BIOMETRIC VOTER REGISTRATION AND ELECTRONIC VOTER IDENTIFICATION SYSTEM ON CREDIBILITY OF THE ELECTORAL SYSTEM IN KENYA A CASE STUDY OF NAIROBI COUNTY

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BIOMETRIC VOTER REGISTRATION AND ELECTRONIC VOTER IDENTIFICATION SYSTEM ON CREDIBILITY OF THE ELECTORAL SYSTEM IN KENYA; A CASE STUDY OF NAIROBI COUNTY

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ABSTRACT

Transparent, Free, fair, and credible elections are core to electoral democracy and provide vital means of empowering citizens to hold their leaders accountable. However, accountability of public officials in Kenya has been undermined by the fact that elections in the country are perennially fraught with irregularities. The announcement of the disputed 2007 presidential election results in Kenya on December 27th, 2007 led to what could be described as the worst political crisis in Kenyan post-colonial history. This study was guided by the following specific objectives; to establish the effect of Biometric Voter Registration (BVR) on the credibility of the Electoral System in Nairobi County, to determine the effect of Electronic Voter Identification System (EVID) on the credibility of the Electoral System in Nairobi County. The study was anchored on Technology Acceptance Theory and employed a descriptive research design. The target population was 2,251,929 registered voters in Nairobi County and 40 Independent Electoral and Boundaries Commission, technical officials. A sample size of 351 respondentswas used determined using Fisher's (2007) formula. Primary data for this study was collected using structured questionnaires. The analysis involved both descriptive statistics and inferential statistics.The inferential results showed a positive correlation of (r=0.773, p=0.000) between biometric voter registration (BVR) and credibility of electoral systems. Results on electronic voter identification (EVID) and credibility of electoral systems showed a positive correlation of (r=0.784, p=0.000). Furthermore there was a significant effect between biometric voter registration (BVR) and credibility of electoral systems(β=.356, p=0.000), and on electronic voter identification (EVID) and credibility of electoral systems (β=.380, p=0.000). The study

concluded that biometric voter registration (BVR) and electronic voter identification (EVID) in the electoral process is very efficient in reducing or eliminating multiple registrations and multiple voting. The study recommends that there should be adequate and strict protocols for supervision, management and storage of electoral data.

Keywords: biometric voter registration (BVR), electronic voter identification (EVID), credibility of electoral systems.

Introduction

Transparent, Free, fair, and credible elections are core to electoral democracy and provide vital means of empowering citizens to hold their leaders accountable (Micheni&Murumba, 2018). In a multi-party democracy, it is expected that both the elected and appointed government officials at all levels of the political system to render a periodic account of their stewardship to the population. However, the accountability of public officials in Kenya has been undermined by the fact that elections in the country are perennially fraught with irregularities. According to Mati (2019), the democratization of politics has been unsuccessful in arresting electoral frauds perpetrated by different political parties and megalomaniac politicians. The importance of Technology in human society can never be relegated; according to Gelb and Diofasi (2019), the uses of technologies in recent times have become inevitable and fundamental to operations and activities of organizations and societies. The role of technology inidentifying and avoiding electoral risks. On the one hand, information technologies are perceived as solutions for many electoral hurdles, such as the creation of an accurate voter register, simplified voting and result tallying and faster transmission of election results.The use of biometric technology in voter registration has enabled electoral management bodies to improve the accuracy of voter registers by providing an effective mechanism for identifying duplicate entries on the voter register. The use of biometric technology to verify voters' identities on Election Day has also contributed to enhanced trust in the electoral process (Effah&Debrah, 2018). Similarly, technology is providing electoral management bodies with ways to count tabulate and transmit the results of elections more quickly through measures such as electronic voting or transferring election data through mobile technology. This enables election results to be announced sooner, which can diffuse tension in closely contested elections and strengthen trust in the process. Research suggests that, despite its cost, biometric technology can be a worthwhile economic investment for a country even if it only decreases the likelihood of severe post-election violence by a few percentage points (Gelb &Diofasi, 2019).

Technology is fast-growing, and electoral management bodies are forced to follow-up on the need to incorporate it in their processes by either acquiring new systems or updating what they currently have keeping in mind what the expected outcome of the system should be (Ayeni&Esan, 2018). James, Garnett, Loeber, and van Ham (2019) posit that it is expected that technology will increase administrative efficiency of the electoral management bodies, ensure cost reduction, transparency of the electoral process, and credibility of the election outcome by all stakeholders. There are several forms of electoral technologies besides those used by the Kenyan electoral management bodies, and they include internet voting, early voting, and basic word processing and excel sheets, optical scanning, and geographical information systems (Kigwiru, 2019). These technologies assist in voter registration, delimitation of boundaries, result transition, and publishing of the results. As indicated by Jacobsen (2019), Biometric voter

registration (BVR) is one of the technologies used by electoral bodies today in enhancing the credibility of election results. The BVR system is used for registering voters. It comprises a laptop, a fingerprint scanner, and a camera. BVR captures a voter′s facial image, fingerprints, and civil data or Personal Identifiable Information (PII)-Name, gender, identity card/passport number, telephone number, etc. The registration takes place at the registration centres where an individual is expected to vote. In Kenya, the BVR method of registration was the only system deployed by IEBC to register voters just before the 2013 general elections. Electronic Voter Identification System (EVID) is another technology used by electoral systems all over the world today. Electronic Voter Identification System (EVID) is an electronic poll book; there are two types of EVID technology, the laptop with the attached fingerprint reader and the handheld device with an in-built fingerprint reader (Tran, 2019). The EVIDs verify and confirm voters electronically as registered by BVR. They are used to ″check-in″ voters at the polling station on polling day and help streamline the voting process. Similarly, EVID curbs impersonation and ensures that only those who registered to vote are allowed to vote.

Abdullahi (2015) considers credible elections to be characterized by inclusiveness, transparency, accountability, and competitiveness. Inclusive elections provide equal opportunities for all eligible citizens to participate as voters in selecting their representatives and as candidates for election to government. According to Onapajo (2015), the legitimacy of democratic government is established, in no small measure, by genuine elections, and they are much more than what happens on Election Day. A real electoral process requires an open pre-election environment in which citizens can participate without fear or obstruction; political parties, candidates, and the media can operate freely; an independent judiciary functions fairly and expeditiously; and electoral authorities act impartially (Rubinstein &Roznai, 2018). Since its earliest days, NDI has been working with partners around the world to help ensure that elections reflect the will of the people. This work primarily intended to ensure the integrity of elections also promotes longer-term governmental accountability as well as widespread political participation. The Institute, in partnership with the U.S.-based Commission on Presidential Debates (CPD), has also taken a leading role in a worldwide movement to organize political debates, which help voters make informed choices, reduce violence, particularly in post-conflict situations, and encourage candidates to focus on issues, not personalities or ethnic loyalties (Appleby & Federico, 2018). While debates have become an accepted and expected part of elections in many parts of the world, they are not the norm in emerging and transitional democracies, where there is less tradition of candidates facing off in person.The Independent Electoral and Boundaries Commission (IEBC)is an independent regulatory agency that was founded in 2011 by the Constitution of Kenya. Article 88 of the Constitution of Kenya establishes the Independent Electoral and Boundaries Commission (IEBC) as the body mandated to conduct and supervise elections and referenda in Kenya (Cheeseman*et al.,* 2019). The Commission is responsible for holding and managing referendums and elections to any elective body or office established by the Constitution, and any other elections as prescribed by an Act of Parliament. It was created in a provision of the 2010 constitution and the Independent Electoral and Boundaries Commission Act.

The mandates of IEBC includes; the continuous registration of voters and revision of the voter's roll, the delimitation of constituencies and wards, the regulation of political parties process, the settlement of electoral disputes, the registration of candidates for elections, voter education, the

facilitation of the observation, monitoring and evaluation of elections, the regulation of money spent by a candidate or party in respect of any poll, the development of a code of conduct for candidates and parties, the monitoring of compliance with legislation on nomination of candidates by parties (Nespeca, Meesters, Comes, Boersma&Tomaszewski, 2018). The utilization of technology in the 2017 Kenya electoral processes was guided by Section 44 of the Elections Act of 2011. Under Section 44 (1) of the act, the Independent Electoral and Boundaries Commission (IEBC) acquired "an integrated electronic electoral system," referred to as the Kenya Integrated Elections Management System (KIEMS). KIEMS was designed to integrate the existing biometric voter registration (BVR), the biometric voter identification (EVI), the electronic results transmission (RTS), and the candidate registration systems (CRMS). Three sub-systems (CRMS, EVI, and RTS) were part of the 2017 procurement, while the BVR system is what the IEBC used during the 2013 electoral process. The bio-data information of all the registered voters was loaded onto the integrated system, with biometric details of specific voters restricted to polling stations in which they are registered.

1.1 Statement of the Problem

There has been recurring post-election violence in Kenya due to disputed elections (Pfeiffer, 2018). The announcement of the disputed 2007 presidential election results in Kenya on December 27th, 2007, led to what could be described as the worst political crisis in Kenyan post-colonial history (Kenny, 2019). This massacre claimed over 1000 lives of children, men, and women, and left about 600,000 Kenyans internally displaced. Different experts have analyzed the immediate and remote causes of the crisis. They established that recurring electoral violence in Kenya since 1992 demonstrated the fluidity of grievance and other factors, which shredded cohesion, exposed the depth of historical injustices, and further polarized the country along ethnic-regional lines. In particular, Laakso (2019) believes that at the core of these grievances is the belief that the electoral body doesn't deliver free fair and credible election and that political power provides the ethnic group of the president with exclusive advantages. Historically, the political leaders who direct political powers in Kenya also control the direction and magnitude of the economic and political resources of the state. In the 2017 presidential elections in Kenya, one of the presidential candidates called for a press conference alleging that the IEBC servers had been hacked and algorithm set to ensure an 11% difference favour of the then incumbent president Uhuru Kenyatta at all levels of results transmission. The centre for intellectual property and information technology (CIPIT) team investigated these allegations but was not able to establish claims based on the evidence presented and recommended a comprehensive audit of the system. The introduction of biometrics technology was meant to ensure the credibility and trust in the electoral system. A hacking claim is, therefore, incredibly severe and could damage such credibility irreparably. The reason this accusation gained traction, without evidence, is in part due to the little knowledge available on how the system worked.

Several studies have been conducted on the use of technology in election for example; Cheeseman, Lynch, and Willis (2018) conducted a study which examined the unintended consequences of election technology in Kenya, Uganda, and Ghana and found that growing use of these technologies has been driven by the fetishization of technology rather than by rigorous assessment of their effectiveness; that they may create significant opportunities for corruption that (among other things) vitiate their potential impact; and that they carry significant opportunity costs. The study presented contextual and conceptual gaps. Agbu (2016) conducted a

study on Election rigging and the use of technology in Nigeria and found that technological input in Nigerian electoral space made it extremely difficult for results to be manipulated, either by anonymous individuals or through arbitrarily and fraudulently manipulating figures. The study presented conceptual, contextual, and methodological gaps. The current study sought to address these gaps presented by establishing the candidate registration system and results transmission system on credibility of the electoral system in Kenya; a case study of Nairobi county.

1.2 Specific Objectives of the study
The following specific objectives guided this study;

i.   To establish the effect of Biometric Voter Registration (BVR) on the credibility of the Electoral System in Kenya

ii. To determine the influence of the Electronic Voter Identification System (EVID) on the credibility of the Electoral System in Kenya

1.3 Conceptual Framework

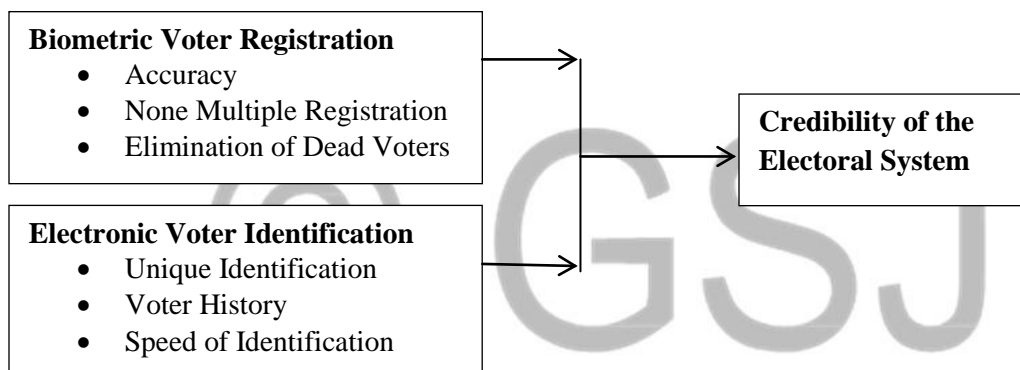**Independent Variables**   **Dependent Variable**

Figure 1.1: Conceptual Framework

LITERATURE REVIEW
2.1 Theoretical Framework
2.1.1 Technology Acceptance Theory
This is the main theory on which this study was underpinned. Technology Acceptance theory was developed by Davis (1989). The theory suggests that when users are presented with a new technology, several factors influence their decision about how and when they will use it (preparedness), notably: Perceived usefulness (PU) defined by Fred Davis (1989) as the degree to which a person believes that using a particular system would enhance his or her job performance. Perceived ease of use was defined by Davis (1989) as the degree to which a person believes that using a particular system would be free from effort. This is an information systems theory that models how users come to accept and use technology. Davis and Venkatesh (1996) add that the Technology Acceptance Theory is influential in predicting user acceptance and users' intentions, as well as the efficient usage of tools in the field of technology. In 1996, Davis and Venketesh made another adjustment to the Technology Acceptance Theory. Bagozzi (2007) found that perceived ease of use and perceived usefulness had a direct effect on behavioral intention and they concluded that users might perhaps use technology even if they do not have

favourable attitudes, and they stated that attitude did not entirely mediate the influence of perceived usefulness on the behaviour intention. Thus, Davis and Venketesh (1996) excluded perspectives from the Technology Acceptance theory and postulated that attitudes do not play a significant role in users' behavioural intention to use since they are confined by performance and effort expectancies (Venkatesh, 2003).

According to Momani and Jamous (2017), the Technology Acceptance theory is also an extension of the Theory of Reasoned Action (TRA) done by Davis. It replaced TRA's attitude toward behavior with two technology acceptance measures which are: perceived usefulness and perceived ease of use. Technology Acceptance Theory did not include the TRA's subjective norms in its structure. It was developed after the introduction of information systems into organizations. It is formed in the information technology field, while Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB) developed in the psychology field so that it is less general than TRA and TPB. The development of technology acceptance theory came through three phases: adoption, validation, and extension. In the adoption phase, it was tested and adopted through a vast number of information system applications. In the context of software use, this provided a mechanism for discussing the current mix of Usefulness and Ease of Use for particular software packages, and for plotting a different course if a different combination is desired, such as the introduction of even more robust software. The Technology Acceptance Theory has been used in most technological and geographic contexts. Some of these contexts are in health care, commerce, and education. This theory was considered relevant to the study in that it helped the researcher understand how the adoption of new technologies by IEBC can improve on their performance and improve on the credibility of the election in Kenya.

2.2 Empirical Literature Review
This section presents a review of the various studies that have been conducted previously by other authors and related to the topic of the current study.

2.2.1 Biometric Voter Registration and Credibility of Electoral System
Wolf, Alim, Kasaro, Namugera, and Saneem (2017) surveyed the introduction of Biometric Technology in Elections. The study adopted a survey research design. The study was conducted in Bangladesh, Fiji, Mongolia, Nigeria, Uganda, and Zambia. The findings of the survey indicated that 35 percent of over 130 surveyed EMBs were capturing biometric data as part of their voter registration process. Biometric technology was found to be widely used in the registration process, especially in Africa and Latin America. In 32 percent of surveyed countries, voter registers were based on civil registers. In many cases, civic registration systems contain biometric data that can be used for electoral purposes. In addition, the study findings indicated that using biometric technology in the registration of voters was found to reduce opportunities for multiple voting significantly. The findings of the study by Wolf *et al* (2017) revealed that during registration biometrics were used to detect and prevent multiple registrations, and biometrics used in polling stations were clearly established a voter's identity and thus mitigate the risk of impersonation, identity theft, the misuse of records of deceased voters, carousel voting and ballot-box stuffing hence improving the credibility of the results. The study concluded that biometric technology is very efficient for reducing or eliminating multiple registrations and multiple voting, as well as producing high-quality, tamper-resistant voter ID cards. Based on the findings, the study recommended that low registration rates will not be improved by using

biometric technology. Additional measures such as providing voter information about the registration systems in place, removing any registration barriers, and introducing an inclusive registration process are essential regardless of whether a biometric system is used.

In Kenya, Jacobsen (2019) conducted a study on Biometric voter registration by focusing on a new modality of democracy assistance. The study adopted a descriptive statistics research design. The findings of the study revealed that, although the 2013 voter registration exercise proceeded relatively smoothly, problems emerged on Election Day, and these included the failure of the majority of the verification kits on polling day and the mobile phone transmission of results also broke down owing to a server system failure. The Independent Election and Boundaries Commission (IEBC) had set a voter registration target of 18. 2 million for the 2013 elections but managed to register only 14.3 million (79% of target). Out of the 14.3 million registered voters, 12.2 million (85.90%) took part in the 2013 General Elections, and 2 million (14.09%) did not turn out to vote. Local CSOs said on Election Day, the Electronic Voter Identification Devices (EVID), which uses fingerprint biometric to identify a voter failed to work in 52% or the polling stations. This led to accusations of rigging and contributed to the losing candidate, RailaOdinga rejecting the election results. The study concluded that, just like in many African countries, some of the Kenyans have little confidence in both the elections and the IEBC. The electoral processes are hugely politicized, and the recently appointed need to deal with a plethora of issues including building trust and confidence of the electorate and stakeholders to enhance the credibility and legitimacy of elections. Absence of trust and confidence can directly affect key electoral processes such as voter registration and turn-out on polling day.

2.2.2 Electronic Voter Identification System and Credibility of Electoral System

Ayeni and Esan (2018) conducted a study to establish the Impact of ICT in the Conduct of Elections in Nigeria. The study adopted observations and oral interviews to collect information for the study. The findings of the study indicated that the introduction of these technologies: Electronic Voters Register(EVR), Automatic Fingerprints Identification System (AFIS) and Smart Card Reader (SCR) had reduced the incidence of multiple registrations and multiple voting to the barest minimum while the development of e-collection support platform has drastically reduced incidence of result manipulation at collection centres. Ayeni and Esan (2018) indicated that the incorporation of Technology in Nigeria electoral process had reduced excessive electoral fraud to the barest minimum and foster credible election. The study further noted that the introduction of technology in the Nigerian electoral system has modernized the system and improve deletions management in the country and enhanced the credibility of the election results. The study recommended that Register update and voters' revalidation exercise should be done before any general election. This will enable the electoral body to detect and remove dead voters from the register. Besides, enough time should be allocated to ICT-based activities, e.g., computer purging and installation for continuous Voters registration (CVR), Smart Card Reader purging and configuration, and printing of registers. Eleventh-hour rush will always give room for avoidable mistakes, which might generate unnecessary tension and problems. It will also reduce the stress of technical support staff and increase public confidence in the electoral body.

Muthuri (2018), in collaboration with Privacy International, conducted a study to Investigate Privacy Implications of Biometric Voter Registration in Kenya's 2017 Election Process. The study aimed to investigate the privacy implications of using biometric technology during the electoral process in Kenya. The project focused on two main concerns, which included the motivations for the adoption of biometric technology in the Kenyan elections and how privacy and security of personal data in Kenya impacted by the adoption of biometrics in the electoral system. The findings of the study indicated that Fingerprint data is collected (all 10 fingers) together with the voter's alphanumeric data that is; name, age, disability, polling station, county, constituency, etc. This information is collected continuously but halted during election petitions, general elections, and referendums. Mass voter registration is carried out to "hype up" voter registration and to support the continuous registration. Data is collected at the polling station level, at registration centres, using stand-alone biometric data kits. This data is backed up on flash disks, which are then taken to and uploaded onto a server at the constituency level/regional level, after which it is transmitted to the central database at the IEBC headquarters. The IEBC saves voter registration data, both continuously and periodically. Uploading of data to the IEBC central database is done via a secure network owned by the IEBC: fortnightly in the case of continuous voter registration, and weekly (at the county level) in the case of mass voter registration.

RESEARCH METHODOLOGY

3.1 Research Design

A research design is an approach for a study and the plan by which the strategy is to be carried out (Cooper & Schindler, 2001). This study adopted a descriptive research design. Cooper and Schindler (2008) demonstrate that the essential features of descriptive that lie in the objectives. If the research is concerned with finding out who, what, where, when, or how much, then the study is descriptive. Descriptive studies are those to describe phenomena associated with a subject population or to estimate proportions of the people that have specific characteristics.

3.2 Target Population and Sample Frame

The target population, as defined by Frederic (2010), is a universal representative set of the larger population of all members; the real or hypothetical set of people, events, or objects to which a researcher wishes to generalize the findings. The accessible population, on the other hand, refers to the population in research on which the researchers can apply their findings (Saunders, Lewis, &Thornhill, 2012). The target population for this study comprised of 2,251,929 registered voters in Nairobi County as per the IEBC voters' register of 2017 (Appendix III) and 40 IEBC technical staffs. Table 3.1 shows the target population

Table 3.1: Target Population

Category	Target Population
Registered Voters	2,251,929
IEBC Technical Staff	40
Total	**2,251969**

3.3 Sample and Sampling Technique

Orodho and Kombo (2002) observe samples as a limited and set number of people in a population to be observed. Stratified random sampling technique was utilized to sample voters from the constituencies in Nairobi County, while Census approach was used to collect data from the technical staffs since their number was manageable; however, since the population of registered voters in Nairobi County was considered too large, the sample size for the voters was determined using the Fisher's *et al*. (2007) formula;

$n = Z^2 \, pq/d^2$

Where n=the desired sample size

Z=standard normal deviation at the required confidence level 95% or 1.96

P= Business owners and managers, 0.7238 of the entire population of SMEs.

$\text{Calculation} \rightarrow \frac{\text{Registered Voters who voted}}{\text{No.of Registered Voters}} \times 100\% = \frac{1,629,894}{2,251,929} \times 100\% =$

72.38% (0.7238)

q=1-p (the proportion without characteristics)

d=level of statistical significance (degree of freedom=0.05)

$n = 1.96^2 (0.7238)(0.2762)/(0.05)^2$

n=307 Voters

The sample size for this study was 347 respondents.

Table 3.2: Sample Size

Category	Technique	Sample Size
Registered Voters	Stratified Sampling	307
IEBC Technical Staff	Census	40
Total		**347**

3.4 Pilot Testing

A pilot test is conducted to detect weaknesses in design and instrumentation and to provide proxy data for the selection of a probability sample (Cooper & Schindler, 2011). The study adopted 10% of respondents for pilot testing representing 34 respondents. A pilot test is conducted to test for the reliability and validity of the data collection instruments.

3.4.1 Validity of the Research Instrument

Validity refers to whether a questionnaire is measuring what it purports to measure (Heale&Twycross, 2015). To ensure content validity, the questionnaire was subjected to a thorough examination by supervisors in charge of the proposal development. They were asked to evaluate the statements in the questionnaire for relevance. Based on the evaluation, the instrument was adjusted appropriately before subjecting it to the final data collection exercise. Their review comments were used to ensure that content validity is enhanced.

3.4.2 Reliability of the Instrument

Heale and Twycross (2015) define reliability as the extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable. The study adopted Cronbach alpha value of 0.70 to test for the reliability of data. Reliability is the consistency of measurement or the degree to which an

instrument measures the same way each time it is used under the same condition with the same subjects. The reliability test results are presented in Table 3.3.

Table 3.3: Reliability Test Results

Variable	Cronbach Alpha	Items	Comments
Biometric Voter Registration	0.842	6	Acceptable
Electronic Voter Identification	0.848	6	Acceptable
Credibility of Electoral Systems	0.833	6	Acceptable

RESEARCH FINDINGS AND DISCUSSION

4.1 Response Rate

Questionnaires were administered to 312 respondents who made up of both registered voters in Nairobi County and IEBC officials in Nairobi County. Out of 312 questionnaires distributed, 271 questionnaires were duly filled and returned. However, some of the respondents returned the questionnaires half-filled, while the others did not return them completely despite an intensive follow up. The response rate result is shown in Table 4.1.

Table 4.1: Response Rate

Response	Frequency	Percentage
Returned	271	86.86
Unreturned	41	13.14
Total	**312**	**100**

The study, therefore, yielded an 86.86% response rate, which, according to Bailey (2000), was very good for this study. Bailey (2000) believes that a response rate of 50% is adequate, while a response rate higher than 70% is outstanding.

4.2 Distribution of Respondents by Demographic Characteristics

4.2.1 Gender of the Respondents

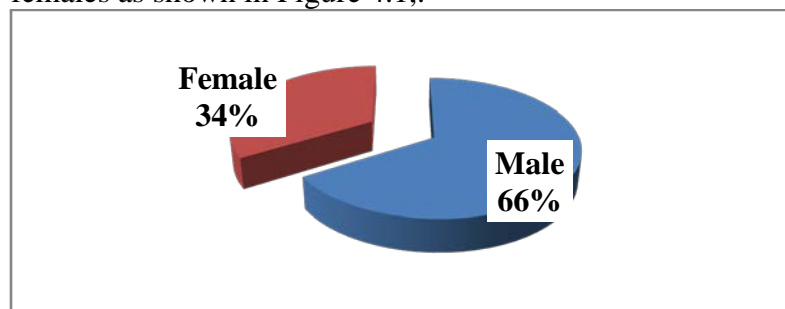The majority (66%) of respondents who took part in this study were males, while 34% were females as shown in Figure 4.1,.

Figure 4.1 Gender of respondents

4.2.2 Age of the Respondents

Based on the results in Figure 4.2, most (42.10%) of the respondents were between the age of 31-40 years, 17.30% were between the ages of 26-30 years, 14.40% were aged more than 50 years. Also, the results show that 13.70% of the respondents were aged between 18-25 years, and only 12.50% were aged between 41-50 years. The results imply that most of the registered voters in Nairobi County are between the ages of 31-40 years. This further implies that this age group is well informed about their rights to vote and elect the leaders they want, this age group is further the most affected by unemployment and therefore they exercise their right to vote to choose

leaders who will create job opportunities for them. The results also imply that voters aged 41 years and above were not many since they have voted for a long time and perhaps they have not realized the change they have always wanted and so they no longer want to participate in the exercise, hence, voter apathy. Holland (2013) indicated that, in 2008 and 2012, younger people overwhelmingly voted for the Democratic candidate Barack Obama, while older people voted for the Republican candidate John McCain and Mitt Romney by wide margins; younger people are usually more liberal than older people, and younger people typically prefer insurgent candidates over mainstream candidates compared to older people.
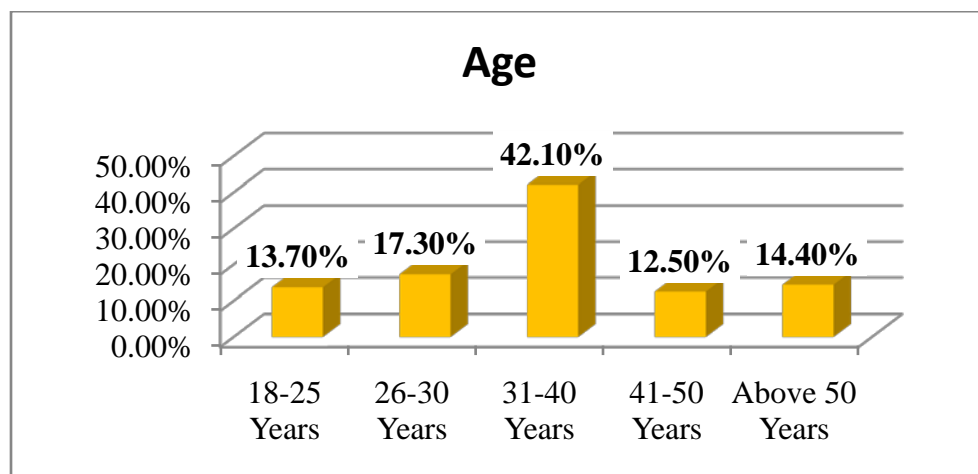

Figure 4.2: Age of Respondent

4.2.3 Respondent's level of Education

The results in Figure 4.3 show that slightly more than half of the respondents were secondary school graduates, 14% indicated that their highest level of education was college and another 14% indicated that their highest level of education was undergraduate. In addition, the results show that 11.40% of the respondents were postgraduates, while 10.30% indicated that the highest level of education they attained was the primary level. The results imply that most of the registered voters in Nairobi County are secondary school graduates.
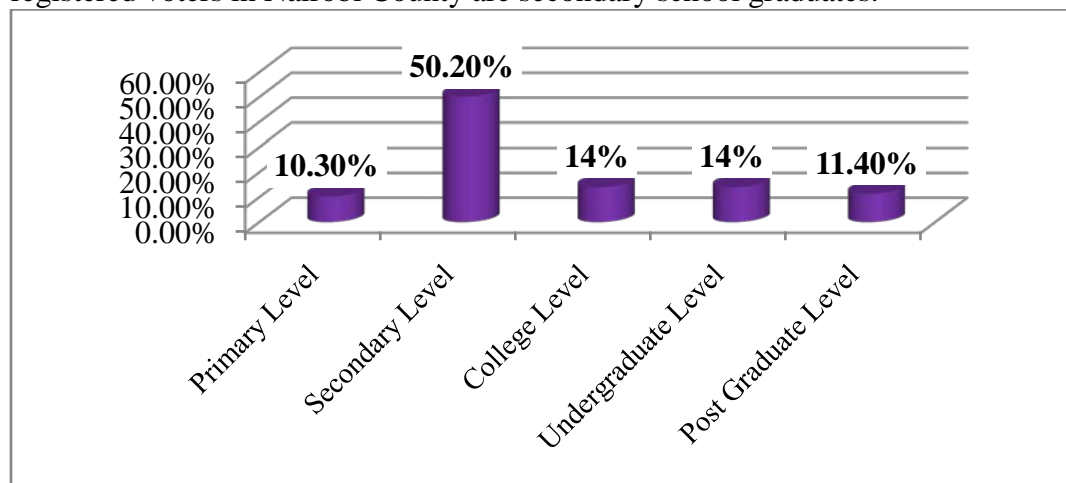

Figure 4.3: Highest Education Level

4.2.4 Number of Times Voted in Nairobi County

As indicated in Figure 4.4, slightly more than half of the respondents had voted in Nairobi County only once, 27% indicated that they had voted twice, and only 21% noted that they had never taken part in any voting process in a general election in Nairobi County. The results imply that most of the voters in Nairobi County have only participated in one general election in Nairobi County as voters.
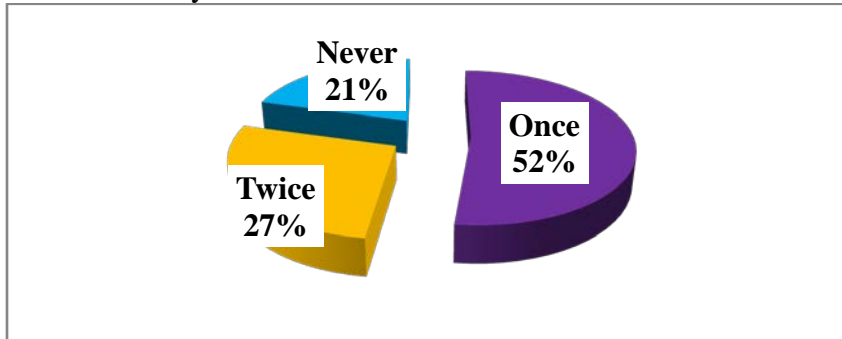

Figure 4.4: Number of Times Respondent had Voted in Nairobi county

4.3 Descriptive Statistics
4.3.1 Biometric Voter Registration (BVR)

The first objective of this study was to establish the effect of the credibility of the Electoral System. Based on the results in Table 4.2, a majority of the respondents 96.00% (43.20%+52.80%) agreed that BVR captures very accurate data of the voter, and this, according to them, could help in increasing the credibility of the election results. The results also show that 3.00% of the respondents were neutral about the matter, while only 1.10% of the respondents disagreed with the statement. The result had a mean of 4.465 and a standard deviation of 0.665, implying that most of the respondents were in agreement with the statement. The same sentiments were shared by Jacobsen (2019), who indicated that Biometric voter registration (BVR) is one of the technologies used by electoral bodies today in enhancing the credibility of election results. The BVR system is used for registering voters. It comprises a laptop, a fingerprint scanner, and a camera. Moreover, the results show that 91.90% of the respondents believed the introduction of BVR had reduced cases of multiple registrations, while only 6.20% of the respondents had a contrary opinion on the same. The results had (M=4.428, Std. Dv=0.997). It implies that most of the respondents agreed with the statement, however, their responses were spread about the mean as indicated by the standard deviation.

Further, the results indicated that 96.70% of the respondents believed that BVR had helped eliminate cases of dead voters in the register, and this, according to them had helped in addressing the problem of credibility of the electoral body. However, 1.90% of the respondents held a different opinion; they believed BVR had not helped in eliminating cases of dead voters in the register. The responses had (M=4.491, Std. Dv=0.693), showing that most of the respondents were in agreement with the statement. Further, 97.00% of the respondents believed that registration of voters had been made faster with the introduction of BVR as compared to before, 2.20% believed otherwise. The results had (M=4.428, Std. Dv=0.711) showing that majority of the respondents agreed that registration of voters had been made faster with the introduction of BVR.Similarly, the results show that majority (86.70%) of the respondents agreed that BVR had ensured voter's data was secured and could be retrieved whenever needed; however, 8.80% felt otherwise. The responses had (M=4.288, Std. Dv=1.118), indicating that most of the respondents

were in agreement with the statement even though the responses were varied. Finally, the results show that majority (87.80%) of the respondents believed that BVR had eliminated cases of multiple voting, while 8.10% felt it had not.The response had (M=4.303, Std. Dv=1.077). The results show that most of the respondents agreed with the statement, but the responses were varied. Overall, the results had an average mean and standard deviation of 4.400 and 0.877, respectively, showing that most of the respondents agreed with the statement, but the responses were varied.

Table 4.2: Descriptive Statistics on Biometric Voter Registration (BVR)

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Dev
BVR captures very accurate data of the voter	1.10%	0.00%	3.00%	43.20%	52.80%	4.465	0.665
Introduction of BVR has reduced cases of multiple registration	5.50%	0.70%	1.80%	29.20%	62.70%	4.428	0.997
BVR has helped eliminate cases of dead voters in the register	1.50%	0.40%	1.50%	41.00%	55.70%	4.491	0.693
Registration of voters has been made faster with the introduction of BVR	1.80%	0.40%	0.70%	47.20%	49.80%	4.428	0.711
BVR has ensured voter's data is secured and can be retrieved whenever needed	7.00%	1.80%	4.40%	28.80%	57.90%	4.288	1.118
BVR has eliminated cases of multiple voting	6.30%	1.80%	4.10%	31.00%	56.80%	4.303	1.077
Average						**4.400**	**0.877**

The results are in agreement with the findings of Wolf *et al.* (2017) which revealed that during registration biometrics were used to detect and prevent multiple registration and biometrics used in polling stations would establish a voter's identity and thus mitigate the risk of impersonation, identity theft, the misuse of records of deceased voters, carousel voting and ballot-box stuffing, hence, improving the credibility of the results. The study concluded that biometric technology is very efficient for reducing or eliminating multiple registrations and multiple voting, as well as producing high-quality, tamper-resistant voter ID cards.

4.3.2 Electronic Voter Identification System (EVID)
The second objective of this study was to determine the influence of the Electronic Voter Identification System (EVID) on the credibility of the Electoral System. Based on the results in Table 4.3, majority of the respondents 95.20% (41.70%+53.50%) agreed that EVID identifies voters uniquely, therefore, eliminating cases of imposters voting. The results also show that 3.00% of the respondents were neutral about the matter, while only 1.80% of the respondents disagreed with the statement. The result had a mean of 4.450 and a standard deviation of 0.728 implying that most of the respondents were in agreement with the statement. The findings are consistent with those of Tran (2019) which pointed out that, EVIDs verify and confirm voters electronically as registered by BVR; they are used to ″check-in″ voters at the polling station on polling day and help streamline the voting process. He indicated that EVID curbs impersonation

and ensures that only those who registered to vote are allowed to vote. In addition, the results show that 90.80% of the respondents believed the EVID had helped in faster voting at the polling station, while only 6.60% of the respondents held a contrary opinion on the same. The results had (M=4.450, Std. Dv=1.028). This implies that most of the respondents agreed with the statement however their responses were spread about the mean as indicated by the standard deviation.

Table 4.3: Descriptive Statistics on Electronic Voter Identification System (EVID)

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Dev
EVID identifies voters uniquely therefore eliminating cases of imposters voting	1.80%	0.00%	3.00%	41.70%	53.50%	4.450	0.728
EVID has helped in faster voting at the polling station	5.90%	0.70%	2.60%	24.00%	66.80%	4.450	1.028
EVID provides very accurate identification of the voter	1.50%	0.40%	1.50%	43.90%	52.80%	4.461	0.692
AFIS reduces risks of unwanted breaches	1.80%	0.40%	0.70%	49.80%	47.20%	4.402	0.708
With the use of EVID, access is permitted by the use of biological characteristics and not password making it easy	7.00%	1.80%	4.40%	29.20%	57.60%	4.284	1.117
EVID has eliminated cases of data duplication or forging	6.30%	1.80%	4.10%	31.00%	56.80%	4.303	1.077
Average						**4.392**	**0.892**

Further, the results indicated that 96.70% of the respondents believed that EVID provides very accurate identification of the voter, and this, according to them, had helped in addressing the problem of credibility of the electoral body. However, 1.90% of the respondents held a different opinion; they believed EVID could not provide accurate identification of the voter. The responses had (M=4.461, Std. Dv=0.692), showing that most of the respondents were in agreement with the statement. 97.00% of the respondents believed that AFIS reduces risks of unwanted breaches, 2.20% believed otherwise. The results had (M=4.402, Std. Dv=0.708), showing that the majority of the respondents agreed with the statement that EVID provides very accurate identification of the voter.Similarly, the results show that the majority (86.80%) of the respondents agreed that with the use of EVID, access is permitted by the use of biological characteristics and not passwords making it easy; however, 8.80% felt otherwise. The responses had (M=4.284, Std. Dv=1.117), indicating that most of the respondents were in agreement with the statement even though the responses were varied. Finally, the results show that the majority (87.80%) of the respondents noted that EVID had eliminated cases of data duplication or forging, while 8.10% felt it had not. The response had (M=4.303, Std. Dv=1.077). The results show that most of the respondents agreed with the statement, but the responses were varied. Overall, the results had an average mean and standard deviation of 4.392and 0.892, respectively, showing that most of the respondents agreed with the statement, but the responses were varied. The results are consistent with the conclusion made by Ayeni and Esan (2018) that the introduction of technologies such as Electronic Voters Register (EVR), Automatic Fingerprints Identification System (AFIS) and Smart Card Reader (SCR) has reduced the incidence of multiple registrations

and multiple voting to the barest minimum while the development of e-collection support platform has drastically reduced incidence of result manipulation at collection centres.

4.3.3 Credibility of the Electoral System

The dependent variable of this study was the credibility of the Electoral System. Based on the results presented in Table 4.4, majority 95.20% (41.00%+54.20%) had the feeling that over the previous two general elections, IEBC had ensured inclusivity in the electoral process. However, 1.80% of them believed otherwise. The result had a mean of 4.458 and a standard deviation of 0.728, indicating that most of the respondents were in agreement with the statement.

Table 4.4: Descriptive Statistics on the Credibility of the Electoral System

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean	Std. Dev
Over the past two general elections IEBC has ensured inclusivity in the electoral process	1.80%	0.00%	3.00%	41.00%	54.20%	4.458	0.728
There has been an increase in openness in the manner in which elections are being held in Kenya	4.40%	0.70%	2.60%	38.40%	53.90%	4.365	0.929
IEBC has been delivering free fair and credible elections since promulgation of 2010 constitution.	1.50%	0.40%	1.50%	43.90%	52.80%	4.461	0.692
IEBC has gained public trust in the manner in which they conduct elections	1.80%	0.40%	0.70%	50.20%	46.90%	4.399	0.707
Because of the integrity of the results delivered by IEBC, there has been a reduction in tension after pols	7.00%	1.80%	4.40%	32.10%	54.60%	4.255	1.111
Election petitions have reduced drastically since the introduction of biometric voting.	5.90%	0.80%	4.10%	33.90%	54.20%	4.288	1.053
Average						**4.371**	**0.870**

The result conforms with the findings of Ibrahim (2019) which revealed that, in 2013, Kenyanelection was a classic case where the Independent Electoraland Boundaries Commission (IEBC) in partnership withthe media made efforts to educate voters weeks before the general elections as a way of increasing the credibility of the election results by reducing the number of spoilt votes. Also based on the results, 92.30% of the respondents believed that there had been an increase in openness in the manner in which elections were being held in Kenya. Conversely, 5.10% believed that there had never been any change in the openness in the manner in which elections were being held in Kenya. The results had (M=4.365, Std. Dev=0.929). This implies that most of the respondents had the feeling that there had been an increase in openness in the manner in which elections were being held in Kenya; however, their responses were spread about the mean as indicated by the standard deviation.The results further show that majority (96.70%) of the respondents thought that IEBC had been delivering free, fair and credible elections since the promulgation of 2010 constitution. However, 1.90% of the respondents held a contrary opinion; they believed IEBC had not delivered free, fair and credible elections since promulgation of 2010 constitution. The responses had (M=4.461, Std. Dv=0.692), showing that most of the respondents were in agreement with the statement. In addition, as shown, 97.10% of

the respondents were holding the belief that IEBC had gained the public trust in the manner in which they conduct elections, while 2.90% of the them felt otherwise. The results had (M=4.410, Std. Dv=0.739) showing that majority of the respondents agreed with the statement.

Similarly, the results show that majority (86.70%) of the respondents agreed that because of the integrity of the results delivered by IEBC, there had been reduction in tension after pols; however, 8.80% did not agree. The responses had (M=4.255, Std. Dv=1.111) indicating that most of the respondents were in agreement with the statement even though the responses were varied. Finally, the results show that majority (88.10%) of the respondents were of the opinion that election petitions had reduced drastically since the introduction of biometric voting system by IEBC, while 6.70% believed nothing had changed. The response had (M=4.288, Std. Dv=1.053). The results show that most of the respondents agreed with the statement but the responses were varied. Overall, the results had an average mean and standard deviation of 4.371and 0.870 respectively showing that most of the respondents agreed with the statement, but the responses were varied.

4.4 Inferential Analysis
4.4.1 Correlation Analysis
In this study, correlation analysis was conducted to establish the relationshipof Biometric Voter Registration (BVR) on the credibility of the Electoral System and to determine the relationship of the Electronic Voter Identification System (EVID) on the credibility of the Electoral System. The correlation results are presented in Table 4.5

Table 4.5: Multiple Correlation Matrix

		Credibility	BVR	EVID
Credibility	Pearson Correlation	1.000		
	Sig. (2-tailed)			
BVR	Pearson Correlation	.773**	1.000	
	Sig. (2-tailed)	0.000		
EVID	Pearson Correlation	.784**	.657**	1.000
	Sig. (2-tailed)	0.000	0.000	

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

The results in Table 4.5 revealed that biometric voter registration (BVR) and credibility of electoral systems are positively and significantly related (r=0.773, p=0.000). In addition, it has been revealed that electronic voter identification and credibility of electoral systems are positively and significantly related (r=0.784, p=0.000). The correlation results affirm the assertion by Jacobsen (2019) that increased internet penetration even in developing countries with poor communications infrastructure is enabling EMBs to be more effective at communicating internally and with all the stakeholders involved in the process. Technology is also playing an increased role in enhancing the integrity and credibility of electoral processes and strengthening trust between stakeholders.

4.4.2 Regression Analysis
The regression analysis was conducted to establish the combined effectBiometric Voter Registration (BVR) and Electronic Voter Identification System (EVID) on the credibility of the

electoral system. The results presented in Table 4.6 indicate the fitness of the model which was interpreted using the R squared value.

Table 4.6: Model Fitness

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.885[a]	.783	.780	.30706

a. Predictors: (Constant), BVR, EVID

The model fitness results in Table 4.6 show that BVR, and EVID are satisfactory variables in explaining the credibility of electoral system in Nairobi County. This is supported by a coefficient of determination also known as the R square of 0.783. This means that BVR, and EVID explain 78.3% of the variations in the dependent variable, which in this case is the credibility of the electoral system.

The results are consistent with the findings of Ayeni and Esan (2018) which indicated that, the incorporation of Technology in Nigeria electoral process had reduced excessive electoral fraud to the barest minimum and foster credible election. The study further noted that the introduction of technology in the Nigerian electoral system had modernized the system and improved election management in the country and enhanced the credibility of the election results. Table 4.7 shows the results of the Analysis of Variance (ANOVA).

Table 4.7: Analysis of Variance

Model		Sum of Squares	Df	Mean Square	F	Sig.
	Regression	90.677	4	22.669	240.425	.000[b]
1	Residual	25.081	266	.094		
	Total	115.757	270			

a. Dependent Variable: Credibility
b. Predictors: (Constant), BVR, EVID

The ANOVA results in Table 4.7 show that the general model was statistically significant. Further, the outcomes suggest that the independent variables (BVR, and EVID) were good indicators of the credibility of the electoral system. This was supported by an F statistic of 240.425 and the reported p-value (0.000) which was less than the conventional probability of 0.05 significance level. The regression of the coefficient table is presented in Table 4.8.

Table 4.8: Multiple Regression Results

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
	(Constant)	-.119	.148		-.806	.421
1	BVR	.356	.039	.362	9.162	.000
	EVID	.380	.041	.379	9.290	.000

a. Dependent Variable: Credibility

The optimal model was therefore;
$Y = -.119 + 0.356X_1 + 0.380X_2$
Where:-Y = Credibility of Electoral System; X_1 = BVR; X_2 = EVID

Regression of coefficients results in Table 4.8 shows that biometric voter registration (BVR) and credibility of electoral systems are positively and significantly related (β =.356, p=0.000). The results further indicated that electronic voter identification and credibility of electoral systems are positively and significantly related (β =.380, p=0.000). This implies that an improvement in BVR and EVID leads to an improvement in the credibility of electoral systems. The regression results are consistent with the findings of Loeber (2017), which indicated that, the applications used for ensuring the security of data include; electoral registers, software for registration of parties and candidates and software for tallying, direct data capture machine and calculating results. However, nowadays, voters are also confronted with ICT solutions in voting in some countries where forms of e-voting are introduced. This can range from fairly simple forms such as a scanner that counts the ballot as the voter puts it in the ballot box, to the use of voting computers in the polling station, but also remote voting through the internet. The use of these new technologies raises new challenges for election management bodies (EMB).

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS
5.1 Summary of findings
5.1.1 Biometric Voter Registration (BVR) and Credibility of Electoral System
The first objective of this study was to establish the effect of biometric voter registration (BVR) on the credibility of the Electoral System in Kenya. Descriptive analysis was conducted on the indicators of biometric voter registration, and the findings were that most of the respondents were in agreement with most of the statements regarding the effect of BVR on the credibility of the electoral system as indicated by an average mean of 4.400 and average standard deviation of 0.877. The study also conducted a correlation analysis to show the strength and the direction of the linear relationship between BVR and the dependent variable, which was credibility of the electoral system. The correlation analysis results revealed that biometric voter registration (BVR) and credibility of electoral systems were positively and significantly related (r=0.773, p=0.000). The findings of the regression analysis revealed that biometric voter registration (BVR) and credibility of electoral systems were positively and significantly related (β =.356, p=0.000). This meant that a unit improvement in BVR leads to an improvement in the credibility of electoral system by 0.356 units holding other factors constant.

5.1.2 Electronic Voter Identification System (EVID) and Credibility of Electoral System
The second objective of this study was to determine the influence of the electronic voter identification system (EVID) on the credibility of the Electoral System in Kenya. Based on the descriptive analysis results majority of the respondents believed that the introduction of EVID in the electoral system of Kenya had helped a great deal in enhancing the credibility of IEBC and indicated by a mean of 4.392and standard deviation of 0.892. The correlation analysis results revealed a positive and significant association between the electronic voter identification system (EVID) and the credibility of the electoral system (r=0.784, p=0.000). Besides, the regression analysis results revealed a positive and significant relationship between electronic voter identification system (EVID) and credibility of the electoral system (β =.380, p=0.000); meaning that a unit improvement in the use of EVID by IEBC would result into an improvement in the credibility of the electoral body b 0.380 units.

5.2 Conclusions

The study concludes that biometric voter registration positively affects the credibility of the electoral system. BVR is very efficient in reducing or eliminating multiple registrations and multiple voting, as well as producing high-quality, tamper-resistant voter ID cards. However, it is important to note that low registration rates cannot be improved by using biometric technology. In addition, the study concludes that the introduction of BVR in the Kenyan election process has enhanced the credibility of IEBC since there are no more cases of multiple registrations of voters or multiple voting.

The study also concludes that EVID positively and significantly influences the credibility of the electoral system in Kenya. The introduction of EVID by IEBC has made sure only those registered to vote votes. The EVIDs helps in verifying and confirming voters electronically as registered by BVR; EVID is also used to check-in voters at the polling station on polling day and help streamline the election process. EVID has helped IEBC curbs cases of impersonation and ensures that only those who registered to vote are allowed to vote.

5.3 Recommendations

Despite the government of Kenya spending a lot of money in acquiring BVR, the adoption of biometrics has not restored the public's trust in the electoral process. The study recommends that there should be adequate and strict protocols for supervision, management and storage of electoral data.

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