Examining voters' intention to use internet voting system: a case of Ghana

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Abstract: This study seeks to examine and understand factors that influence internet voting (i-voting) adoption intention from young voters' perspective, using unified theory of acceptance and use of technology (UTAUT) and the trust as a framework. Using a quantitative research method, the researcher collected data from 274 university students in Ghana, using closed-ended questions, and the data was analysed using the partial least square with SmartPLS 3. The results of the findings indicates that accuracy ($\beta = 0.251$, $p = 0.001$), performance expectancy ($\beta = 0.406$, p = 0.000), and effort expectancy ($\beta = 0.136$, $p = 0.008$) have a significant positive effect on behavioural intention to use i-voting system. Facilitating condition was also find to have significant effect on trust in EC ($\beta = 0.237$, $p = 0.001$). But social influence ($\beta = -0.074$, $p = 0.207$), facilitating condition ($\beta = -0.004$, $p = 0.936$), trust in EC ($\beta = -0.018$, $p = 0.368$) and confidentiality ($\beta = 0.066$, $p = 0.293$), were found not to have any significant effect on users behavioural intention to use i-voting system.

1 Introduction to internet voting (i-Voting)

New voting technologies, such as direct recording electronic (DRE) and remote internet voting (i-Voting) are being experimented in several countries to improve it electoral process. This new voting technology generally referred to as electronic voting (e-voting)

technology, has been argued to be a solution of some of the electoral challenges. i-Voting can be define as any electronic means of casting, storing, and tallying votes remotely via internet (Agbesi, 2018; Awad and Leiss, 2011; Kumar and Walia, 2011). OCSE (2013) defines i-voting as online or internet voting. According to OCSE (2013), i-voting allows the voter to vote remotely in an uncontrolled environment. According to Shat and Pimenidis (2017), i-voting systems are mostly implemented with the sole aim of improving the election process, reducing election cost, increasing voter participation especially among the youth and also increasing efficiency (Germann and Serdült, 2017; Choi and Kim, 2012). There has been suggestions from various stakeholders for a change in Ghana's voting system. The current paper-based system is perceived to give room for manipulation by officials at various polling stations and also at the collation centres (Agbesi et al., 2014). The mistrust of the current paper-based voting has resulted in dispute in election results across various polling station in Africa (Frimpong, 2012; DW, 2015; Duruji et al., 2015). It has been argued that with the introduction of i-voting, voter participation by the youth will increase (Carter and Campbell, 2011).

Using the unified theory of acceptance and use of technology (UTAUT) and trust construct as a research model, this study seeks to examine the factors that will influence user's intention to use i-voting, focusing on university students between the ages of 18 and 30 years. These population forms a larger part of the youth bracket being considered, in terms of participating in elections. This study focus on users behavioural intentions to use i-voting, and UTAUT and trust provides the appropriate model in understanding and predicting voters' behavioural intention to use i-voting technology, as has been exemplified in previous studies (Kabra et al., 2017; Taiwo et al., 2012; Schaupp et al., 2010). There has been varied results in previous studies (Achieng and Ruhode, 2013; Carter and Campbell, 2011; Choi and Kim, 2012; Schaupp and Carter, 2005) on e-voting adoption intention. Secondly, studies integrating UTAUT and trust constructs are scanty and fewer studies (Kabra et al., 2017; Taiwo et al., 2012; Schaupp et al., 2010) has explored how trust affects technology such as e-government and e-file system adoption in sub-saharan Africa but not i-voting. I-voting system cannot be treated like any other online transaction or e-commerce system, because the stakes are high when it comes to democratic elections.

The main objective of this study is to examine and understand voters' behavioural intention of use of internet voting (i-voting) system using UTAUT and Trust model. The main issues when it comes to democratic elections in developing countries like Ghana is trust in the electoral process and the underlying technology. The main significance of this research is to provide a model that can explain voter's behaviour intention towards the use i-voting. The next section review literature on internet voting system and theories underpinning this study.

2   Literature review

2.1   Internet voting adoption

This section discusses i-voting adoption and examine the factors that can influence voter's behavioural intention to use i-voting systems. There are several adoptions and use of technology studies in developed and developing country context. For example, Carter and Bélanger (2012) and Carter and Campbell (2011) studied internet voting adoption

and trust, Amegavi et al. (2018) studied the dynamics of e-government enactment in a developing country public sector organisation, Mohammed et al. (2016), studied cloud computing adoption, Lallmahomed et al. (2017), Al Athmay (2015) and Witarsyah et al. (2017), studied e-governments service adoption. But few studies (Achieng and Ruhode, 2013; Adeshina and Ojo, 2014; Shat and Pimenidis, 2017; Choi and Kim, 2012) has been done in the area of i-voting systems The next section discusses studies in i-Voting adoption and use from developed and developing context.

The main difference between developed and developing countries, according to Heyneman (1980), is the difference in the impact of economic status. World Bank classification is based on gross domestic product (GDP) per capita (Amadeo, 2018). "GDP per capita is a measure of a country's economic output that accounts for its number of people. It divides the country's GDP by its total population" (Amadeo, 2018). According to Shih et al. (2008), there are significant gap between developed and developing countries that makes it difficult for developing countries to gain the maximum benefits of IT innovations adoption and diffusion compared to developed countries. The current classification of countries, by World Bank, is based on Low-income countries ($1025 or less), Lower middle income countries ($1026–$4035), Upper middle income countries ($4036–$12,236) and High income countries ($12,237 and above) (Fantom et al., 2016). In the context of this research, I grouped low, lower middle and upper middle into developing nations, and high-income countries into developed countries. Ghana GDP as at 2017 was $1,641.49, which fall within low middle-income country.

2.1.1 *Developed countries context*

Carter and Bélanger (2012) studied internet voting and political participation. The main purpose of the study was to identify the impacts of both technological and political factors on intentions to use an internet voting system. Results from the findings shows that relative advantage and trust of the internet impact intentions to use internet voting, whiles perceived internet accessibility impacts the perceived convenience of voting online, which in turn impacts the perceived relative advantage of online voting. Similarly Carter and Campbell (2011), also identified relative advantage, internet trust, and e-government information utilisation as the key significant factors of users intention to use internet voting, while disposition to trust has a significant impact on internet trust and accessibility has a significant impact on relative advantage. Powell et al. (2012) studied E-voting intent: a comparison between the young and the elderly voters. The main purpose of the study was to examine factors that can affect a citizen's intent to vote online. The results of Powell et al. (2012) findings shows that performance expectancy, effort expectancy, social influence, trust in the internet, and computer anxiety has significant effect on voters intention to use online voting, while trust in the government was insignificant. The study shows that effort expectancy relates to senior adults intention to vote online but not young adult, whiles trust in internet relates to young adults' intent to vote online but not senior adults.

Choi and Kim (2012) studied voter intention to use e-voting technologies. The study examines how users' perceptions of security principles, technology acceptance, election type, and political ideology affect their intentions to use e-voting systems. The study reveals that perceived usefulness, perceived ease of use, accuracy, and confidentiality have direct and indirect impacts on intention to use e-voting. Schaupp and Carter (2005)

studied e-voting from apathy to adoption. The results of the findings show that user's perception of compatibility, usefulness, and trust significantly influence their intention to use the e-voting system. Oostveen and Van den Besselaar (2009) comparative study of users' experience on e-voting identified that e-voting does not necessarily increase voter turnout, and similarly, the study identified trust in the security of the e-voting system having the significant effect its adoption.

2.1.2   Developing countries context

Similarly, Achieng and Ruhode (2013) studied the adoption and challenges of electronic voting technologies within the South African context. The purpose of their research was to analyse the challenges and prospects of e-voting adoption in South Africa. The findings reveal that relative advantage, compatibility, and complexity has significant influence on voters and the electoral management bodies (IEC) intention to adopt e-voting technologies. The results of the findings of the work of Shat and Pimenidis (2017) on e-voting vs. e-trust also shows respondents willingness to trust and use e-voting systems. Amegavi et al. (2018) identified challenges such as low information communication technology (ICT) literacy as well as inadequate ICT equipment and low internet connectivity as the main barriers to e-government adoption. Lallmahomed et al. (2017) also identified performance expectancy, facilitating conditions, perceived value are positively related to behavioural intention when they study factors influencing the adoption of e-government services in Mauritius.

2.1.3   Summary of review

Studies on internet voting in developing country like Ghana is lacking in the body of literature. Most of these studies (Carter and Bélanger, 2012; Awad and Leiss, 2011; Choi and Kim, 2012; Schaupp and Carter, 2005) were done outside the context of Sub-Saharan Africa and little or no studies has been done to examine these factors in developing countries like Africa. Achieng and Ruhode (2013) was limited to Cape Town province and the study was based on Roger's diffusion of innovation theory. The study fills this gap by exploring how performance expectancy, effort expectancy, facilitating conditions, social influence and trust influence i-voting adoption in Ghana by young voters.

2.2   Theoretical perspective

2.2.1   Unified theory of acceptance and use of technology (UTAUT)

The development of UTAUT was as a result of the review of eight (8) prominent theories that were used to explore the behaviour of Information System (IS) usage, and it includes theory of reason action (TRA), TAM, the motivational model (MM), theory of planned behaviour (TPB), the Pc utilisation model (MPCU), innovation diffusion theory (IDT), the social cognitive theory and integrated model of technology acceptance model (TAM) and the theory of planned behaviour (TAM-TPB) (Baptista and Oliveira, 2015; Venkatesh et al., 2003). UTAUT model consists of four (4) basic construct, and these constructs are performance expectancy (PE), effort expectancy (EE), social influence (SI) and facilitating conditions (FC). Venkatesh et al. (2003) indicated that PE, EE, SI and FC's are the determinants of behavioural intention or use behaviour, and that age, gender, experience, and voluntariness of use have moderating effects in acceptance of

information technology (IT) (Wang and Wang, 2010). Venkatesh et al. (2016) updated UTAUT due to its limitations to develop UTAUT2 by including three (3) other constructs namely hedonic motivation, price value, and habit and dropping voluntariness (Venkatesh et al., 2012).

UTAUT has been used in the past to explore user acceptance of IS and the adoption and use of technology innovation in various research as reviewed in Williams et al. (2015) and Venkatesh et al. (2016) studies. Alapetite et al. (2009) use UTAUT to study the adoption of speech recognition by a physician in the clinical departments in a hospital. Al-Shafi et al. (2009) studied the adoption of e-government services by citizens in Qatar. The results of the study show that performance expectancy, effort expectancy, and social influences determine citizens' behavioural intention. Additionally, facilitating conditions and behavioural intention determine citizens' use of e-government services. Gruzd et al. (2012) studied the adoption and use of social media by Academic researchers. Even though UTAUT has been applied in several fields in Information Technology, there is a lack of literature in i-voting adoption in developing country context using UTAUT.

In this current study, the researcher adopts UTAUT to understand the user's behavioural intention (BI) in the use of i-voting system by examining variables like performance expectancy (PE), effort expectancy (EF), facilitating conditions (FC) and social influence (SI) and integrated with trust constructs. Studies integrated UTAUT and trust constructs in the area of i-voting in developing countries are lacking.

2.2.2 *Trust*

Trust refers to the predictability of another person, which implies that having a high level of trust in someone, and this means being certain that you can predict the person will perform what is expected of him (Geels-Blair et al., 2013). The trust human expects from another human is similar to human verse machine interactions (Reeves and Nass, 1996). That is, they expect the system or machine to perform as expected of it, a deviation from its expected task can be a basis for mistrust. Hoffmann and Söllner (2014) explains that the key factor that usually influences users to use any new technology is trust because users tend to use a system that they can trust. Some of the current problems associated with the current paper-based ballot are mistrust of the system because of the perception that the system is not performing as it was expected to do (Karikari-Apau, 2012). Studies show that to implement a successful technological system the perception of trust has to be addressed (Hoffmann and Söllner, 2014).

Trust is an important component of any electronic transactions due to the risk associated with online transactions (Chen et al., 2015; Mostafa and El-Masry, 2013). Chen et al. (2015) divided trust into two major components namely; trust in the entity providing the service, in this case, the organisation in charge of providing this service such as the electoral commission (EC) in this context, and trust in the technology, such i-voting. Studies show that these two components are significant factors that influence users in using a particular service, in this case, the i-voting system (Chen et al., 2015).

Trust constructs has been used in previous studies to understand how it affects user's adoption and use of information technology systems. Warkentin et al. (2018) studied social identity and trust in internet-based voting adoption, and the finding of the studies shows trust has influence on perceived ease of use which in turn have effect on intention

to use internet-based voting. Powell et al. (2012) studies also shows performance expectancy, effort expectancy, social influence, and trust in the internet has significant effect on voters intention to use online voting, while trust in the government was insignificant. Carter and Bélanger (2012) findings also shows that, relative advantage and trust in internet have significant effect on online voting intentions. Similarly studies (Kim et al., 2008; Filieri et al., 2015; Kim et al., 2008; Abu-Shanab, 2014; Ganguly et al., 2009; Rodrigues et al., 2016) has identified accuracy, and confidentiality as antecedents of trust. Since one objective of this study is to examine how trust in institutions (example government or EC) and trust in internet affect voter's decision to use i-voting, the study will examine how trust in an institution (e.g., EC), accuracy and confidentiality influence voters decision to use i-voting system.

2.2.3   *Conceptual model and hypothesis development*

Based on the literature reviewed, the researcher came out with a conceptual model, as shown in Figure 1, which draws inspiration from Venkatesh's UTAUT and trust construct. The UTAUT model has been extended by integrating trust in an institution (EC), and trust in technology, looking at confidentiality and accuracy.

Figure 1   Conceptual model (see online version for colours)
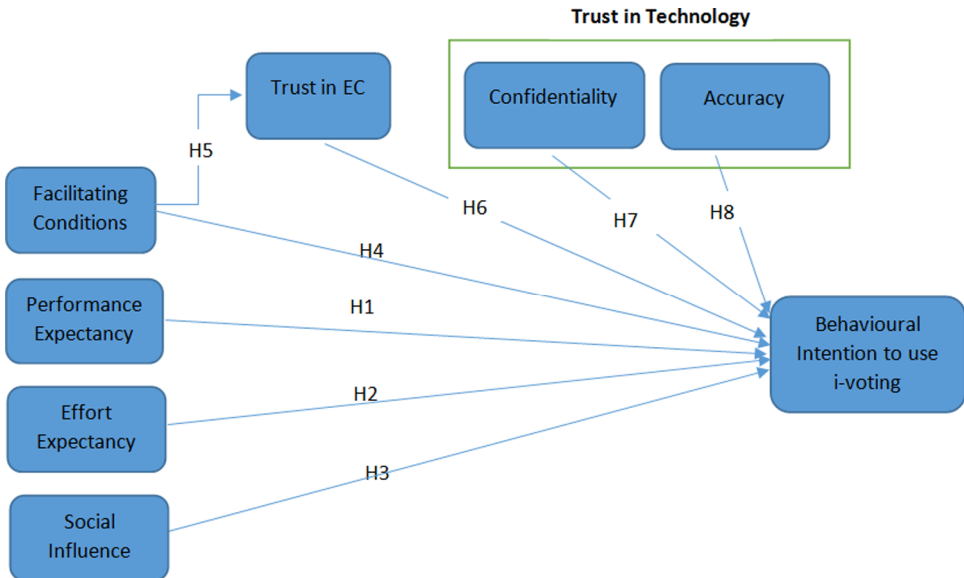
The various variables highlighted in this model are interlinked and cannot be addressed in isolation. These variables stated under each group are very critical to i-voting use, hence need to be addressed for a successful i-voting adoption. The next section explains the constructs of the UTAUT and Trust model and further raise the hypothesis to be tested.

a   Performance expectancy (PE)

Venkatesh et al. (2003) define PE as the degree to which individuals believes that using an information system will help him or her to attain gains in job performance. Venkatesh posits that PE is the strongest predictor of behavioural intention to use the

information system. Adopting performance expectancy to i-voting context implies that voters will find the system more beneficial or useful, because it will enable them to accomplish their voting task more efficiently and with more flexibility. Therefore the following hypothesis is tested:

H1: Performance expectancy will have a positive effect on behavioural intention to use i-voting system.

b   Effort expectancy (EE)

Effort expectancy is the extent of ease of use concerning the use of an information system (Venkatesh et al., 2003). Adopting effort expectancy to i-voting context will imply that the voter's intention to use i-voting will be based on the ease of use of i-voting system, hence the study posit that effort expectancy will significantly influence user's intention to use i-voting. The following hypothesis is tested:

H2: Effort expectancy will have a positive effect on behavioural intention to use i-voting system.

c   Social influence (SI)

Social influence is the extent to which individuals perceive that their use of a technology, in this case, i-voting, is influenced by other people (peers or influential persons). Therefore the following hypothesis is tested:

H3: Social influence will have a positive effect on behavioural intention to use i-voting system.

d   Facilitating condition

Facilitating condition refers to the degree to which an individual believes that an organisation and technical infrastructure exist to support the use of the system. The researcher posit that if voters believe that there are technical infrastructure by EC to support i-voting adoption it will influence their behavioural intentions and will also have effect on individual trust in EC. Therefore the following hypothesis is tested:

H4: Facilitating condition will have a positive effect on behavioural intention to use i-voting.

H5: Facilitating condition will have a significant effect on trust in EC.

e   Behavioural intention

Behavioural intention (BI) is the extent to which a person makes a conscious effort to perform or not to perform some future behaviour.

f   Trust in electoral commission (EC)

Trust in the EC, the organisation that organises the elections occurs if voters or the citizenry have confidence in the entity. When EC is a perceived to be biased and favouring a particular political party (especially the party in power) and not having the voters' interest at heart, voters will lose confidence in the service they provide. Karkin and Janssen (2013), suggested that trust in an entity can quickly change depending on how they actually work. There are not enough studies exploring trust in the entity in the context of i-voting in Sub-Saharan Africa. This study argues that trust in EC by the

citizenry will positively affect their intention to use i-voting system. Therefore the following hypothesis is tested:

>   *H6: Trust in EC will have a positive effect on the behavioural intention to use i-voting.*

g   Trust in technology

Trust in technology means to trust in the tool that is used to provide the services (Beldad et al., 2011). For the citizens to accept any information system they should be able to trust that, the system will be reliable and safe to provide it intended services. Previous studies (Kim et al., 2008; Abu-Shanab, 2014; Ganguly et al., 2009) has identified other antecedents of trust in technology/internet, such as confidentiality and accuracy. Wixom and Todd (2005) explain accuracy as a representation of the user's perception that the information generated by the system is correct and reliable, and Murphy (2007) also define accuracy as "the degree of correctness that remote electronic voting system can guarantee in ballot storage, transportation, and counting". In the context of this study, accuracy is defined as the degree to which the output of the final results generated by i-voting system is correct, reliable and conform to standards. Therefore, having citizens to trust in a technology is vital to the success of it adaption and use; a system that cannot be trusted will be rejected. Two trust components, confidentiality, and accuracy are tested with the following hypothesis:

>   *H7: Voter intention to use i-voting system are positively related to perceived confidentiality.*

>   *H8: Voter intentions to use i-voting system are positively related to perceived accuracy.*

3   Methodology

3.1   Research design

The correlational research design was used in this study. Correlational research design as explain by Clark and Creswell (2015) is used to describe the extent to which predictor variables relates to an outcome variable. This research design is suitable for the study because the study examines how performance expectancy, effort expectancy, social influence, facilitating conditions, trust in the entity, confidentiality, and accuracy can predict the behavioural intention of use of i-voting system.

3.2   Participant

The population of study for this research was Universities students in Accra, Ghana with age between 18 and 30 years, as shown in Table 1. Students from Ghana Institute of Management and Public Administration (GIMPA), Ghana Technology University College (GTUC), Pentecost University College (PUC) and Accra Institute of Technology (AIT) were selected to participate in the survey. The validity of the use of students' participants has often been criticised, however in the context of this study the focus is on internet-based voting use intention by university students (Compeau et al., 2012), and the

participant should have access to the internet which can make it possible for the use of i-voting. Internet usage is evident in the younger population, and these population of voting age between 18 and 30 years, are mostly found in the universities. Hence using university students as the population of study, as has been used in previous studies (Choi et al., 2012; Taiwo et al., 2012), has an important effect. All participant completed closed-ended questionnaires that measure the variable of interest to the researcher. The survey questionnaires were based on Venkatesh et al. (2003) UTAUT and the trust model (Chen et al., 2015).

Table 1 Demographic information

Measure	Item	Total No.	Percentage
Gender	Male	162	59.12
	Female	112	40.88
Education	Undergraduate	230	83.94
	Graduate	44	16.06

3.3 Procedure

The research questions were adopted from these previous research and modified to suit the current study. This was done in order to ensure the validity and reliability of the research constructs to be measured. The questions were set using a five-point Likert scale from one (1) strongly disagree to five (5) strongly agree (Likert, 1932). The questionnaire also contains a section that allows the respondents to comment on their response. The questionnaire was designed using Google forms and the link (URL) to the questions was sent to the respondents through WhatsApp, and group mail address, and participant were informed of the intention of the survey and each was asked to fill and submit only once. A hard copy was also printed and manual administered to participants. 42% of the response was through online and 58% were through printed forms. A total of 274 students responded to the questionnaires (both online and manual administration). PLS-SEM was used to develop the model using Smart-PLS, and reflective measurement model was used (Hair, 2014).

3.4 Overview of testing

The initial model was based on eight (8) constructs or latent variables and 27 indicators or measuring items, and the software was set to the default three hundred (300) and eight (8) iterations and stop criterion respectively. After the first run, it identified four (4) indicator values less than 0.7, and these indicators were removed one after the other, starting with the one with the lowers value. These were done to improve the model, and the researcher saw an improvement after the fourth indicators were removed.

4 Data analysis and results

The data was analysed using the partial least square with SmartPLS 3. The researcher followed the two-step approach to PLS-SEM by Hair (2014). First, the researcher

examined the measurement model to evaluate the reliability of the instrument by assessing the internal consistency and also to test the research hypothesis proposed in this study.

4.1   *Reflective measurement models*

With the reflective measurement model, the internal consistency reliability can be assessed using either the Cronbach's alpha (CA) or the composite reliability (CR), but studies show that CA has limitations, hence in this study CR was used to assess the internal consistency (Hair, 2014). Internal consistency estimates the reliability based on the inter-correlation of the indicator variables being observed. The rule of thumb is that composite reliability should be higher than 0.708 (Hair, 2014), and as shown in Table 2 and Figure 2 each latent variable CR exceeds the acceptable level of 0.708. Secondly, the researcher assessed the convergent validity, as defined by Hair (2014) "convergent validity is the extent to which the measure correlates positively with an alternative measure of the same construct".

Table 2   Construct reliability and validity

	CA	*CR*	*AVE*
AC	0.616	0.838	0.722
BI	0.841	0.904	0.760
CO	0.869	0.939	0.884
EE	0.790	0.876	0.703
FC	1.000	1.000	1.000
PE	0.733	0.849	0.653
SI	0.918	0.958	0.920
TEC	0.881	0.926	0.807

Figure 2   Structural equation model with eight (8) latent construct (see online version for colours)
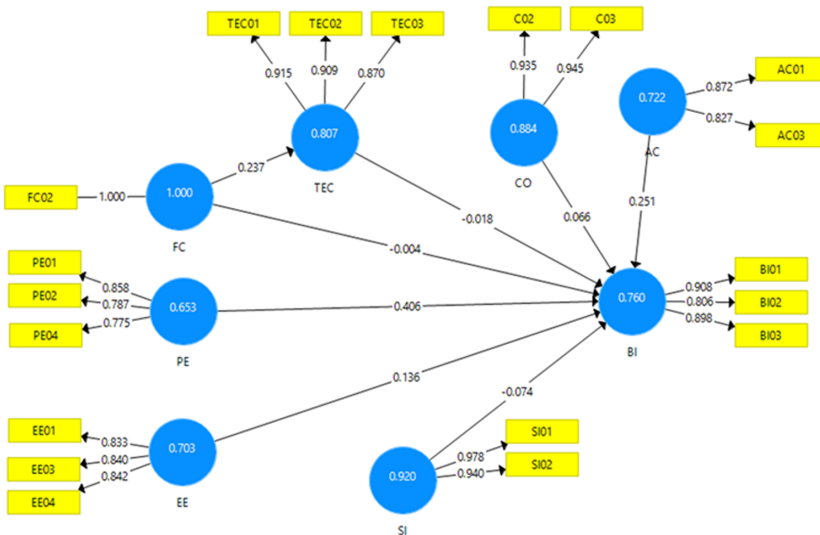
One popular measure of convergent validity is average variance extracted (AVE), which is calculated as the grand mean value of the square loadings of the indicators associated with a construct, which is the sum of the square loadings divided by the number of indicators (Hair, 2014). The AVE of each construct should be higher than 0.50 which implies that, on the average, the construct explain more than half of the variance of its indicators.

Next, the researcher assessed the discriminant validity. Discriminant validity (DV) as define by Hair (2014), is the extent to which a construct is distinct from other constructs, which is the uniqueness of individual constructs. To assess DV, Fornell-Lacker criterion (FLC) and cross-loadings were used to check for discriminant validity. FLC states that the square root of the average variance extracted (AVE) of each construct should be greater than the construct's highest correlation with any other construct in the model (Fornell and Larcker, 1981). First and foremost the researcher examined the cross-loadings of the indicators, and studies show that the indicators outer loadings in the associated construct should be greater than all its cross-loadings (Hair, 2014).

It is evident in Table 3 that the all indicators load their highest on their construct and no indicator loads higher on other constructs. Secondly, as evident in Table 4, the square root of the AVE for each construct is greater than the cross-correlation with other constructs.

Table 3   Discriminant validity using cross loadings

	AC	*BI*	*CO*	*EE*	*FC*	*PE*	*SI*	*TEC*
AC01	**0.872**	0.536	0.301	0.336	0.308	0.549	0.093	0.218
AC03	**0.827**	0.467	0.508	0.354	0.476	0.581	0.012	0.443
BI01	0.548	**0.908**	0.410	0.346	0.328	0.560	−0.109	0.246
BI02	0.430	**0.806**	0.208	0.464	0.244	0.550	0.044	0.177
BI03	0.562	**0.898**	0.380	0.329	0.350	0.609	−0.118	0.205
C02	0.408	0.348	**0.935**	0.170	0.377	0.390	−0.036	0.401
C03	0.468	0.378	**0.945**	0.211	0.376	0.453	−0.018	0.363
EE01	0.282	0.361	0.227	**0.833**	0.196	0.350	−0.109	0.221
EE03	0.264	0.322	0.068	**0.840**	0.250	0.329	0.020	0.211
EE04	0.454	0.394	0.202	**0.842**	0.395	0.454	0.049	0.118
FC02	0.454	0.355	0.400	0.340	**1.000**	0.416	−0.116	0.237
PE01	0.589	0.565	0.430	0.444	0.355	**0.858**	0.028	0.260
PE02	0.465	0.505	0.456	0.207	0.337	**0.787**	−0.065	0.243
PE04	0.546	0.523	0.202	0.442	0.315	**0.775**	−0.029	0.235
SI01	0.034	−0.084	−0.023	−0.025	−0.123	−0.036	**0.978**	0.159
SI02	0.109	−0.051	−0.035	0.002	−0.094	−0.004	**0.940**	0.247
TEC01	0.308	0.181	0.341	0.216	0.218	0.273	0.232	**0.915**
TEC02	0.341	0.166	0.417	0.205	0.227	0.252	0.170	**0.909**
TEC03	0.366	0.286	0.338	0.163	0.194	0.291	0.141	**0.870**

Table 4   Discriminant validity using Fornell-Larcker criterion

	AC	BI	CO	EE	FC	PE	SI	TEC
AC	**0.849**							
BI	0.592	**0.872**						
CO	0.467	0.386	**0.940**					
EE	0.405	0.431	0.203	**0.838**				
FC	0.454	0.355	0.400	0.340	**1.000**			
PE	0.663	0.658	0.450	0.455	0.416	**0.808**		
SI	0.065	–0.075	–0.028	–0.015	–0.116	–0.025	**0.959**	
TEC	0.380	0.241	0.406	0.215	0.237	0.305	0.199	**0.898**

Square root of the AVE is shown on diagonal with boldface.

4.2   Structural model

After it was confirmed that the construct measures are reliable and valid, the researcher examines the structural model based on the magnitude and the significance of the path coefficients of each path. Standard bootstrapping (a nonparametric procedure that allows testing the statistical significance of various PLS-SEM results such path coefficients, and R^2 values) procedure using 5000 samples was used in order to determine the significance of each estimated path. The path coefficient represents the relationships between the hypothesised construct and standardised values between –1 and +1. An estimated path coefficient closer to +1 represents a strong positive relationship and the one closer to –1 represent a strong negative relationship (Hair, 2014). Table 5 presents the assessment of the structural model.

Table 5   Path coefficient and their significance

Hypothesis	Path	Path coefficient	Significance level	T-statistics	P-values	Results
H1	PE -> BI	0.406	***	5.338	0.000	Supported
H2	EE -> BI	0.136	***	2.643	0.008	Supported
H3	SI -> BI	–0.074	NS	1.207	0.207	Not Supported
H4	FC -> BI	–0.004	NS	0.080	0.936	Not Supported
H5	FC -> TEC	0.237	***	3.344	0.001	Supported
H6	TEC -> BI	–0.018	NS	0.722	0.368	Not Supported
H7	CO -> BI	0.066	NS	1.053	0.293	Not Supported
H8	AC -> BI	0.251	***	3.328	0.001	Supported

NS – not significant, $*p < 0.10$, $**p < 0.05$, $***p < 0.01$.

Accuracy (AC) was found to have a significant positive effect on behavioural intention to use i-voting system ($\beta = 0.251$, $p = 0.001$), Performance expectancy (PE) was also found to be significant ($\beta = 0.406$, $p = 0.000$), likewise effort expectancy ($\beta = 0.136$, $p = 0.008$) was also found to be significant. Facilitating condition was also find to have significant effect on trust in EC ($\beta = 0.237$, $p = 0.001$). The remaining construct social influence

(β = -0.074, p = 0.207), facilitating condition (β = –0.004, p = 0.936), trust in EC (β = – 0.018, p = 0.368) and confidentiality (β = 0.066, p = 0.293), were found not to have any significant effect on users behavioural intention to use i-voting system

5 Discussions and conclusions

5.1 Discussion of findings

Previous studies on i-voting adoption have been done in developed countries context, and few studies exist in developing countries context. The study of internet voting use intention by young voters (University Students) in Ghana has added insight into the existing body of knowledge. This study examined the relationships between performance expectancy, effort expectancy, social influence, facilitating conditions, trust in EC, confidentiality, and accuracy and behavioural intention to use i-voting system. Out of the eight (8) hypothesis raised, only four were supported. The remaining hypothesis were not supported.

Performance expectancy and behavioural intention to use i-voting

The study shows performance expectancy to have a positive significant effect on voters' behavioural intention to use i-voting system. Performance expectancy has a path loading on voters behavioural intention as 0.406, (p = 0.000), and this results support previous studies like Choi and Kim (2012), and Yao and Murphy (2007). This result indicates that this sample of voters will be willing to use the internet voting (online voting) if they perceive this new innovation to be beneficial or useful and will help them to cast their vote more effectively and efficiently as compared to the current voting system (paper-based voting).

Accuracy and behavioural intention to use i-voting

The result of this study shows a strong positive relationship (β = 0.251, p = 0.001) between accuracy and user behavioural intention to use i-voting system, which is consistent with Choi and Kim (2012) studies. This result indicates that voters will be willing to use the internet voting system if they perceive that the new system can guarantee the correctness and reliability of the results produced by the system as compared to the current voting system (paper-based voting). The sample voters are of the opinion that a system that cannot guarantee the accurate recording and reporting of votes will not be accepted. From the open-ended response, they argue that it is imperative for EC to ensure transparency in the design and implementation of i-voting system in Ghana, by involving all stakeholders (EC, Political parties, media etc.) in the implementation and testing process. If political parties involved are satisfied with the reliability of the system they will influence their support-base in trusting the system. Furthermore, they were of the view that a facility where political parties can also monitor the results online, such as a read-only access portal, will go a long way to build confidence and trust in the system.

Effort expectancy and behavioural intention to use i-voting

Effort expectancy (β = 0.136, p = 0.008), which is the extent of ease of use of i-voting system, was also found to be significant. This result indicate that the ease of use of

i-voting has significant effect on voters behavioural intention to use i-voting system, and this was consistent with the work of Choi and Kim (2012), Karkin and Janssen (2013), Powell et al. (2012). The sample of voters in this study was of the opinion that if more education goes into the use of the system, it will be easier for the voters to understand and use it.

Confidentiality and behavioural intention to use i-voting

Similarly, confidentiality was found not to have any significant effect ($\beta = 0.066$, $p = 0.293$), on voters behavioural intention to use i-voting contrary to previous studies such as Choi and Kim (2012) and Rodrigues et al. (2016). This indicates that there is no significant correlation between confidentiality and voters intention to use i-voting systems among this group of voters that were sampled.

Trust in EC and behavioural intention to use i-voting

Trust in EC, which is the extent to which voters have confidence in the entity or organisation in charge of the electoral process, was also found not to have any significant effect ($\beta = -0.018$, $p = 0.368$), on voters behavioural intention to use i-voting. These results support previous studies by Horsburgh et al. (2011) whose results show no significant correlation between trust in government and the use of e-government services, and Powell et al. (2012), whose results also show that trust in government does not have any significant influence on online voting interactions.

Social influence and behavioural intention to use i-voting

Social influence, which is the degree to which individual perceive their use of information system to be influenced by others, was found not to have any significant effect ($\beta = -0.074$, $p = 0.368$) on behavioural intentions to use i-voting system contrary to other studies like Powell et al. (2012), Al-Shafi et al. (2009), and Chauhan et al. (2018).

Facilitating conditions and behavioural intention to use i-voting

Facilitating condition, which is the extent to which a voter believes that an organisation and technical infrastructure exist to support the use of a technology, was also found not have any significant effect ($\beta = -0.004$, $p = 0.936$) on behavioural intentions to use i-voting. This result was in support of the study of Kabra et al. (2017). But facilitating condition was found to have a significant effect on trust in EC ($\beta = 0.237$, $p = 0.001$).

5.2   Limitations and future studies

The results of the findings show that performance expectancy, effort expectancy, and accuracy are the most significant factors influencing the voter's intention to use i-voting system. Despite this findings, the study contains some limitations. First, the population of study was based on university students and this make the study sample more educated than the average Ghanaian citizen, and different results may be achieved in a population that are less educated. Secondly, the age group was predominantly between 18–30 years, and this was due to the study population of university students; the study can be extended to include ages above this range in a form of a comparative study between the young and adult's voters. Finally, the population of study were universities in the capital city, and these universities may have internet resources that may not be available in other

universities in other parts of the countries, hence it will be appropriate for future research to be extended into other these universities in the rural areas.

The findings of this study should be used with caution in view of the limitations stated above, but these limitation does not affect the findings obtained from this sample of voters. Future research should be extended to the entire voter population and also look into how trust and risk perceptions affect voter's intentions to use i-voting in Ghana.

5.3 Research implications

The results of the findings show that performance expectancy, effort expectancy, and accuracy are the most significant factors influencing the voter's intention to use the internet voting system among the youth or young voters of university students. Similarly, the themes identified from the open-ended questions suggested political party inclusion in the implementation as well as the education of voters on the use of internet voting (i-Voting) systems.

5.4 Conclusion

This study identifies factors that can influence user's behavioural intention to use i-voting system using adoption model derived from literature and from UTAUT and trust model. Findings from the study indicates that performance expectancy, effort expectancy, and accuracy has a strong positive relationship to the user's behavioural intention to use i-voting system. This study does not find any statistical evidence of a relationship between, social influence, facilitating conditions, trust in EC, confidentiality and the intention of users to use i-voting system. The study shows an indications that voters' intention to use i-voting can be influenced by how they perceived i-voting system to be a better system, in terms of performance, in casting their vote over the paper-based voting method and also the reliability of the system. Also accuracy in processing and storing voting data has significant influence on voters' behavioural intention to use internet voting systems.

The findings obtained from this study is not to make a generalisation but only to provide an indication and to guide policymakers in their attempt to adopt i-voting system.

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