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THE USE OF BIMODAL VOTERS ACCREDITATION SYSTEM (BVAS) IN NIGERIA ELECTIONS: USER'S PERCEPTION

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ABSTRACT

Since the return to democracy in Nigeria the electoral process is been faced with various challenges, the voting systems adopted have identified instances of violence, system failure, and malpractice. Individuals employ the voter card of others to cast their votes, which allows them to vote more than once as against the law stipulated by the electoral body the "Independent National Electoral Commission" (INEC). This paper set out to investigate users' perception of the new Bimodal Voters Accreditation System (BVAS) that was introduced in 2023 for the Nigerian general election. Utilizing a questionnaire survey of registered voters in Delta State Nigeria, The study revealed the voters' perceptions as it regards how satisfied they are with the BVAS, their opinion about the functionality, acceptance, security, and accuracy of the system, and their attitude towards the use of BVAS technology for future elections in Nigeria. These issues are not exclusive to Nigerians but also extend to countries that use manual voting systems. To combat the problems mentioned above, many solutions have been implemented to ensure credible elections. Some existing methods include the use of paper ballots, and card readers, and the most recent method is the use of the Bimodal Voters Accreditation System (BVAS) which uses a fingerprint and facial capture to authenticate a voter. Although the current solutions reduced election malpractices and the amount of time they spend in the queue. There still exist some loopholes and dissatisfactions. The study was conducted using quantitative analysis methodology to identify the key issues with the existing system, Voters' opinions on several issues such as the Functionality, Ease of Use, Acceptance of the existing system, and Security were sampled from a population size of 400. The Problems identified in the existing system include; a high rate of compromise because of the weak security features of the existing system. In conclusion, this study provides useful insight into users' perception of the Bimodal Voters Accreditation System, which electoral institutions, government, and political parties should take into consideration when implementing electronic voting systems for future elections. It recommends that a thorough assessment should be carried out on the technical aspect of the system, with more emphasis on ensuring the security of systems and sensitizing the public on how to use the system. Furthermore, the government should

consider more authentication systems that can be used in the event of technical difficulties for the conduct of future elections in Nigeria.

1. INTRODUCTION

An election is a procedure that allows citizens the chance to select candidates democratically. Election addresses democracy and citizens' free will. This is why voting is considered to be a very critical and delicate procedure, and consequently, the conduct of elections must serve several conditions for a credible election to take place. (Makungu, 2018). Biometric systems have proven effective in mitigating issues by requiring validation through specific traits. Protection mechanisms must be in place to prevent unauthorized access and ensure the integrity of the process. With the development of information technology, nations all over the world are replacing archaic punch cards and mechanical voting systems with electronic voting systems (e-voting) aimed at increasing voter participation and speeding up the release of election results. One of the most important features of democracy that is very common to all people of various types is the act of election. Democracy thus encourages individual freedom according to the rule of law, so that people may behave and express themselves as they choose. This not only gives people a chance to elect their leaders but also to freely express their views on issues.

Biometric technology uses unique physical and behavioral characteristics to distinguish individuals and can analyze data in visible light, infrared, and acoustic bands. Common traits include fingerprints, retinas, iris, facial images, and hand geometry. It is an application-specific system that uses pattern recognition and algorithms with efficient hardware to deliver output.

Biometric data are characterized by the features they have such as; Universality, Distinctiveness, Permanency, Contestability, Reliability, and Acceptability (Yanushkevich, 2021). Any human physiological and/or behavioral characteristic can be used as biometric data as long as it satisfies.

In a biometric system, an identifier is linked to its intrinsic human characteristics. These characteristics are physiological and behavioral, which can be used to identify a person digitally (Meng *et al.,* 2014) (Rui & Yan, 2018). Biometric security helps in authentication, which takes place by identifying human characteristics. The specific human characteristics mentioned above are defined as follows: Physiological biometrics are based on physical characteristics that vary between individuals, such as fingerprints, face, iris/retina, etc. Behavioral biometrics are based on individual behavioral characteristics, such as voice, gait, signature, etc.

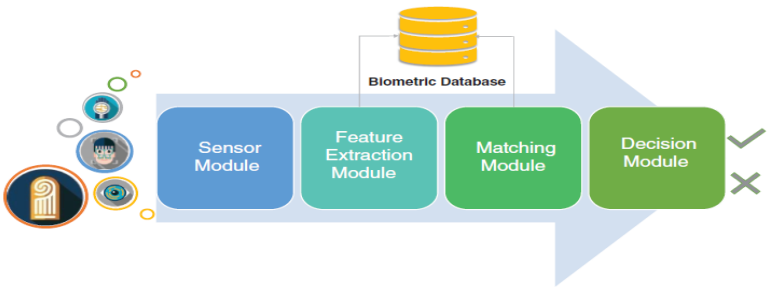

Figure 1. Logical block of a generic Biometric Authentication System (Source: Aftab et al. (2021)

The diagram in Figure 1.0 provides an overview of the essential components of a conventional biometric system. The sensor module is responsible for capturing user data, which is then processed by the feature extraction module for matching with templates stored in the database. The matching module generates matching scores, and the decision module utilizes these scores to determine user permissions. When selecting a biometric identifier, it is critical to consider factors such as permanence, universality, measurability, circumvention, and performance. (Bhattacharyya *et al.,* 2009). Another important factor is the suitability of the application. Nevertheless, the choice of a single bio-

metric identifier that meets all the requirements of every possible application is not possible since there are tradeoffs between different performance metrics. There is a possibility to optimize several measures by using a combination of various biometric identifiers. Therefore, we can logically characterize a biometric system into two distinct categories: (1) UNIBIOMETRIC systems, and (2) MULTIBIOMETRIC SYSTEMS. Uni-biometric systems traditionally, biometric recognition systems are Uni-biometric, which employ a single biometric trait for authentication purposes, on the other hand, Multi multi-biometric Systems use more than one biometric trait for authentication

The Bimodal Voters Accreditation System (BVAS) is a biometric system, that combines two different modes of identification, typically fingerprint and facial recognition to register voters and is equally used to authenticate and verify the identity of voters during the accreditation process on Election Day: This system enables voters to cast their vote by verifying their biometric data match the data stored in the database otherwise rejected, the system is used only for registration and Accreditation, while voting is done by the use of paper ballots.

The issue of electoral fraud and irregularities has become of significant concern at the national level down to the local government level in Nigeria. However, the effectiveness of the Bimodal voting system will rely greatly on the confidentiality, integrity, and reliability this technology can provide. This study aims to determine the operational functionality of a Bimodal Voters Accreditation System (BVAS), identify challenges through a literature review, and assess the system's flexibility for voting.

2. Aim and Objective of the Study

The aim is to determine the users' perception of the Bimodal Voters Accreditation System (BVAS) voting system. The objective involves assessing the operational functionality of the BVAS, measuring user acceptance, and evaluating the security level of implementing the Bimodal Voters Accreditation System in the Nigeria general elections.

3. RESEARCH METHODOLOGY

A quantitative methodology approach was used to elicit facts from the target audience (Those who participated in the use of the Bimodal Voters Accreditation System during the last election in Delta State Nigeria. Quantitative analysis has some advantages such as the ability to directly compare results and conduct analysis on large samples of data using reliable and consistent procedures. The expected participants are those who have attained the voting age as stipulated by the Nigerian electoral law which is 18 years and above. Therefore, the questionnaires were administered to these categories of users. Four variables were used in structuring the questionnaire with five questions to test each variable. The Taro Yamani formula was used to determine the sample size because the formula allows for inferences and conclusions to be drawn from the survey and applied to the complete population from which the sample was drawn. It is one of the most widely used methods for calculating sample size. The formula states that to determine the confidence level of any data to be correct, the interval must align to 90%. If it goes below 90% the data cannot be said to be accurate. Due to the large size of the targeted population, the Taro Yamani formula was used to determine the acceptable population size of the study. The formula is stated as follows:

$$n = N/ 1+ N(e)^2 \qquad \text{equ (1)}$$

Where;

(n) = is the required sample size for the population under study

N= is the whole population that is under study

e = is the precision or sampling error which is (0.1)

To determine the adequate sample size of the population under study, the Tora formula was applied as follows:

$n = N/ 1+ N(e)^2$

$N= 400; e= 0.1; e^2 = 0.01$

$n = 400/ 1+ 200(0.1)^2$

$n = 400/1 + 200(0.01)$

$= 400/1 + 2$

$=400/2$

$n = 200$

Therefore, a sample size of 200 out of the population of 400 respondents was considered to be the lowest acceptable number of respondents to maintain above 90% confidence level.

Data were collected from primary sources (survey, observation, and questionnaire), and secondary sources were obtained from published articles, journals, websites, and books. The major research instrument used was the Survey method (questionnaires) designed using the Google Form application. It was appropriately moderated and the targeted respondents were administered the questionnaires to complete, without disclosing their identities. The questionnaire was structured into four thematic areas with twenty questions.

4. DATA ANALYSIS

The data collected was analyzed for meaningful interpretation using the Statistical Package for the Social Sciences. For a comprehensive analysis of the data collected, emphasis was laid on the use of absolute numbers frequencies of responses, and percentages. Answers to the research questions were provided through the comparison of the percentage of responses to each statement in the questionnaire related to any specified question being considered. Frequency in this study refers to the arrangement of responses in order of magnitude or occurrence while percentage refers to the arrangements of the responses in order of their proportion. The simple percentage method is believed to be straightforward to interpret the result from the analysis.

Data gathered from the field were analyzed using the Statistical Package Social Science (SPSS) version 23 to code the data using an ordinal scale after the data was cleansed. Descriptive analysis was performed on the data set and the P-Value using Chi-Square is set at 0.5. To test the hypothesis of this study the Positive Value (P-Value) is expected to be (>= 0.5) to give validity to the hypothesis and where it is (<0.5) it then means that the hypothesis is not valid. The P value is a statistical measurement used in determining whether or not a hypothesis is correct or valid. The two hypotheses that will be tested are:

H_1) Unimodal voting system is less complex as a result it influences electoral outcomes and is more reliable.

H_2) Multimodal voting system is safer and more secure when compared with the existing voting system despite its complexity.

5. DISCUSSION OF FINDINGS

The data collected from the respondents were cleansed and coded using SPSS software thereafter, it was analyzed in both tabular and graphical format with simple percentages for easy understanding. Cronbach's alpha was employed to assess the reliability, or internal consistency, of the set of test items to justify the extent to which it is a consistent measure of the concept. Cronbach's alpha takes values from 0 to 1, with 1 being the highest value, meaning perfect internal consistency. A Cronbach's alpha with a value higher than 0.7 is considered reliable in comparison with values lower than 0.7 which is not considered reliable.

The following Cronbach's alpha formula was used to get a conclusive result.

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N-1) \cdot \bar{c}}$$

Where:

N *= the number of items in a group*

$\bar{\mathbf{c}}$ *= the average covariance between paired items*

$\bar{\mathbf{v}}$ *= the average variance*

Cronbach's alpha is thus a function of the number of items in a test, the average covariance between pairs of items, and the variance of the total score. Therefore, the set of test items gave the following output

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.711	.703	20

Figure 2. Reliability Statistics

Table 1. What is your Gender?			
Variable	Frequency	Percent	Valid Percent
	Female	108	52.2
	Male	99	47.8
	Total	207	100.0

Table 1. Shows the distribution of responses from both males and females to the questionnaire.

Table 2. Nationality

Variable		Frequency	Percent	Valid Percent
	Nigeria	207	100.0	100.0

Table 2. Shows all 207 respondents were Nigerian Citizens from all the Local Government Areas of Delta State, who are within the age group constitutionally permitted to participate in an election. Also, the geographic location mapped out for this research is Delta State

Table 3. Local Government of Origin					
	Frequency	Percent		Frequency	Percent
Aniocha North	4	1.9	Oshimili North	8	3.9
Aniocha South	5	2.4	Oshimili South	5	2.4
Bomadi	4	1.9	Sapele	3	1.4
Burutu	8	3.5	Udu	4	1.9
Ethiope East	4	1.9	Ughelli North	4	1.9
Ethiope West	2	1.0	Ughelli South	3	1.4
Ika North East	2	1.0	Ukwuani	7	3.4
Ika south	38	18.4	Uvwie	5	2.4
Isoko North	4	1.9	Warri South West	8	3.9
Isoko South	5	2.5	Patani	44	21.3
Ndokwa East	5	2.4	Warri North	20	9.7
Ndokwa West	7	3.4	Warri south	5	2.4
Okpe	6	2.9	**Total**	207	100.0

Table 3. shows the respondents from the 25 local Government Areas in Delta state, with the highest response from the Patani Local Government Area at 21.3% (44) closely followed by the Ika South Local Government Area at 18.4% (38). The response also reveals that all the local Governments in Delta State are interested in the electoral process but express divergent views as will be seen from the rest of the results analyzed.

Table 4. X1: Summary of BVAS FUNCTIONALITY

Variables	Frequency	Percent
Strongly agree	44	21.2
Agree	26	12.6
Disagree	98	47.4
Indifference	39	18.81S
Total respondents	207	100

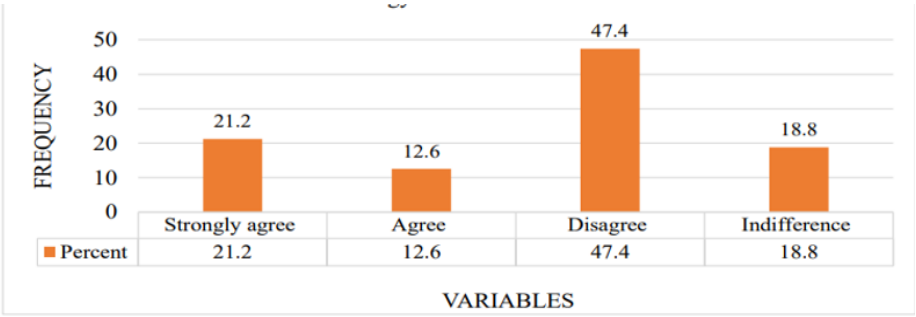

Figure 3. X1: Summary of BVAS Functionality

The survey on functionality and efficiency of BVAS technology during the general election reveals a diverse set of opinions among respondents as represented by X1. The majority expressed disagreement, while a significant portion strongly supported its effectiveness. Based on

the information provided in Table 4 as represented in Figure 3 it appears that 47.4% of respondents disagree with the effectiveness of the BVAS (bimodal Voters Accreditation System), stating that it is prone to errors, and compromise. On the other hand, 12.6% and 21.2% of the respondents agree and strongly agree respectively that the BVAS technology was functional, while the 'indifferent' category represents 18.8%. These individuals neither strongly support nor oppose BVAS technology, indicating a level of uncertainty, this could be having limited knowledge about the technology or a need for further information before forming a concrete opinion. From the analysis, it can be inferred that a significant proportion of respondents have reservations about the system. Initial findings indicate that there is a notable lack of confidence in the BVAS technology among respondents surveyed and this suggests that exploring an alternative technology like a multimodal biometric online voting system could be considered to address the concerns and improve the overall effectiveness of the voting process.

Table 5. X2: Ease of the use of BVAS technology.

Variables	Frequency	Percent
Strongly agree	43	20.8
Agree	82	39.6
Disagree	46	22.2
Indifference	36	17.4
Total respondents	207	100

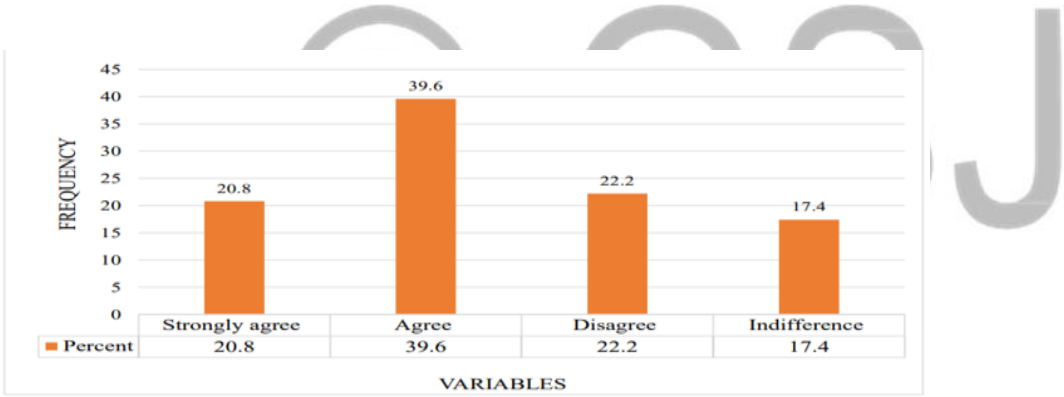

Figure 4. X2: Ease of the use of BVAS Technology

From the perception of the ease of use of the Bimodal Voters Accreditation System (BVAS) in Figure 4, a significant percentage (39.6%), and 20.8% of the respondents expressed agreement and strongly agreed respectively, that the BVAS is user-friendly, this indicates that a substantial number of users find the technology accessible, this group's high level of satisfaction indicates a positive experience with the technology, further reinforcing the importance of user-friendly design and implementation. BVAS technology is believed by most respondents to be reliable for voting. The reliability can be tied to the flexibility of the system as agreed by the respondents in Table 5 and Figure 4 indicating that BVAS technology implemented during the general elections offered flexibility, and user-friendliness, and improved the voting process compared to the previous voting system. However, with this, 39.6% and 20.8% agreed and strongly agreed respectively, there is a shared concern that the technology's flexibility could potentially make it vulnerable to manipulation by insiders. While 22.2% of respond-

ents expressed disagreement. The “indifferent” category (17.4%). This group’s response could be influenced by factors such as limited exposure to technology or lack of familiarity.

Table 6. X3: Summary of BVAS Technology Users Acceptance.

Variables	Frequency	Percent
Strongly agree	42	20.1
Agree	67	32.3
Disagree	60	29.1
Indifference	38	18.1
Total respondents	207	100

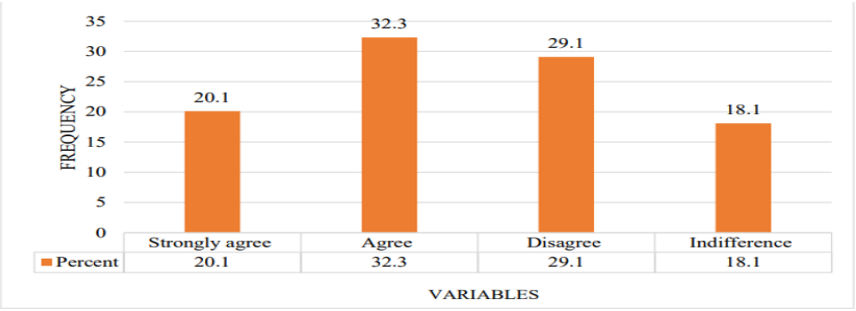

Figure 5. X3: Summary of BVAS Technology User's Acceptance

As demonstrated in Table 6 and Figure 5 the data show that BVAS (Biometric Voters Accreditation System) has received divergent responses from the respondents. While a significant proportion of 32.3% agrees with its usage, a substantial number of 29.1% disagree with it. Additionally, 18.1% of respondents show indifference and 20.1% strongly agree with BVAS. This suggests a diverse range of opinions on the technology’s acceptance. Furthermore, the survey heightens the potential impact of the ICT competency of the citizens on digital voting adoption. This points to the significance of technology literacy in facilitating the integration of advanced voting systems.

Table 7. X4: Summary BVAS Technology Users Security Assessment Level

Variables	Frequency	Percent
Strongly agree	115	55.5
Agree	42	20.5
Disagree	20	9.6
Indifference	30	14.4
Total respondents	207	100

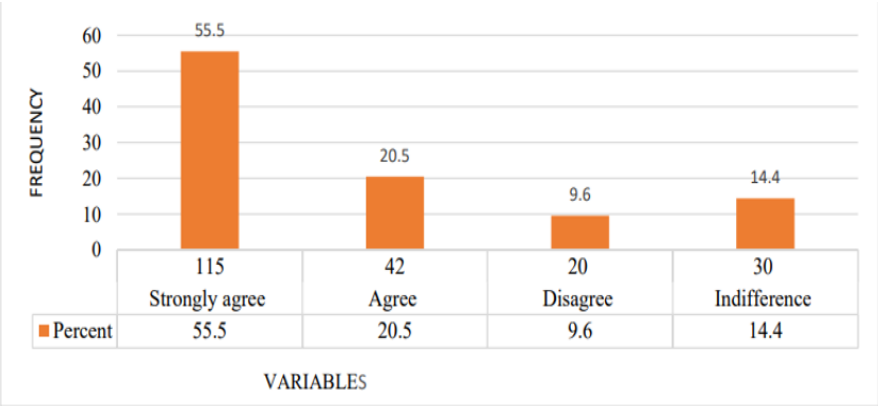

Figure 6. X4: Summary of BVAS Technology Users Security Assessment

The BVAS technology users' security level has been revealed based on the survey during the general election as represented in Table 7 and Figure 6 indicating that 55.5% and 20.5% of the respondents strongly agreed and agreed respectively, that there were issues noticed with the system security, safe result upload, and operators manipulation during the general election. They think that a more complex and completely online voting system with strong data protection, and secure access granting protocols to minimize electoral fraud, in different accounts for 14.4% of the respondents, which implies they neither strongly agree nor disagree with the BVAS performance during the election, on the security failure 9.6% of the respondents disagreed, stating that it was satisfactory with their own opinion of the outcome, that the system should be relied upon, that major issues were trust and integrity electoral officials handling the system, rather attributing any failure to the technology, the recommend paperless complete digital voting system for voter registration and the voting process to gain trust in the Independent National Electoral Commission (INEC) the electoral body to increase citizens' participation in future elections, assure reliability and integrity to minimize election fraud.

TABLE 8. Summary Of X1, X2, X3, And X4

VARIABLE	X1 :(BVAS)	X2 :(BVAS)	X3 :(BVAS)	X4 :(BVAS)
	FUNCTIONALITY	EASE OF USE	ACCEPTANCE	SECURITY
STRONGLY AGREE	37.1	20.6	29.1	55.5
AGREE	18.8	40.0	32.3	20.5
DISAGREE	31.5	22.2	20.5	9.5
INDIFFERENCE	12.1	17.2	18.1	14.4
TOTAL RESPONDENTS	100.0 %	100.0 %	100.0 %	100.0 %

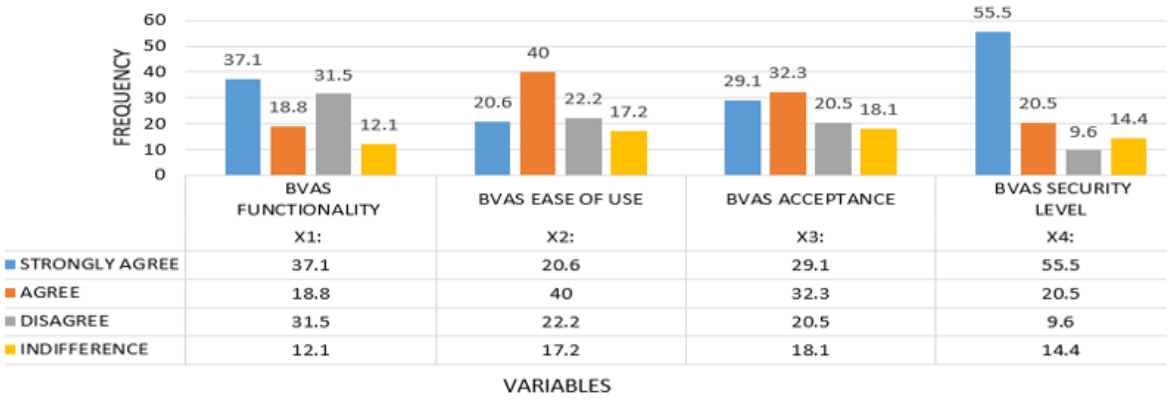

Figure 7. Summary of X1, X2, X3 and X4

Table 8 and Figure 7 above represent the four variables X1, X2, X3, and X4, considered in the survey to determine the user's perception of the functionality, ease of use, acceptance, and the user's security assessment level conducted on the BVAS (Biometric Voters Accreditation System) technology used in Nigerian general election. The overall analysis reveals a divergent set of opinions among respondents. A considerable proportion of participants 47.4% expressed disagreement with the BVAS functionality, citing concerns about errors and inaccuracies, while 21.2% strongly agreed, and 12.6% agreed that the BVAS was functional and efficient. Indifference accounted for 18.8% of respondents. Showing a lack of a clear stance on the matter, on the ease of use, 39.8% of respondents found the BVAS accessible and user-friendly, while 22.2% disagreed. Additionally**,** 20.8% strongly agreed with the technology's ease of use, showing a positive experience with BVAS. However, 17.4% were indifferent, possibly with limited exposure to the system. BVAS acceptance revealed mixed responses, with 32.3% agreeing and strongly agreeing respectively, accepting the use of the BVAS, while 29.1% disagreed with the use of the BVAS technology during the general election. Stating the credibility in the voting process, the need to promote ICT competency in both electoral officers and voters to facilitate the integration of advanced voting systems, such as multiple biometric voting systems. The BVAS has contributed to the fast voting process, as evidenced by Table 8 as well as it is represented in Figure 7 including swift accreditation. Also, the preference for BVAS technology stems from its ability to verify voters quickly on Election Day, making it a preferred option for voting, but doesn't mean the system performed satisfactorily but indicates an improvement compared to previous systems used in conducting elections in the state and Nigeria in general.

6. CONCLUSION

Electronic methods of counting ballot papers have been around for a while, but the focus has been shifted to how to cast online ballots. The system can speed up the casting of votes and counting of ballots. The study reveals that the Bimodal Voter Accreditation System (BVAS) is a technology is one that has changed the voting process. It has helped in addressing the many challenges with manual voting but it has been observed to have lapses in terms of security, results transmission, and operations. Credit has been given to biometrics by faultfinders, because of its ability to erode anonymity. Overall, while electronic voting systems have much optimism in the credible electoral process, ongoing refinement is essential to meet the necessary standards for a secure and reliable online voting process.

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