ELECTRONIC VOTING PERCEPTIONS IN GHANA: IN SEARCH OF A CRITICAL MASS

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Abstract

As the world continues to embrace technology in various sectors, electoral processes have also witnessed significant advancements. E-voting offers the potential for enhanced efficiency, transparency, and accessibility in elections. However, its successful implementation requires careful consideration of socio-technical factors, encompassing both technological and human elements. This study aims to assess Ghana's preparedness for implementing electronic voting at the national level and determine the socio-technical feasibility of conducting future elections using electronic means. A self-administered questionnaire was employed, utilizing an online survey method to collect data from 197 respondents in Ghana. Quantitative responses were coded and analysed using SPSS v25, while qualitative responses underwent thematic analysis. The unified theory of acceptance and use of technology (UTAUT) served as the analytical framework. The findings indicate a strong positive perception among Ghanaians regarding the potential benefits of electronic voting systems, including increased acceptability and accuracy of election results. The respondents exhibited confidence in their personal abilities to use future e-voting systems. The study suggests that critical mass acceptance could be achieved by the 2024 elections through stakeholder efforts, such as education and campaigning. Consequently, the implementation of electronic voting in Ghana appears opportune. Additionally, this study provides insights into the acceptance mindset towards electronic systems, surpassing previous studies which focused solely on trust in electoral institutions. This research sheds light on Ghana's readiness and the feasibility of adopting e-voting at the national level. The positive perceptions and confidence expressed by respondents indicate a favourable environment for the implementation of e-voting. The study further emphasizes the importance of quantifying and predicting the critical mass point for acceptance, supporting informed decision-making and strategic planning for the introduction of electronic voting in Ghana.

Keywords: e-voting, UTAUT, Technology Acceptance, Digitalisation, Democracy

Introduction

In 1992, the Republic of Ghana made the fourth attempt at ensuring that national leadership is determined through the ballot box, through universal adult suffrage supervised by the Electoral Commission (EC). This follows three previous attempts in 1960, 1972 and 1979. (Willis et al., 2021). The EC is legally responsible for organizing national elections, and it identifies voters through an identification (ID) card system. In 1992, the EC used picture-less ID cards, which were later improved to include a monochrome passport pictures in 1996. By 2000, a voter card with a colour passport photo was issued. In 2012, the voter's database was upgraded to include biometric data.

By way of election results transmission, the EC upgraded its system from telephone calls in 1992 to Internet transmission in 2012 and 2016

but reverted to manual transmission in 2020 due to alleged hacking. In 2016, the EC used a dual system that transmitted results concurrently using both electronic and manual systems. The electronic component was allegedly hacked.

Over the years, the EC has been deploying improved technology often on the back of complaints and suggestions for improvement from the electorate, political parties and other stakeholders (Schedler et al., 1999).

Although actual vote casting has not changed and still involves thumb printing, citizens have supported the use of technology in collating, verifying, and transmitting election results. This research, therefore, was motivated to ask: Is the voter trusting enough of the use of technology to collect, register and tally her/his choice?

Digital technology has been adopted remarkably well in Ghana, with mobile telephony exceeding 100%, nearly half the population using smartphones, and mobile money exceeding total banking deposits for three continuous years (Kemp, 2022). Most tertiary institutions now manage student records on electronic platforms and employ electronic systems for student elections. However, it is unclear whether voters are willing to cast their votes electronically in national elections. This study aims to investigate factors that could influence the adoption or acceptance of e-voting.

Literature Review

One of the aspirations of any identifiable entity is the involvement of all qualified stakeholders in a democratic decision-making process. The decision-making process by the people and for the people often involves debates, lobbying and voting among other activities. Various authors have demonstrated the direct correlation between democratic governance, development and growth (Adams & Agomor, 2019; Bardhan, 2020). The reasons for this would include trust by investors (Özen, 2019), stability (Nemčok &

Wass, 2020), assured long-run growth (Gök, 2020) and an allowance for a broader range of interests to be considered on a regular basis (Mills et al., 2019). Ghana, since its birth in 1957 has chosen, despite a number of setbacks, to practice democracy. In most democratic practices, the voting component of democracy is so discrete, detailed and structured that it lends itself to automation. This paper explores the feasibility of adopting electronic voting in Ghana.

Broadly speaking, the use of electronic systems to implement a voting process may be called e-voting. Technically the practice of electronic voting involves a wide-ranging set of options involving some or all of the major aspects; identification of voters, vote casting and counting. This paper opts to focus on the definition espoused by the Institute for Democracy and Electoral Assistance (IDEA) which states that it is a "system where the recording, casting or counting of votes in political elections and referendums involves information and communication technologies" (IDEA, 2011). Our interest lies in the use of electronic systems to capture the intentions of the voter.

Voting in Ghana is a very thorough and manual process involving more than 200,202 personnel, 33,367 polling stations and hundreds of other officials not involved directly in voting on the day of election (in the 2020 general election). The over 200,000 temporary staff (CODEO, 2020; Electoral Commission, 2020) presented over 200,000 possible fail points given the error prone nature of human endeavours.

If properly implemented, e-voting solutions can eliminate certain common avenues of error, fraud, and possibly reduce the cost of elections in the long term.

Trust in an e-voting system

Despite the associated costs, Ghanaians have been passing more money through the mobile money ecosystem than through their bank accounts (Kubuga & Konjaang, 2016). We note

that there is an extra layer of trust required in a voting system than in a money exchange system. Although for voting systems, there is a requirement to protect the secrecy of an individual's vote, it is necessary to establish a link between the voter and the vote so that, if required later, there can be proof that every vote was indeed counted and tallied as such. This may be problematic as voters may not want a record of their voting choice to be kept. There have been cases where votes cast and counted electronically have had to be recounted manually such as in Florida, USA in 2000 (Hasen, 2012) and in India in 2014 (Solanki & Meva, 2019). This extra layer of security needing a depersonalisation yet verifiability of a cast vote may contribute to making the implementation curve for e-voting a steep one in Ghana.

E-voting Successes and Reversals Worldwide
There are already some limited successes of national e-voting scenarios worldwide. We highlight this with the experiences of Australia, France, Namibia, Estonia and Brazil.

The Australian government started to use e-voting in 2001 in some places during the national elections. State by state, the e-voting system in Australia has grown in integrity and transparency (Buckland & Wen, 2012) and very likely on course to become the premier government-level universally verifiable public e-voting system in the world. Phased and backed by legislation and leadership, the Australia case is an example of how e-voting may be deployed. A high average literacy rate of 99% (World Bank, 2007) could be a contributory factor to this success since a sufficient level of formal education makes it easier for an individual to adapt and use a new technology (Almarashdeh & Alsmadi, 2016).

The French government developed an Internet voting system to allow for French Citizens Living Abroad to participate in national elections (Pinault & Courtade, 2012).

On the other side of the divide, Estonia with Internet penetration of over 90% (Kemp, 2021) and literacy rate of over 99% (UNESCO, 2021) has no issues rolling out an Internet based e-voting system available to all citizens on the back of a pre-existing secure online and Internet verifiable Estonian national ID card system. The Internet voting system has been piloted alongside the traditional stationed voting booths in nine (9) legally binding elections since 2009 each year seeing an increment in the number of citizens who opt to use the electronic platform; from 1.9% in 2005 to 43.8% in 2019 (Vassil et al., 2016). The gradual acceptance of e-voting supports the argument that a phased or piloted e-voting is possible everywhere.

On the African continent, Namibia has been able to conduct general elections for all citizens using electronic voting systems since 2014 (Madhani et al., 2021). To prevent possible cybercrime, electronic Voting Machines were stand-alone battery-powered machines which were not connected to any computer network and thus unable to transmit or receive any electronic signals. The use of stand-alone battery-powered systems was ideal for the third world country of Namibia. It, however, inadvertently meant voters still had to physically be present at a designated area. The high level of formal literacy in Namibia is partially a contributing factor to the successful deployment of e-voting in that country as well. UNESCO (2021) reports a 91.53% literacy rate for Namibia.

The Namibia and Estonia examples though, may only paint the picture that e-voting is successful only in countries with smaller populations. There are countries with large populations with relative success stories of nationwide deployment of e-voting, namely Brazil. Beginning with the 1996 general elections when the first tests were carried out on a pilot basis in just one state, the 2010 presidential election saw a nationwide deployment of e-voting with over 135 million

voters participating (Schneider, 2020). The collated election results were declared just about an hour and fifteen minutes after close of polls. In contrast, Ghana's 2020 national election, which was carried out mostly manually, with a voting population of just over 16 million took about 48 hours with a number of published corrections made by the EC (MyJoyOnline, 2020).

Where carefully planned and piloted, e-voting has been successful. These countries may be described as the early adopters. The rest of the world will learn from their mistakes and it is just a matter of time before the rest of the world adopts e-voting. Already the challenges faced by Kenya's 2013 attempt at e-voting has been a reference point for other countries (Barkan, 2013). In the Kenyan situation, the election management body was forced to stop the electronic tally of provisional results entirely after the server receiving them proved unable to compile incoming data (Carter Center, 2013). There were also allegations of third-party unauthorised access to the servers (Chege, 2018). It is the view of this paper that once the source of a problem is identified, the solution is feasible. Kenya and the rest of the world, including Ghana stands to benefit from these solutions.

Important factors
The two major barriers to the adoption of e-voting are technology and perceptions/trust. Technology often grows faster than anticipated (Weaver et al., 2017). Perceptions, however take experience, training and education to reshape. This study delves into trust and perceptions and studied this in relation to any future plan of the EC to organise e-voting on a national scale. For an e-voting system to successfully work in Ghana, voters will have to have confidence in the entire electoral system.

A voting system is only as good as the public believes it to be (McGaley & Gibson, 2003) and people will use insecure systems if they feel or think they are secure (Oostveen & Besselaar, 2004).

Conceptual Framework
The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) is employed in this paper. Figure 1 below illustrates the model and indicates four independent variables; Performance Expectancy (PE), Effort Expectancy (EE) and Social Influence (SI) and Facilitating Conditions (FC) that influence behavioural intention and eventual Use Behaviour. The variables of interest to this research were Performance Expectancy (PE) and Effort Expectancy (EE).

The model also recognizes that individual differences such as age, gender, and experience can moderate the effects of these factors on technology acceptance and use.
In general, the UTAUT model provides a comprehensive framework for understanding the complex interplay of factors that influence the adoption and usage of technology in various contexts. It has been widely used in research and practical applications to inform the design and implementation of new technologies.

All four control variables; gender, age, experience, and voluntariness of use were used and studied. Although, respondents were randomly sampled and participation was voluntary, the research used a purposive and targeted approach in a follow up mop-up data collection to allow for an alignment of the demographics of the survey and the actual demographics in the official register of the EC.
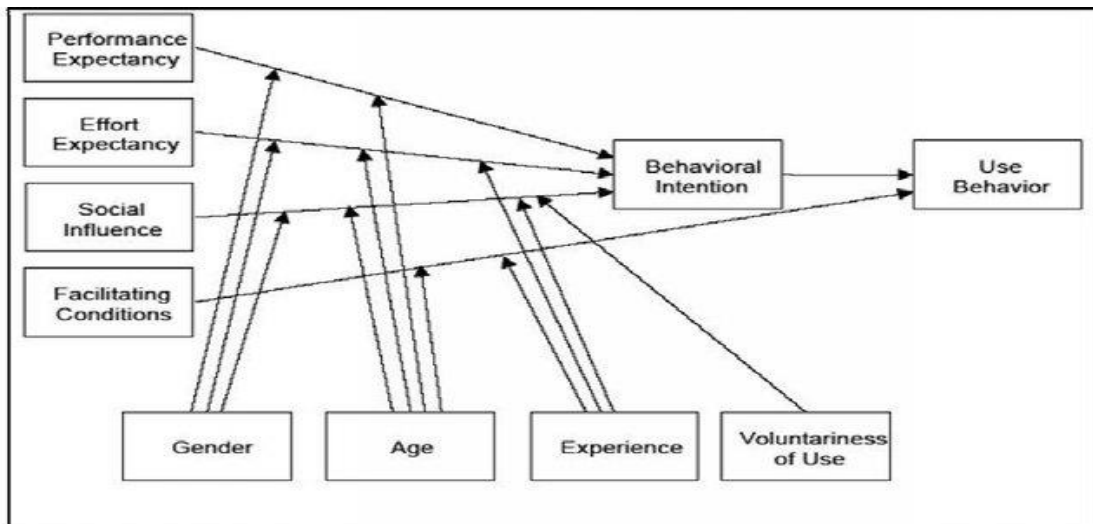
Figure 1: UTAUT model, (Venkatesh et al., 2003)

Methods and Data Collection

This study adopted the use of online data collection tools for convenience, flexibility and other advantages (Evans & Mathur, 2005).

Data Collection

Pre-testing was carried out to assess the survey instrument, data collection procedure and to create an opportunity to restructure questions if need be. Questions were written in an easy to understand fashion requiring respondents to select from a list of options in most cases. This was done as a work around for possible respondent fatigue. There were a few optional open-ended questions at the end, requiring opinions and other inputs. All responses were collected into a single Google Spreadsheet which was later downloaded for analysis.

Interviews with 56 students from 22 secondary and tertiary institutions showed 20 (91%) institutions may already be using e-voting to some extent.

The survey attracted two hundred and twenty (220) individual's voluntary participants. After data cleaning, 197 responses were deemed "valid responses".

Data Analysis

MS Excel was mostly used to generate summaries and charts and exported unto an SPSS coded form for some specific quantitative procedures such as chi-squared tests. Through a deductive thematic approach (Braun & Clark, 2006), qualitative data provided by respondents were carefully analysed, coded and extracts used either directly or paraphrased in portions of the findings to emphasise, support or provide detail to some of the quantitative values obtained from analysis.

Findings

Demographic Characteristics of Respondents

Except for the 18–22-year-old group (first time voters, where the questionnaire elicited an equal number of responses from both sexes (n=8) male respondents dominated in every other age category (see Table 1). Majority of respondents were aged between 23 and 45 (93.9%) similar to the data shared by the (Electoral Commission, 2020). Two questions were asked to elicit and confirm respondents' prior exposure to e-voting; "Have you ever participated in an electronic voting?" and "How often have you participated in an electronic or online election?" In the end, data collected

indicated that 74 respondents (37.6%) had never participated in an e-voting activity while the rest indicated they had participated once (13.2%), twice (20.3%) or more (28.9%). For those who had prior experience with e-voting, a greater number (91 respondents, 66.4%) responded that the results were satisfactorily received by voters.

Table 1: Demographic Characteristics of Respondents
Demographic Characteristics (n = 197)

Age	Frequency	Percentage	Male Respondents	Female Respondents
18-22	8	4.1	4	4
23-25	44	22.3	28	16
26-35	67	34.0	53	14
36-45	55	27.9	30	25
45-55	19	9.6	13	6
56-65	4	2.0	4	0

Sex of respondents	Frequency	Percentage
Male	132	67
Female	65	33

Prior Participation in e-voting

	Frequency	Percentage
Once	26	13.2
Two times	40	20.3
More than 2 times	57	28.9
Never	74	37.6

Digital Literacy and Skills

	Frequency	Percentage
Advanced computer user	137	69.5
Slightly advanced skills	18	9.1
Just adequate skills	35	17.8
Inadequate computer skills	6	3.0
Little/No Computer Literacy	1	0.5

Source: Field survey, 2021

Object 1: Determine the current perceptions of electronic voting
Research questions on Performance Expectancy and Ease of Use are asked thus;
i) To what degree do Ghanaians believe using an e-voting system will improve elections?
ii) To what extent do Ghanaians perceive an e-voting system as easy to use?

Performance Expectancy
We studied this by asking direct questions on acceptability and accuracy;
> "If we choose to use e-voting for the 2024 presidential elections… [Results will be more acceptable]".

More respondents; 89 (45.6%) agreed with the statement. These sentiments were independent of Age and Previous exposure to e-voting (p-

values = (0.118,0.844)>0.05, Pearson Chi square = 32.366, 20.530). Although, younger respondents (up to 35 years) leaned slightly more, but insignificantly, towards agreeing to the statement. There was, however, a statistically significant relationship between the perception that e-voting system will improve the electoral process of Ghanaians and the sex of respondents with p-value (0.050) = 0.050, Pearson Chi square=9.171, df=4. Male respondents were more likely to perceive the results as more acceptable if e-voting is used during the next national elections.

Table **2** summarises the findings.

Table 2: Chi Square Test of association of independent variables and perception of acceptability of e-voting results

SN	Results will be more acceptable If we choose to use e-voting for the 2024 presidential elections	N	Pearson Ch-Square	df	Sig.
1	Age	197	32.366	24	0.118
2	Sex	197	9.171	4	0.050
3	Previous exposure	197	20.530	28	0.844

Source: Field survey, 2021

A simultaneous analysis was done with the statement "*Results will be more accurate if we choose to use e-voting for the 2024 presidential elections*" as shown in Table 3. A slight majority of respondents comprising 107 (54.9%) indicated the belief that an e-voting system would produce a higher accuracy of results as against the 67 (34.4%) who perceived otherwise. Here also, the perception is irrespective of sex, age and prior exposure to e-voting.

Table 3: Chi Square Test of association of independent variables and perception of accuracy of e-voting results

SN	Results will be more accurate If we choose to use e-voting for the 2024 presidential elections	N	Pearson Ch-Square	df	Sig.
1	Age	199	31.557	24	0.138
2	Sex	199	1.602	4	0.808
3	Previous exposure	199	1.987	4	0.738

Source: Field survey, 2021

Respondents generally believe an electronic voting system will yield more acceptable accurate results. Some respondents (48%) though believed such a system would disenfranchise some voters. Although respondents were upbeat about the possibilities of e-voting in Ghana, they had opinions and fears of possible challenges. Mostly, respondents were of the view that a segment of the population does not readily have the required skillset or know how-to participate in an e-voting system. Some randomly selected qualitative responses from the survey paint a fuller picture of the perceptions of participants:

"*This kind of vote will not give chance to the aged to vote. Because some are not familiar with ICT. Furthermore, voters will be exposed since some will like to be assisted before voting*.",

"*A simple choice interface will make it easier for the average voter. Some education will definitely be needed given our illiteracy rate. We can start small but we must start something*"

"*I think introducing e-voting will not help since most of the people are living in a rural area and more to the point, are illiterates*"

Ease of Use

The ease of use section has been truncated probability because of the columns. It should reads as follows:

The other dependent variable of interest in the guiding framework is Ease of Use. The perception of how efficient or user friendly an envisaged information system would be, plays a major role in it's over all acceptability. The research tested this by asking respondents to respond to the statement "If we choose to use e-voting for the 2024 presidential elections… [I will find it easy to use]". To find out how they felt about the general population (besides the self-description), participants were required to respond to the statement "If we choose to use e-voting for the 2024 presidential elections… [A lot of people will be disenfranchised]". A good majority of 121 respondents representing 62% perceived they would have little or no trouble using an e-voting system (Strongly Agreed or Agreed). Only 1 out of 4 (25%) disagreed (Strongly Disagreed or Disagreed) with the statement. Chi square tests probed further with resulting p-values of 0.425 and 0.229 for sex and age of respondent. Data on Table 4, shows no association between the positive perception of ease of use of a future e-voting system and the sex or age of the respondent. To the statement, … [A lot of people will be disenfranchised]", a slight majority of respondents (53%) believed it to be true. A greater proportion of male respondents (58%), however, believed an e-voting system would disenfranchise a lot of voters.

Table 5 summarises the responses.

Table 4: Perceived ease of use of future e-voting System

If we choose to use e-voting for the 2024 presidential elections… [I will find it easy to use]														
	Male	% Male	Female	% Female	Total	% Total		18-22	23-25	26-35	36-45	45-55	56-65	Total	% Total
	n	%	n	%	n	%									
Strongly agree	54	43%	17	26%	71	37		3	14	25	21	7	1	71	37%
Agree	28	22%	22	34%	50	26		3	10	19	14	3	1	50	26%
No Comment	11	9%	8	12%	19	10%		0	4	4	9	1	1	19	10%
Disagree	14	11%	7	11%	21	11%		0	5	7	4	5	0	21	11%
Strongly Disagree	18	14%	11	17%	29	15%		2	10	7	6	3	1	29	15%

Source: *Field survey, 2021*

Table 5: Perception of Possible Disenfranchisement of Citizens

If we choose to use e-voting for the 2024 presidential elections… [A lot of people will be disenfranchised]

	Male	% Male	Female	% Female	Total	% Total	18-22	23-25	26-35	36-45	45-55	56-65	Total	% Total
Strongly agree	40	32%	13	20%	53	28%	1	8	18	19	5	2	53	28%
Agree	32	26%	16	25%	48	25%	4	9	17	11	7	0	48	25%

No Comment	11	9%	7	11%	18	9%	2	4	6	4	1	1	18	9%
Disagree	25	20%	13	20%	38	20%	0	9	13	12	4	0	38	20%
Strongly Disagree	18	14%	16	25%	34	18%	1	13	9	8	2	1	34	18%

Source: Field survey, 2021

Object 2: Determine at what time it might be most feasible to introduce electronic voting in Ghana's national elections

There is a dearth of research continuity in the subject matter. We could also not find a definite plan in any country to eventually have a 100% universal adult suffrage. The attempts so far showcase some phased planning and some leapfrogging with due strategic design steps often taken only post socio-technical design and implementation. This has been the case mostly for technology on the continent (Krauss, 2013) leading to the conclusion that it (the lack of a phased plan) is not a pointer to the impossibility of future e-voting. It is just a matter of time.

The paper aimed to identify the most feasible time to introduce e-voting in Ghana's national elections. Critical mass - the point where voices or opinions for the system are significant enough to cause and sustain change - is one of the conditions for introducing new technology. When a technology use reaches critical mass, adoption accelerates and new businesses or markets emerge (Chesney & Lawson, 2013). Focus here is on the adoption of e-voting. Historically, critical mass tends to occur when 10 to 20 percent of users adopt the new technology (Raunair et al., 2014; Fan et al., 2021). In the case of e-voting, because unlike other technologies or information systems that have the opportunity to be used and reused frequently, projection of critical mass had to be done, using a correlation of number of users with the desired perception, the population distribution in the official voters register and the population growth rate.

Critical Mass for Acceptance of E-voting in Ghana

Using data from Statista (2021), the Ghana Statistical Service (GSS) (2021) and statistical forecasting tools available in SPSS and MS Excel, the research projected a total population of about 671,929 tertiary students in Ghana as of end 2022. From 2020 to 2024 alone, a cumulative of over a million potential voters (approximately 1,021,041) would have passed, attended or studying in Ghana's tertiary education institutions. This demographic is of interest because they are an assured group of voters who would have had prior exposure to some form of e-voting by the 2024 elections. There are other avenues where individuals may get exposed to the use of electronic voting but the research conservatively leaves those out because of data verifiability challenges. The research also leaves out all would be voters who would already have had exposure to e-voting prior to 2020. Ghana's total registered voter population in 2020 was 17,027,655 out of a national population of 31,072,945 (World Bank, 2020). Our projections coincide with that of the GSS (2020) projecting a total population in 2024 of around 33,740,000.00 with a voter population around 18,123,083. Given that a minimum of 1,215,041 would-be voters would have had prior experience, we would have had about 7% of would-be voters with an inclination to accept electronic voting. This conservative estimate (using only potential voters with prior experience) is below the 10% threshold for critical mass but an encouraging figure.

Implications

From the findings we observe that 7% of Ghanaians are positively biased towards accepting e-voting, making the 10%

acceptance threshold achievable. By the 2024 elections, there would not be sufficient critical mass of persons with a positive orientation towards the acceptance of e-voting. Technically, there exists the base infrastructure and environment to pursue e-voting at the national level.

Perception-wise, the citizenry is open to the idea of e-voting but with the premonition that an actual e-voting exercise on the national scale ought to be preceded by intensive education and piloting.

This research recommends to the Electoral Commission of Ghana to begin considering the possibility of holding a future election using electronic systems. Actual implementation, however, may begin with small scale elections such as the district assembly or elections conducted for political parties and/or other smaller groups backed by intensive education. Interested researchers should study deeper into the various technologies available and the efforts already made by other nations to employ e-voting and make possible recommendations for adaption in Ghana.

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