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AN ASSESSMENT OF THE EXTENT OF ADOPTION OF ELECTORAL TECHNOLOGIES IN NIGERIA'S ELECTORAL SYSTEM

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Abstract: This study identified the extent of adoption of the electoral technologies being used in Nigeria's electoral system to enhance the system. The study was carried out in the six (6) State offices of the Independent National Electoral Commission (INEC) in southwestern Nigeria, a geopolitical zone comprising Lagos, Oyo, Ogun, Osun, Ondo, and Ekiti states, and at the national head office of INEC, Abuja. Primary data were collected using semi-structured key informant interviews and 240 copies of structured questionnaires administered in the Information and Communication Technology/Voter Registry (ICT/VR) and Electoral Operations (EOps) departments of the commission. The questionnaire elicited information on the extent of adoption of electoral technologies, such as biometric technologies and electronic registers of voters. Semi-structured key informant interviews of one of the top managers were conducted to assess the manager's views on adopting electoral technologies in the commission. The study showed that out of the twenty (20) electoral technologies presented in this study, 99.5% had adopted both biometric technologies and electronic register of voters, election results viewing portals (99.1%), electronic voters' accreditation technologies (98.2%), electronic election results transmission technology (96.8%) and electronic voter ID or smart voter ID (94.1%). However, optical scan voting/scanned paper ballots (10.0%) and Internet voting technologies (6.4%) were rarely used. The study concluded that the extent of the adoption of electoral technologies in Nigeria's electoral system could be improved.

Keywords: Electoral Technologies, Extent of Adoption, Electoral system, Nigeria electoral management, Democracy, Electoral Integrity, Technology adoption.

INTRODUCTION

It is common knowledge that the disappointing voting experiences that Nigerian voters witnessed at the poll at one point or another are reflections of how badly Nigeria's democracy is performing. This reality has dealt Nigerians many blow uninvitedly. It has inflicted them with untold consequences of poorly managed governance and a flawed democratic system, which have positioned them inadvertently at the receiving end of several political and economic nativities. This narrative has been corroborated by the 2021 Democracy Index, in which Nigeria was ranked 107th among 108 democracies of the world, scoring 5.17 out of 10 points in the electoral process (EIU, 2022).

Democracy is people-centred. It is the government of the people. Democracy is the system in place when the people actively partake in governing themselves by majority votes. The concept of democracy is such that the people, owing to the size or expansiveness of their communities, recruit representatives or political leaders, who make rules, laws, and decisions and undertake community affairs on behalf of the people through the electoral process. Democracy essentially represents the effective contributions of the people to self-governance, powered by the majority's rules and balanced by the minority's rights (Edosa, 2014). Dahl (2020) posited that democracy is beneficial because it provides fundamental rights, general freedom, moral sovereignty, self-government, prosperity, peace-seeking, political equality, protection of essential personal interests, human development, and prevention of despotism.

However, it takes an election to authenticate democracy legitimized governance, and confirm the people's sovereignty in a democratic system of government. When the electoral integrity of the electoral system is compromised, it is bound to produce a flawed democracy (Ekong *et al.*, 2020). When considering both transitional and developed democracies, electoral integrity must take center stage. Thus, the key variables that could improve electoral integrity in Nigeria's electoral system are transparency, capacity building, and the independence of the electoral umpire (Omoleke, 2018).

Over a period of time, Nigeria's electoral system has been suffocating under the heavyweight of corrupt practices, fraudulent subversion, and other sharp practices that have ultimately messed up the people's votes, producing illegitimate leaders, causing a great deal of reduction in the rate at which people participate in the election (Lawal, 2015). In addition to the common knowledge that the 2019 general elections were badly marred by corruption, national and international observers, who covered the elections, reported numerous irregularities that need to be rectified (Kimpact, 2020). Thus, the process that addresses electoral fraud, malpractice, administrative irregularities, and violation of democratic principles throughout an electoral cycle, to achieve the conduct of free, fair, and credible elections, is a broad definition of electoral integrity (Sahoo, 2015). Therefore, to achieve the delivery of free, fair and credible electoral services, which, in general, is critical to building quality democracy, electoral integrity must be ensured.

The increasing levels of electoral malpractice and fraud are responsible for why electoral stakeholders, such as the electorate and politicians, are dissatisfied with the outcome of elections (Fortin-Rittberger *et al.*, 2017). When an electoral system is deficient in electoral integrity, political and electoral trust is ruined, leaving citizens who voted for political parties that were legitimately defeated in an election, distrusted of the government and its institutions (Mauk, 2020). Electoral disputations, which are reflected by petitions filed against an election, the conduct of the election, and its result, often result from the fact that the public, as well as the candidates, lack confidence in the electoral system and the results it produces (Otieno, 2016).

However, technologies can improve the electoral system by increasing its transparency, speed, accuracy, efficiency, and inclusiveness. It can also lower the cost of elections and increase voters' access to electoral services and processes. The introduction of technologies to some parts of electoral systems has positively impacted electoral integrity (Haque *et al*., 2020). Therefore, the deployment of information and communication technologies (ICT) into the electoral process in different democratic states was done to achieve several results, ranging from solving voter apathy problems, strengthening electoral integrity, ensuring the credibility of voter registration, enhancing the accuracy of the voter register, preventing voter fraud, and improving the speed of votes' collation and election results processing (Loeber, 2020).

According to Haque and Carroll (2020), electoral technologies refer to diverse sets of hardware, software and other related electronics or equipment that are deployed by electoral management bodies to enable effective administration, efficient management, and world-class delivery of electoral processes and services. The deployment of a smart card reader (SCR), an example of electoral technologies, into the Nigerian electoral system has been found to enhance the credibility of the 2015 general elections, thereby awakening voters' confidence in the Nigerian electoral system (Nwangwu *et al.,* 2018).

LITERATURE REVIEW

Relevance of Technologies throughout the Electoral Cycle

Considering the 2019 Manual for Electoral Training Study Cycle (ETSC) of the Independent National Electoral Commission (INEC), electoral cycles were designed and developed by some heavyweight aid donor countries and international agencies. For instance, after the fall of the Berlin Wall in 1989, electoral aid donors such as the United States of America, the United Nations, the European Commission, the International Institute for Democracy and Electoral Assistance (International IDEA), and the European Union have been relentlessly making ever-increasing and improved contributions to help build and grow the electoral process in many developing democracies across the globe (ETSC, 2019).

According to ETSC (2023), the electoral cycle is a pictorial planning, programing and operational tool created to rip off the difficulties obstructing the execution of long-term support in the field of election management. It was designed to help electoral development bodies, electoral aid provider agencies, electoral managers, and administrators in partner countries understand the recurrent nature of activities in the electoral process. According to the stance of the ECES (2014), the electoral cycle was developed on the shared basic understanding that elections are not a one-day show, but a multipart continuing process that has to do with inter-reliant phases and activities. Against this background, the electoral cycle approach to managing elections has become a procedural position, and has served as an answer to the lack of an articulated method for electoral aid programing.

The electoral experts therefore collaboratively fashioned the electoral cycle to transform electoral process theories into reality. The electoral cycle is divided into three major periods: the pre-election period, the election period, and the post-election period. Each of the periods of the electoral cycle, as detailed in Plate 1.0, encapsulates bundles of activities such as legal framework, planning and implementation, training and education, voter registrations and electoral campaigns, which were all categorized under the pre-election period; voting operation and verification of election results were categorized under the election period and finally auditing.

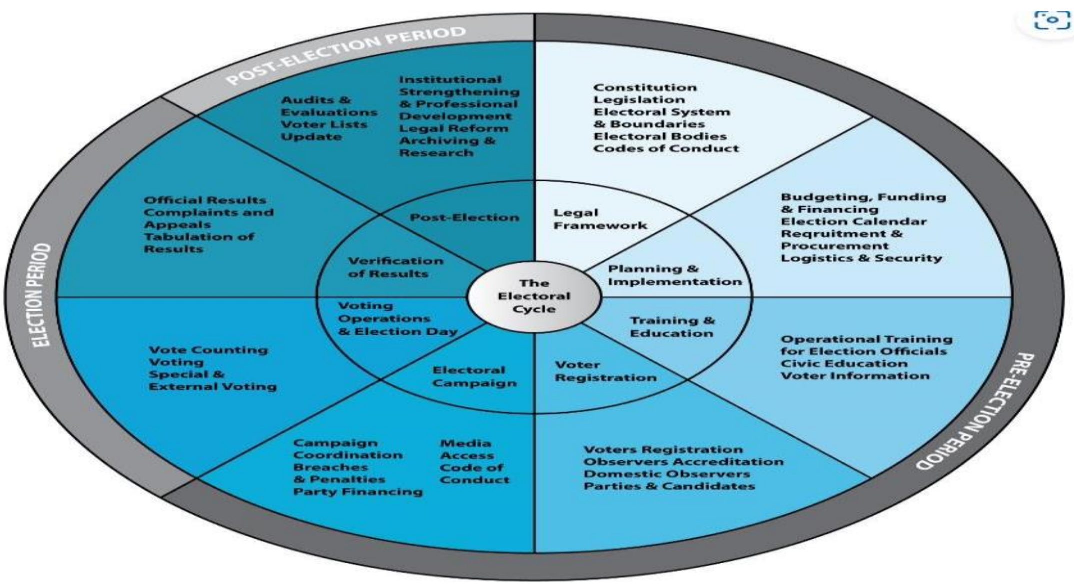

Plate 1.0: An electoral cycle's steps Source: ECES (2014).

Evaluations and voter list updates were categorized under the post-election period. These are the major activities that need to be performed to reach the set electoral goals. However, Plate 2.0 keenly detailed the relevance of technologies to electoral activities and processes throughout the electoral cycle. The inner-coloured wheel points out the nitty-gritty of electoral activities in each part of the election cycle, while the outer coloured ring recognizes the technologies used in each of the said parts. Also according to Plate 2.0, for instance, under the election period ring, which is the outermost layer, we have the voting operations, verification of election results, and other Election day activities. Immediately underneath this ring, we have detailed electoral activities such as tabulation of votes, the transmission of election results, voters' identification and authentication, and many other electoral activities that are carried out electronically with the aid of electoral technologies.

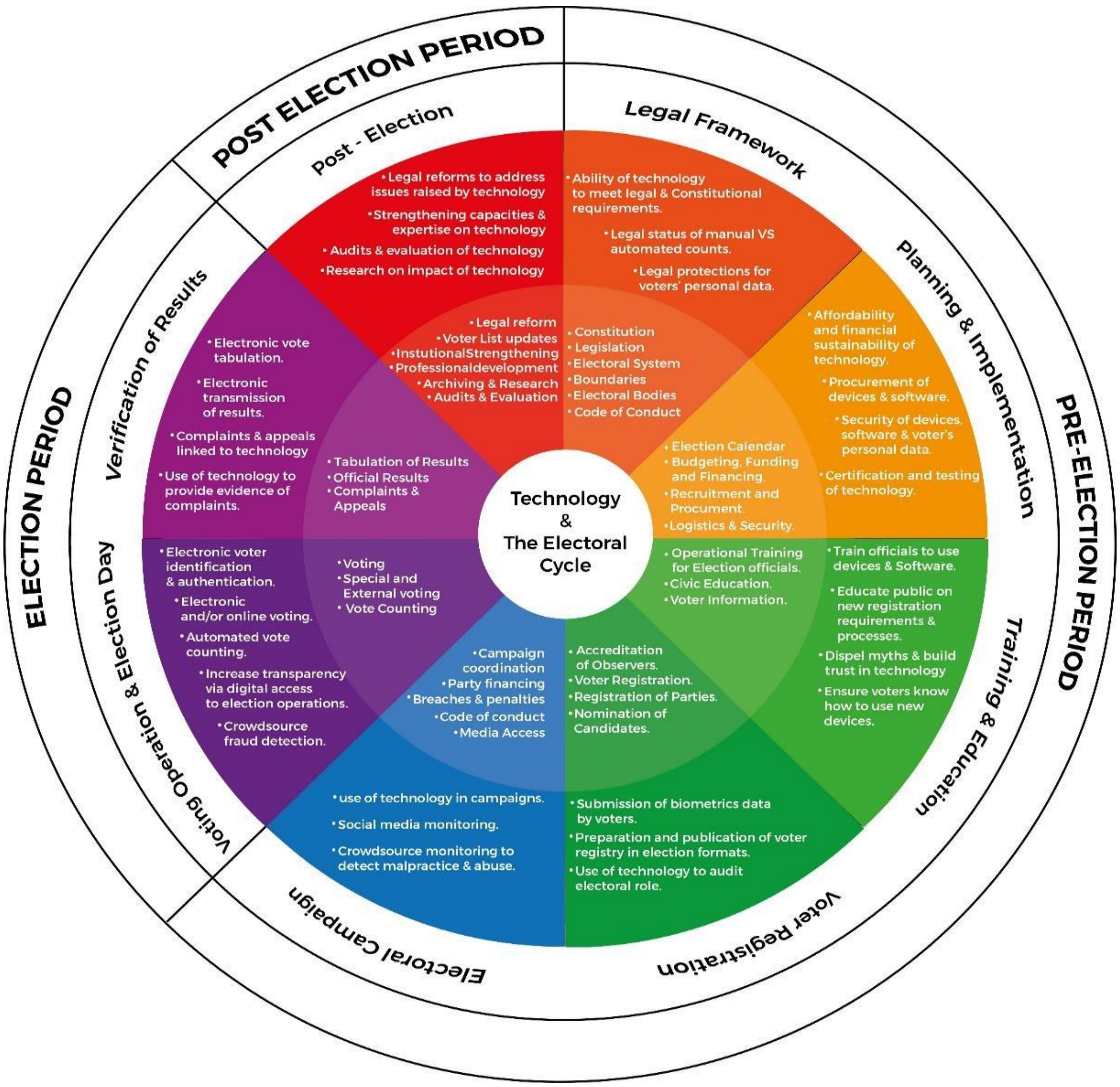

Plate 2.0: Electoral technologies throughout the electoral cycle
Source: (Herbert, 2021)

ETSC further explained that the pre-election period is a period in which electoral activities centered on planning, training, informative exercises, and registration of all sorts are simultaneously happening or conducted one step at a time. According to Plate 2.0, electoral technologies are deployed in the pre-election period to monitor online, offline and physical election campaigns, crowdsourcing monitoring, party financing monitoring, media access monitoring, accreditation of observers, voter registrations, political party registration, candidate nomination, election official operational training, and civil education. Other electoral activities and processes carried out by electoral technologies during the pre-election period include voter information, recruitment, logistics planning and implementation, procurement, security, budgeting, delimitation of electoral boundaries, and election calendar scheduling.

The election period is the period of the nomination of candidates, campaign, polling, voting, collation of results, and declaration. In this period, according to Plate 2.0, electoral technologies are deployed to undertake polling surveillance, voter accreditation (identification and authentication), special voting, external voting, absentee voting, diaspora voting, in-person voting, vote counting, result tabulations, result transmission, appeal and complaints collation, and other election-related feedback collection.

Finally, the last period, which is the post-election period, is where the review of all that has been done is achieved. This is the period in which reformative strategies are made to improve in the next elections. Relative to election technologies, the post-election period is the period during which the electoral legal frameworks are reformed to address issues raised by the electoral technologies deployed during the pre-election and election periods. This is also the period in which the technological and technical capabilities and expertise of operators (both administrators and end-users) of electoral technologies are strengthened. Auditing and evaluation of electoral technologies and impact analysis of the electoral technologies are researched during this period.

Rogers' innovation diffusion theory

When it comes to understanding how or how not an innovation permeates into a population, Everett Rogers' seminal book of 1962, The Diffusion of Innovations, which he later updated first in 1971, then in 1983, 1995, and finally in 2003, was debatably, the most prominent for this study. Given its interdisciplinary roots, it provided a simple structure that aided the thorough understanding of both individual and collective diffusion, with evidence of its impacts on other theories of technology adoption and diffusion. This is in addition to being powerful for the wide-ranging base it provided to help understand technology adoption and the factors influencing the individual choices of technological innovation (Straub, 2009; Miller, 2015).

Adoption is defined as the stages of choosing a technology for use by an individual or an organization (Sharma and Mishra, 2014). However, considering Rogers' theory, the technology adoption process and technology diffusion process are intertwined, as diffusion is a composite of adoption. It is diffusion that explains the adoption process across a population over a period (Straub, 2009). Whereas, adoption is the decision to start implementing the use of innovation (Miller, 2015). However, the adoption process is the progression through which an adopter unit conveys the first knowledge of technological innovation, which would result in creating an attitude toward the technological innovation, in making a decision either to adopt or reject the technological innovation (Bhattacharya, 2015). Rogers' diffusion theory has presented awareness, interest, evaluation, trial, and adoption as the five stages that illustrate the adoption process (Hassinger, 1959). Therefore, the adoption decision process expatriates five stages that individuals/organization usually pass through during their evaluation of technological innovation (Straub, 2009). In other words, the adoption decision process is the method employed in choosing to adopt and implement a technological innovation (Miller, 2015). Thus, it is the technological innovation decision process, which is the information-searching and information-processing endeavour, which fuels individuals' motivation to lower doubt about the pros and cons of technological innovation, as outlined in a time-ordered series of five steps given in Figure 1.0 as knowledge, persuasion, decision, implementation and confirmation. (Sahin, 2020).

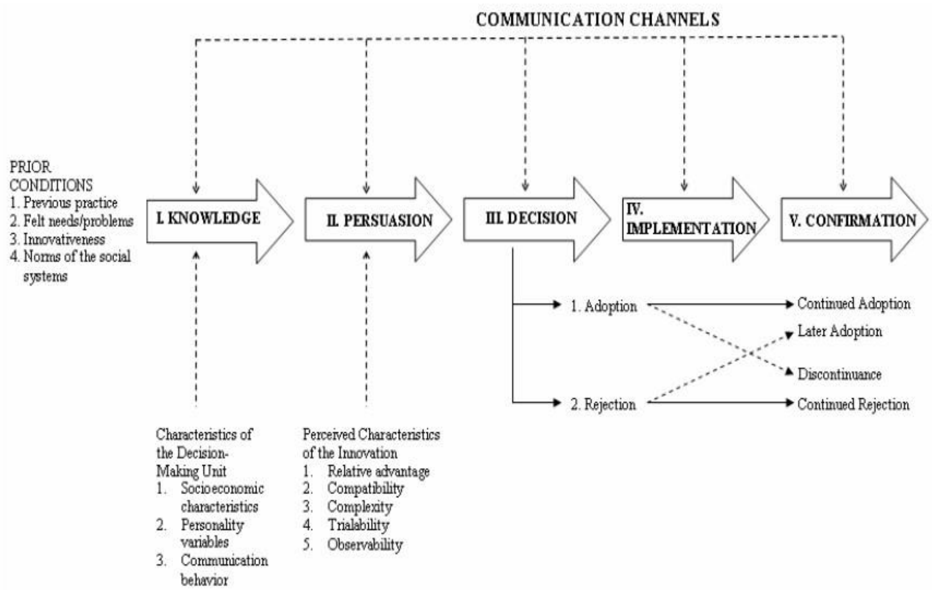

Figure 1.0: Rogers' model of five stages in the technological innovation decision process
Source: (Sahin, 2020)

The Knowledge Stage

Sahin (2020) explained that this is the first stage in a time-ordered series of adoption-decision processes. This is the stage where an individual becomes aware of technological innovation, and seeks information about it by asking questions such as "What?", "How?", and "Why?". As conceptualized by Rogers, the knowledge of the innovation that an individual looks to have by asking these questions leads to three types of questions:

(1). awareness-knowledge (implying the knowledge of innovation's existence that usually motivates the quest to want to know more, and eventually adopt it);

(2). how-to-knowledge (speaks to the information about the correct use of the innovation, critical in enhancing the chance of adopting complex innovations); and

(3) principles-knowledge (pointing to the functioning principles knowledge describing how and why an innovation works. This knowledge level could influence a continuance or discontinuance of technological innovation). This stage is cognitively centered. *The Persuasion Stage*

This is the stage where an individual develops a negative or positive attitude concerning the innovation. However, since an adoption or rejection of a technological innovation is not always occasioned either directly or indirectly by an approving or a disapproving attitude developed toward the innovation, the stage is affective or feeling centered (Sahin, 2020). *The Decision Stage*

Sahin (2020) described this as the stage where a decision is made. The individual decides either to adopt or reject the technological innovation. Adoption is making full use of an innovation as the best course of action available, while rejection connotes the converse meaning of adoption. At this stage, innovation that have a partial trial basis are typically adopted more swiftly, because most people prefer to experience innovation in their situation before making an adoption choice. The innovation decision procedure can be fast-tracked by a vicarious trial. However, at any point in the innovation-decision method, rejection is plausible. Active rejection and passive rejection are two different types of rejection described by Rogers. In the case of active rejection, a person attempts an innovation and considers adopting it, but decides against doing so. An active kind of rejection could be the decision to stop using an innovation after earlier adopting it. The person does not think about accepting the innovation when they have a passive rejection (or non-adoption) attitude. In rare circumstances, the knowledge–persuasion– decision phases might be completed in the reverse order.

The Implementation Stage

Sahin (2020) clarified that this is the stage where innovation is put into action. Nevertheless, innovation adds novelty, and spread involves some levels of hesitation. At this point, uncertainty about the innovation's results can still be an issue. Thus, to lessen the level of ambiguity about the outcomes, the implementer may require technical support from change agents and others. Additionally, the invention-decision procedure will come to an end because the innovation loses its unique nature, as the unique identity of the new idea diminishes. Reinvention is a crucial part of this stage because it typically occurs during the implementation phase. The degree to which a user alters or changes an innovation during the adoption and implementation phase is known as reinvention. Rogers (2020) distinguished between innovation and invention. According to him, the process of adopting or putting an existing concept to use is an innovation, while invention is the discovery or creation of a new idea. Rogers said that the more innovation gets adopted and institutionalized more quickly, the more time it is reinvented. Computer technologies are more amenable to reinvention, because they are innovations with various potential uses and applications (Sahin, 2020). *The Confirmation Stage*

Sahin (2020) explained that before confirmation stage, the decision to innovate had already been made. However, at the confirmation stage, the person hunts for evidence to support the choice. If the person encounters contradictory messages about the invention, Rogers contends, the decision can be changed. The user prefers to circumvent unpleasant information and seek affirming information that reinforces their choice. Consequently, attitudes become more significant at the confirmation stage. The next adoption or discontinuation occurs at this stage, depending on the level of support for the innovation's adoption and the person's mindset. During this phase, discontinuance can occur in two different ways. First, the person rejects the innovation and replaces it with a superior one. Replacement discontinuance is the term used to describe such discontinuation. Disenchantment discontinuance is the opposite form of discontinuance choice. In the latter case, the person rejects the innovation because they are dissatisfied with how well it performs. The invention not meeting the needs of the individual may also be a factor in this type of discontinuance decision. Consequently, it lacks the first attribute of innovations that influences the rate of adoption: a perceived relative advantage.

RESEARCH METHODOLOGY

The study was conducted in Southwestern Nigeria, a geopolitical zone that comprises Osun, Oyo, Lagos, Ogun, Ekiti and Ondo States. It covered the Independent National Electoral Commission (INEC) State Headquarters in these locations, and the National Headquarters of INEC at the Federal Capital Territory (FCT) Abuja was purposively selected.

The Information and Communication Technology/Voter Registry (ICT/VR) and Electoral Operations (EOps) departments were purposively selected in the commission, given the critical roles they play in technology-related policy making, policy implementation, technological innovations, technology adoption, and super-intending electoral technologies in INEC. Both primary and secondary data were used for this study. Primary data were collected using questionnaire and semi-structured interview methods. A set of questionnaires was designed and administered to 105 respondents from the ICT/VR departments in the six selected states and FCT Abuja, with an equal number (15 respondents) from each state. Similarly, one hundred and forty (140) respondents were distributed among Electoral Operations department, with an equal number (20 respondents) in each state and the FCT, resulting in a total of 245 respondents, as shown in Table 1.0. The administered questionnaire elicited information on the extent of adoption of electoral technologies in Nigeria's electoral system (such as Election guard technologies, Biometric technologies, Mobile voting system, among others) using Yes/No.

Table 1.0: Distribution of respondents for the Study

S/N	State	Department and Number of Selected Respondents		Total
		ICT/VR	Electoral Operations	
1	Ekiti	15	20	35
2	Osun	15	20	35
3	Oyo	15	20	35
4	Ondo	15	20	35
5	Ogun	15	20	35
6	Lagos	15	20	35
7	FCT	15	20	35
	Total	105	140	245

PRESENTED ELECTORAL TECHNOLOGIES

Twenty (20) electoral technologies were identified from the extant literature, collected, and presented as variables for this study.

Election guard technologies: These are free, open-source tool sets that enable voters to confirm that their votes were correctly tallied, while allowing third-party organizations to verify election results (Bridget, 2020). They are a system for conducting end-to-end verifiable elections. They are election software that uses cryptography to encrypt and safeguard votes, and enable voters to verify that their votes were accurately recorded and correctly calculated, and that the final vote count matched the votes cast. They are used for secure remote voting on untrusted devices. It is crucial to remember that the Election guard excludes voter authentication. The job of an election official is to ensure that only legitimate voters are allowed access to the polling places, where election guard is being used. Election guard allows for complex elections that span multiple districts or constituencies with various ballot formats, and each consists of a subset of all contests. For instance, it might be conceivable to hold a presidential election and allows voters to select representatives for their states. Voting for unlisted candidates may also be permitted (Zanga, 2020).

Biometric technologies: These technologies are used for voter registration and voter identity verification in the electoral process. Biometric technologies come in different forms. Some of these include palm veins, DNA, palm prints, hand geometry, among others. However, the three most common types are fingerprints, facial recognition, and iris, which are commonly used for voter identification during the voting process at the poll (Wolf et al., 2017). Iris-based technologies are unaffected by dirty or scarred fingers, tattoos, facial hair, makeup, spectacles, or contact lenses (Murad, 2021).

Cloud computing technology: This technology keeps and handles information using remote servers connected to the internet, rather than a computer network interconnecting computers within a limited area (i.e. LAN). It enables real-time collaboration, and allows access to documents by specified users. Dropbox, One Drive, and Google Drive are good examples of remote servers running on cloud computing technologies. It is an on-demand network or "shared pool" of resources where people work together to update information dynamically (Kropf, 2018).

Blockchain technologies: This is an unchallengeable time-stamped sequence record of data distributed and managed by a cluster of computers. Using a crypto-analytic hash function, blockchain technology is a peer-topeer distributed data infrastructure. It refers to either a distributed data infrastructure or a mechanism for storing data.

It consists of multiple-computers, public or private networked and encoded digital ledger (Wang *et al*., 2018). It is used to ensure two-factor authentication of voters and securely store the vote on a mobile voting system (Abayomi-Zannu *et al*., 2020).

Mobile voting system (m-voting): This term describes the prospect of voters casting ballots online via a phone or tablet. Voters download a mobile app, use the camera on their phone to authenticate their identity, make their selections, and then submit their ballot online (Anthony, 2019). It is an Internet vote on a mobile platform, such as a smartphone, tablet, or i-pad. In other words, it is an I-voting procedure, where the voters get to cast their votes anywhere using their respective smartphones, without having to go to polling units to cast their votes (Campbell *et al*., 2014).

Direct Recording Electronics (DREs): These are portable computers that show ballot options electronically, digitally record votes and hold or produce a paper audit trail for vote auditing and recounting. With these machines, voters can aim the machine's cursor at their preferred candidates or the displayed logo of the political parties to where their preferred candidate belongs, hit a button next to their name, or just touch their favorite party's legalized unique symbols on the screen touch interface of the DRE devices. The political party or candidate's name is then recorded on a memory drive and gathered by poll workers at the end of the polls across the electoral jurisdiction (Bridget, 2020).

Optical scan voting/scanned paper ballots: This is an example of an electronic voting system that reads marked paper ballots and totals the votes using an optical scanner. After filling out the bubble next to a candidate's name, voters drop the ballot into the voting machine. The ballot box is overlaid with a scanner that counts the votes and tallies them for that polling station after polling. The central election office then receives the results in a printed or electronic format (Bridget, 2020).

I-voting: This is a specific form of electronic voting using internet connectivity. It is conducted in unsupervised and uncontrolled environments, such as the voter's home (Licht *et al*., 2021). This could be postal voting or mobile voting.

Voter ID cards/voter's cards: This is a smart card. It is a contactless, anti-counterfeitly secured smart card embedded with a chip, storing electronized biometrics, biodata, and a photograph of a legitimate registered voter, usually called a cardholder. An example is the Permanent Voters' Card (PVC) deployed in Nigeria's election (INEC, 2019). It is usually designed to be suitable for online authentication and electronic voter accreditation (Russell & Zamfir, 2018).

Smart card reader (SCR): This was designed and developed to perform voter accreditation electronically, and to keep a tally of voter accreditation data in each polling unit of its deployment, to be communicated to the central server, either intermittently during the poll, or at the close of the poll. It performs the e-accreditation by reading the swiped voter ID like PVC (INEC, 2019).

Voter verifiable paper audit trail (VVPAT): This is usually used in conjunction with Direct Recording Electronics (DRE). As a result, the voter's options are recorded twice: once on a touchscreen display and once on paper. Before saving the records, the voter must ensure that both are accurate. A paper ballot known as a voter-verified paper audit trail (VVPAT) contains the same data as a single DRE block. After voters cast their electronic ballots, printers in the voting booths print the VVPATs. Before leaving the polling places, voters dispose of their paper ballots in conventional ballot boxes. This technique gives the entire system more audit and verification capabilities (Rivest and Virza, 2016).

Cameras/webcams: As a step to increase transparency and confidence, these are utilized in voting centers. Already used in nations including Russia, Ukraine, Georgia, Azerbaijan, Sierra Leone, Colombia, and Albania during their electoral procedures. They were installed not to jeopardize the confidentiality of the ballots, but to provide a form of surveillance that would deter or prevent electoral malpractice, both at the polling places and collation centres (ACE, 2014).

Geographical information systems (GIS) software: This is deployed to collect geospatial data that are usually used to draw electoral constituency boundaries, evaluate polling unit redistribution plans, and help create online voting point directions in collaboration with Google Maps. Examples of GIS software in use include Arc/Info, Intergraph, MapInfo, and Maptitude (ACE, 2014).

Electronic transmission technology: This technology is deployed to enable poll officials to electronically transmit duly signed and stamped election results, right from the polling units to various levels of collation stages until the election results are declared (INEC, 2019).

Cybersecurity technologies: These technologies are deployed to ensure electoral cybersecurity by forestalling or mitigating cyber threats targeting internet-connected or offline electoral technologies or protecting or strengthening the vulnerabilities of the said technologies. These are long-term commitments that require implementation the electoral cycle (Van der Staak and Wolf, 2019). Examples of such technologies include Control Objectives for Information and Related Technologies Methodology (COBIT 5) for risk management (Brown *et al*., 2020) and installation of firewall solutions.

Project planning and management technologies: These technologies are deployed to assist project planning and management. A good example of such technology is cloud-based project management software deployed to make planning, execution, and management of electoral operations or election-related projects easy and collaborative. They provide improved communication, real-time updates and reporting, mobile and decentralized project teams, and social collaboration. A good example of this is Planview Adaptive Work Project Portfolio Management Software (Planview, 2019)

Election results viewing web pages or portals: This is an online technology deployed to publish the results and statistics from the election information systems (INEC, 2019).

Public websites: These are online websites deployed by the Election Management Body (EMB) for public use. The members of the public, usually the electorates, get to browse the sites in order to lodge complaints, seek information, and take delivery of other electronic electoral services (Abimbola, 2022)

Electronic register of voters (EVR): This is a digitalized voters' roll, usually designed to operate a smart card reader, characterized with Voter Identification Number (VIN), QR codes, voters' pictures and other features (Abimbola, 2022).

Human resources Key Performance Indicators (KPI) technologies: These are technologies deployed by human resources managers to measure and evaluate the productivity and efficiency of the manpower or workforce of an organization in terms of their set goals. They are usually ready-made dashboards or specialized Excel dashboards created to automate the assessment of the strength and performance of each member of staff or the entire staff and provide interactive and visual feedback (Sparrow *et al.,* 2004; Green, 2014; Bersin, 2017; Eubanks, 2021).

Results and Discussion

Of the 245 copies of questionnaire administered for the study, only two hundred and twenty (220) were retrieved, implying a response rate of 89.80% as shown in Table 2.0. Therefore, the socio-demographic characteristics of the two hundred and twenty (220) respondents are reported in Table 2.0. One hundred and sixty-nine (169) males and fifty-one (51) females participated in the survey, implying that the majority (76.8%) of the respondents were male. Regarding academic qualifications, 48.6% of the respondents have HND/BSc as their highest academic qualification, followed by MSc with 46.8%, then OND with 2.7% and PhD with 1.8%. The fact that the majority (48.6%) of the respondents had an HND/BSc suggested that the least academic criterion used to employ or deploy staff to the selected departments of INEC was an HND/BSc.

As also shown in Table 2.0, the extent of adoption of these technologies was established by evaluating the electoral technologies already listed, using Yes or No. It was found that Biometric Technologies and the Electronic Register of Votes have a 99.5% adoption rate each, suggesting that both were actively and mostly used. The Election Results Viewing Portals (99.1%), Electronic Voters' Accreditation Technologies (98.2%), Electronic Election Results Transmission Technology (96.8%), Electronic Voter ID or Smart Voter ID (94.1%), Public Websites (88.2%), Geographical Information System, GIS (86.8%), Cloud Computing Technologies (80.5%), and Cybersecurity Technologies (80.0%) were with high adoption rates, suggesting that they were actively used by Nigeria's electoral system.

Table 2.0: General socio-demographic characteristics of the respondents

Characteristics		Frequency	(%)
Gender	Male	169	76.8
	Female	51	23.2
Age	<20	0	0
	21–34	23	10.5
	35-50	166	75.5
	51–65	31	14.1
	>65	0	0
Highest Academic Qualification	Senior School Certificate or lower	0	0
	OND	6	2.7
	HND/BSc.	107	48.6
	MSc	103	46.8
	PhD.	4	1.8

The Internet voting technologies had a lower implementation percentage of 6.4%, which might be because they are rarely used. Thus, Biometric Technologies and the Electronic Register of Voters that were found to have the highest adoption rate, as earlier stated, suggested that both were adopted by the Commission and were actively and mostly used by the Commission as parts of the electoral technologies across Nigeria, as corroborated by several studies. For instance, INEC's biometric technology has had many advantages by successfully preventing the recurrence of inflated voter statistics based on fictitious and invalid names, thereby reducing the possibility of vote rigging and impersonation. In addition, the Bimodal Voters' Accreditation System, BVAS, has been used in conjunction with electronic voter roll to prevent voter fraud and cases of people voting more than once (Acheampong, 2023; Iyamu, 2023; Samuel *et al*., 2022). This attests to the active usage of biometric technologies by the Nigerian electoral system, as indicated by the study's findings. Optical scan voting/scanned paper ballots

(10.0%) and Internet voting technologies (6.4%) were the electoral technologies with the lowest adoption rate according to Table 3.0, indicating that they are rarely used in Nigeria's electoral system.

Table 3.0: Extent of adoption of electoral technologies in Nigeria's electoral system

S/N	Technology	Freq (%)
i.	Biometric Technologies (e.g Fingerprints, hands geometry, face recognition, etc)	219 (99.5%)
ii.	Electronic Register of Voters (EVR) or Electronic Voters Rolls	219 (99.5%)
iii.	Election Results Viewing Portals	218 (99.1%)
iv.	Electronic Voters' Accreditation Technology e. g Smart Card Reader (SCR) or Bimodal Voter Accreditation System	216 (98.2%)
v.	Electronic Election Results Transmission Technology	213 (96.8%)
vi.	Electronic Voter ID or Smart Voter Identity Card, e.g PVCs	207 (94.1%)
vii.	Public Websites	194 (88.2%)
viii.	Geographical Information Systems (GIS) technology	191 (86.8%)
ix.	Cloud Computing Technologies e.g., Dropbox, One Drive, and Google Drive	177 (80.5%)
x.	Cybersecurity Technology	176 (80.0%)
xi.	Project Planning and Management Technology e.g Plan	159 (72.3%)
xii.	Human Resources KPI technology to measure the productivity of the workforce	137 (62.3%)
xiii.	Cameras/Webcams Surveillance technology at the polling stations or collation centres	62 (28.2%)
xiv.	Blockchain Technologies (for end-to-end voter verification)	57 (25.9%)
xv.	Election Guard technologies	52 (23.6%)
xvi.	Direct-Electronic Record Machine (DREs)	35 (15.9%)
xvii.	Voter Verifiable Paper Audit Trail (VVPAT)	26 (11.8%)
xviii.	Mobile Voting (M-Voting) technologies (e.g., Mobile Apps.)	22 (10.0%)
xix.	Optical Scan Voting/Scanned Paper Ballots	22 (10.0%)
xx.	Internet-Voting Technologies(I-Voting)	14 (6.4%)

Qualitative Results and Discussion

The respondent interviewed for qualitative data was a Deputy Director (System Analyst) serving as a Head of the Division of ICT/VR in one of the INEC State Headquarters, female by gender, and her age was between 45 and 50 years. The respondent has the academic qualifications of a Bachelor of Science in Computer Science and an MBA. Her professional qualifications were Nigeria Computer Society (NCS) and Computer Professionals of Nigeria (CPN). Having served for twenty-three (23) years as a System Analyst in the ICT/VR Department of

INEC, the respondent branded herself as an expert in electoral technologies with 24 years of professional experience.

Semi-structured questions were used to guide the interview. Out of the list of twenty electoral technologies mentioned to her during the interview, she affirmed the adoption of only ten (10) of the electoral technologies as listed below: Election Results Viewing Portals, Electronic Voters' Accreditation Technologies, Electronic Election Results Transmission Technology, Electronic Voter ID or Smart Voter ID, Public Websites, Geographical Information System (GIS), Cloud Computing Technologies, Cybersecurity Technologies, Cloud Computing Technologies (such as Dropbox, One Drive, and Google Drive), and Cybersecurity Technology.

The interviewee revealed that other technologies, such as Project Planning and Management Technology, Human Resources KPI technology, Cameras/Webcams Surveillance technology, Blockchain Technologies, Election Guard technologies, Direct Recording Electronics (DREs), Voter Verifiable Paper Audit Trail (VVPAT), Mobile Voting (M-Voting) technologies (e.g. Mobile App.), Optical Scan Voting/Scanned Paper Ballots, and InternetVoting Technologies (I-Voting) had not been adopted by the Commission. The technologies mentioned by the respondents were also confirmed through observation. Therefore, the response of the interviewee on whether or not the presented electoral technologies were already being adopted by INEC, corroborated the findings of the questionnaire method, and thus can be concluded that the adoption of electoral technologies in Nigeria's electoral system could be improved.

Conclusion and Recommendations

The study conclusively suggests the need to adopt more appropriate electoral technologies into Nigeria's electoral system, as an increased improvement in the extent of adoption of electoral technologies would enhance her electoral operations.

It is therefore recommended that The Independent National Electoral Commission, INEC, consider adopting electoral technologies that are not already used, but are found to enhance the electoral system. For instance, evoting technology with excellent audit trails should be adopted to replace the presently adopted polling methodology; camera/webcam surveillance technology for transparency and accountability of the polling and results collation procedures; i-voting technology for diaspora voters; human resources KPI technology to help measure and evaluate the productivity of the workforce; project planning and management technologies for effective collaborative project management; and blockchain technology for improved voting cyber security. INEC should thus be guided by discussed technology solutions to carry out all electoral activities throughout the electoral cycle. A good number of electoral activities and processes, such as political party campaigns, party financing, code of conduct and party media access, among others, are still not fully carried out with technologies. This study has established that adopting electoral technologies fully in these areas would undoubtedly heighten the credibility of Nigeria's electoral system and inspire voters' confidence in the process.

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