (PB).*The fifteen (15) items under this construct (dimension) are found to be reliable with the average Cronbach's alpha (α) of 0.767 which is greater than the benchmark of 0.7 (Sekaran, 2000; Pallant, 2001, Olakunle, 2003) as shown in Table 3.

*Organizational Readiness (OR).*The readiness of the organization to adopt E-Voting Systems is a construct in this study with twenty items, the reliability of which was measured using

Cronbach's alpha (α) with recorded value of 0.882. According to Sekaran (2000), items under a construct (dimension) with the average Cronbach's alpha (α) greater than 0.7 are reliable. Therefore, OR in this study with an average Cronbach's alpha is reliable as shown in Table 3.

*Environmental Factors (EF).*EF, a construct under this study ten items whose reliability was measured with Cronbach's alpha (α) of 0.762 which is considered reliable (Sekaran, 2000; Pallant, 2001). See Table 3.

*EVS Adoption (EAD).*EAD is a construct under in this study with five items whose reliability was measured with Cronbach's alpha (α) as 0.853. BI in this study is therefore reliable with an average Cronbach's alpha greater than 0.7 (Sekaran, 2000; Pallant, 2001). See Table 3.

Technological Readiness and EVS Adoption. The bi-variate analysis (correlation) between the average of TR and the average of EAD was measured and the value is given by 0.658 which shows high correlation significant at 0.01 level (i.e. <0.05) as shown in Table 4. This correlation value means that TR can explain 65.8% variance of EAD which means that the Technological Readiness influence the EVS Adoption. Thus, the higher the TR, the higher the EAD.

Table 4: Correlation between TR and EAD

		AVEAD	AVTR
AVEAD	Pearson Correlation	1	.658**
	Sig. (2-tailed)		.000
	N	47	47
AVTR	Pearson Correlation	.658**	1
	Sig. (2-tailed)	.000	
	N	47	47

**. Correlation is significant at the 0.01 level (2-tailed).

Perceived Benefits and EVS Adoption. The analysis of correlation between the average of PB and the average of EAD was measured and the value is given by 0.456 which shows that PB influences on EAD. The correlation is significantly at 0.01 level i.e. <0.05, as shown in Table 5.

Table 5 PB and EAD

		AVEAD	AVPB
AVEAD	Pearson Correlation	1	.456**
	Sig. (2-tailed)		.001
	N	47	47

		AVEAD	AVOR
AVEAD	Pearson Correlation	1	.869**
	Sig. (2-tailed)		.000
	N	47	47
AVOR	Pearson Correlation	.869**	1
	Sig. (2-tailed)	.000	
	N	47	47

**. Correlation is significant at the 0.01 level (2-tailed).

AVPB	Pearson Correlation	.456**	1
	Sig. (2-tailed)	.001	
	N	47	47

**. Correlation is significant at the 0.01 level (2-tailed).

Organizational Readiness and EVS Adoption. The analysis of correlation between the average of OR and the average of EAD was measured and the value is given by 0.869 which shows that OR has a high influence on EAD by 68.9%. The correlation is significant at 0.01 level i.e. <0.05, as shown in Table 6.

Table 6: OR and EAD

Environmental Factors and EVS Adoption. The correlation between the average of EF and the average of EAD was measured and the value is given by 0.764 which shows high correlation significant at 0.01 level (i.e. <0.05) as shown in Table 7. This correlation value means that EF can explain 76.4% variance of EAD which means that the Environmental Factors influence the EVS Adoption.

Table 7: EF and EAD

		AVEAD	AVEF
AVEAD	Pearson Correlation	1	.764**
	Sig. (2-tailed)		.000
	N	47	47
AVEF	Pearson Correlation	.764**	1
	Sig. (2-tailed)	.000	
	N	47	47

**. Correlation is significant at the 0.01 level (2-tailed).

C. **Multiple Regression Analysis**

The researchers decided to run a preliminary regression analysis so as to test the predictive tendency of the model on the overall. From the result as shown in Table 8, the value of adjusted R^2 is 0.796 suggests that 79.6% of the variance in of adoption of E-voting is explained by the model. Thus, this informs the researchers of the appropriateness of the constructs constituting the

model in measuring the adoption of the technology under study.

IV CONCLUSION

Various issues associated with the conventional manual voting have paved ways for the emergence of E-voting system. This study aimed at exploring the factors influencing the E-Voting Systems adoption within the organizational context using Independent National Electoral Commission, Nigeria as the case study. The results shows that the four constructs, TR, OR, TB, and EF significantly predicated EAD. This is as a result of combining variables from three models of DOI, TOE, and Lacovou et al. The results equally show that organizational readiness highly impacted the adoption process of E-Voting when compared with other factors. The preliminary study helps to fill some gaps by providing insight into the issue of E-Voting adoption from the perspectives of developing country, Nigeria.

Table 8: Model Summary (Regression Analysis)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.902[a]	.814	.796	.3185

a. Predictors: (Constant), AVEF, AVPB, AVOR, AVTR

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