A framework for Mobile Application integrated with Biometric Authentication to Improve Youth participation in Elections

A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Management in the field of Digital Business

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Abstract

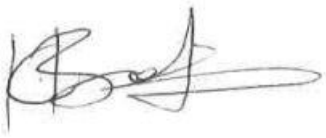
The purpose of this research study is to apply the technology acceptance framework to assess the prospect of using mobile application integrated with biometric authentication that might improve the South African's youth participation in elections. The main objectives of this research are to measure the extent to which youth voters have trust in internet and the ability for the national government to conduct online elections, evaluate the youth voters ICT accessibility and skills and to determine the attitudes, perceptions as well as intention to participate in online elections using framework for mobile application.

A quantitative research approach was adopted for this research. An online questionnaire on formplus platform is used to collect data from Gauteng youth (18-35 years); 209 participants had valid responses. A conceptual framework is proposed using constructs and theories from the Technology Acceptance Model (TAM). The constructs were adopted from the Technology Acceptance Model (TAM), and it was also extended with trust constructs.

The findings of this research are youth respondents have indicated that they agree (eighty-four percent) and have intention to use the mobile application to participate in online voting if it becomes available and they have the willingness to learn how to use it. The intention of youth to use mobile phones for online voting as an important contributing factor to improve youth participation in elections.

Declaration

I, Kealeboga Botsime, declare that this research report is my own work, except as indicated in the references and acknowledgments. It is submitted in partial fulfillment of the requirements for the degree of Master of Management in the field of Digital Business at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Name: Kealeboga Botsime **Signature:** 

Signed at: Johannesburg

On the: 28 **day of** June 2023.

Acknowledgement

First, I want to thank God for strength and wisdom to pursue and complete this dissertation. To my supervisor, Prof René Pellissier, thank you for the continuous support, patience, guidance, and critical role you played, and all the time spent reviewing my work. Your contribution is highly appreciated. I would like to thank my daughter Tshepiso and family for being my pillar through the duration of this master's degree. I dedicate this dissertation to my late daughter Okgethilwe. Lastly, I would like to thank my best friends, Tebogo Sebekedi and Herbert Makgoane for all the support and encouragement.

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CHAPTER 1. INTRODUCTION

1. Statement of purpose

The purpose of this quantitative research study is to apply the technology acceptance framework to assess the prospect of using mobile application integrated with biometric authentication that might improve the South African's youth participation in elections. The research study will contribute towards the literature by providing the new data that will be collected with information regarding South African youth's lack of participation in the election, exploration of a mobile application use as way of influencing the youth participation. According to figures from the Independent Electoral Commission (Electoral Commission of South Africa, 2014), more than 50 percent of South African youngsters who are entitled to vote do not participate in elections. Voter engagement is crucial to the sustainability of South Africa's democracy, and the adoption of digital technology could be a crucial tool to take into account for South Africa's fledgling democracy.

The low youth voter turnout in South Africa is an issue for the electoral system (Business Tech, 2019). Statistics South Africa (2019) states that 17.84 million people in South Africa are under the age of 30. Less than half (less than 5.5 million) of South African youth were registered to vote for the 2019 general elections, and less than 40 percent (less than 7.12 million) of youth participated in the national and provincial elections, according to the 2019 elections report. (Electoral Commission of South Africa, 2019). Compared to other age groups, the number of South African youth who registered to vote and cast ballots is lower. South African youth participate in politics and increasingly express their political opinions on digital social media platforms, yet they exhibit a lack of maturity. (Business Tech, 2019).

1.1 Background of the study

According to Cho, Byrne and Pelter (2020:3), Youth are digitally literate and are participating in digital spaces to develop their civic identities and express political stances in creative ways, claiming that the current traditional voting system may not be affordable because time spent at voting stations and costs associated thereof. In addition, Ross et al., (2017:1) stated that as leading technology companies embrace biometrics, artificial intelligence (AI), drones, and other exciting digital technologies, senior business executives at many other companies feel pressured to do the same.

Ross, Sebastian and Beath (2017:3) further posit that, if companies are to maximize the value from investment in new technologies, business leaders first must make sure that their companies have a great digital strategy. The South African Electoral commission is under pressure to align with the international trends, hence the need to introduce digital voting. In adopting the digital technology, the Electoral Commission will be enhancing voter participation. Mathe (2022:17), citing Ott and Rosser (2000), posits that digital technologies enhance political participation of political players and voters alike.

The relationship between business and digital has benefited from the growth of mobile devices, cloud solutions, social media usage within organisations, and the extending of internet applications to the physical through the Internet of Things (IoT) (Mishra et al., 2022). The development of mobile application might favour the link between electoral commission and online voting by Youth through the digital technology (online voting mobile application platform)

Mishra et al., 2022 further posit that large volumes of fast-moving, complex, and changing data also known as Big Data are thus increasingly stored, and the necessity for specialized tools for data analysis which in turn spurs further digital transformations increases. Online voting will consist of very big complex data that require digital technology tools for voting data analysis and to digitally transform the online voting of South Africa.

The Independent Electoral Commission (IEC) is a permanent body created by the Chapter 9 Section 190 of the Constitution of the Republic of South Africa, 1996 to manage free and fair elections at all levels of government, it is publicly funded and accountable to parliament (Electoral Commission of South Africa, 2021:15). The IEC is mandated by the Constitution to manage free and fair elections and managing free and fair elections is gauged by electoral integrity. The Electoral Commission in its concept document (Electoral Commission of South Africa, 2020:1), posits that electoral integrity is at the heart of free and fair elections and the continued growth and perseverance of democracy on our continent. The IEC further acknowledges that to ensure that it attains its vision of being pre-eminent election management body, it must continuously seek improvement and innovation through the use of technology. (Electoral Commission of South Africa, 2021:33). This acknowledgement is not unique to the election management in South Africa. The South African Parliament stated that the truth of the matter is That technology preparation must be started to ensure that we have both the legal framework and the technical experience that will ensure that elections are secure if a decision to vote through e-voting is taken (Parliament Communication Services, 2020:1).

According to Mishra et al (2022:3),in the last 15 years, we have seen the tremendous growth of digital platforms and their influence on our lives. Now consumers are influenced by things they see on social media (Facebook, Twitter, and Instagram) and other such popular websites (YouTube etc.). The framework will attempt to explore the use of mobile application online voting to improve the youth participation and taking into consideration the growth use of digital platforms that are integral part of youth's and everyone's lives.

Mathe (2022:15), posits that South Africa is not the first country to embrace technology and innovation for electoral processes He (Mathe, 2022) further stated that there is a large literature on the adoption of digital technologies for managing elections in various

countries as a means of addressing various challenges, including double voting and low voter turnout (Mathe, 2022:15).

Mishra et al (2022:5) further alluded that, in the fast-paced world of modern technology, many leadership executives and organizations understand that building online communities for their customers or members to learn, share, and collaborate is critical for increasing growth and relevancy. The online voting in South Africa might bring the online youth community together to even learn, share or collaborate and thus understand the political and economic importance of voting and might improve the overall participation of youth in electoral matters.

According to Statista (2022:4), the internet penetration in Africa January 2022, posits that across the nation, about 89 percent of web traffic was generated via smartphones and only 10 percent via PC devices. Statista further states that It is because mobile connections are much cheaper and do not require the infrastructure that is needed for traditional desktop PCs with fixed-line internet connections (Statista, 2022:5). The relevance of the internet penetration in South Africa specifically is that IEC is leasing the schools and other infrastructures during local, municipal and national elections which is costly and with introduction of mobile framework for voting in the long run or term, the cost of leasing can be very minimal.

This is supported by the IEC 2021 Annual Report as it posits that Fixed and permanent structures, especially schools, are preferred venues to serve as voting stations. Some 63% of the voting station network comprises schools, 10% community halls and 9% places of worship (Electoral Commission of South Africa, 2021:66).

The below graph illustration shows that South Africa is ranked fourth at 68.2% share of internet users in Africa which shows the digital maturity within the region.

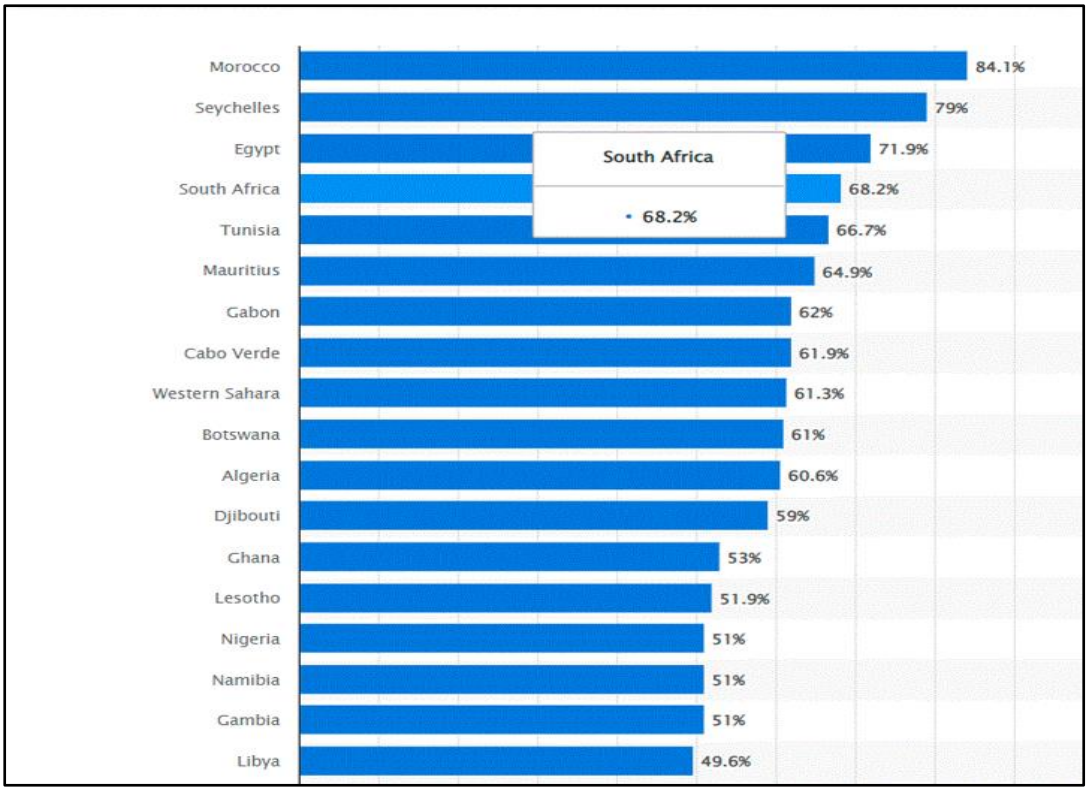

Figure 1. The internet penetration in Africa January 2022 (Statista, 2022:2).

South Africa has a share of the digital buyers using the mobile devices equalled to 38.9 percent of the internet penetration. (Statista, 2022). The term mobile application refers to software created specifically for wireless mobile devices like smartphones and tablets. (Statista, 2022). The most used application categories globally as the third quarter of 2020 were chat applications and social networking apps, with utilization reaches of 91% and 88%, respectively (Statista, 2022). There use of mobile devices by youth has been showing positive increase and they feel at ease to utilize their smartphones through social networking apps and the above statistics provide is supporting this utilization and internet penetration which might yield success to the improvement of youth participation in election.

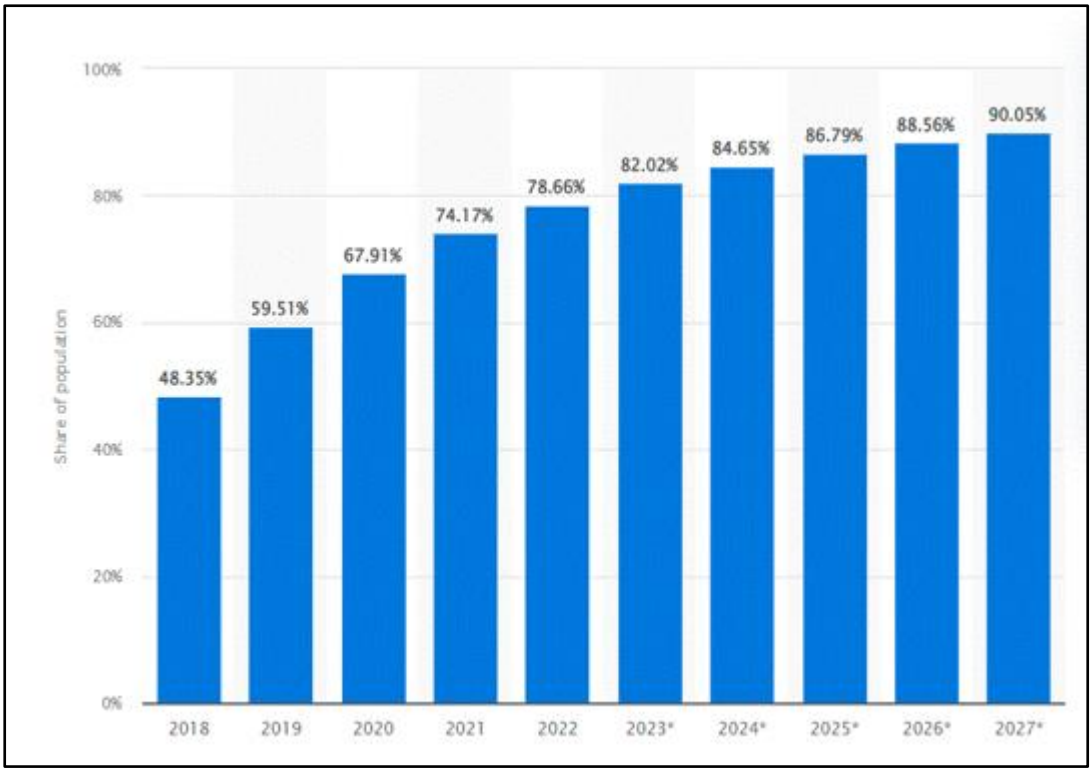

Figure 2. The share of the digital buyers using the mobile devices and the level of internet penetration. (Statista, 2022:3).

The above illustration shows the increasing levels of phones or smartphones internet penetration, its usage and how it is a contributing factor to digital technology.

South Africa has enjoyed considerably high voter turnout over the years, until recently where in the National and Provincial Elections 2019, the voter turnout was 66.0% as opposed to 89.3% in 1999. *(Electoral Commission Annual Report 2021, 2021).* It seems that, the election participation in South Africa is gradually facing a declining youth participation in the electoral process according to (Moletsane, 2021:9). To increase voter registration despite the COVID-19 pandemic, the IEC established an internet tool for doing so. Voter turnout appears to have been higher if electronic voting, which appeared to be broken down owing to COVID-19, had been supported by online registration. (Mathe, 2022).

The use of digital technologies has become more urgent than before hence the importance of developing platform that will bring about this realisation.

According to Rogers (2016:54), digital Platforms represent a fundamental shift in how businesses relate to each other, from linear to more networked business models. The mobile application as an online platform for youth to cast their votes might shift the traditional voting methods which are linear to online voting that might enable improvement of overall youth participation in electoral matters. Rogers (2016:54) further stated that the Mobile operating systems like Apple's iOS, Google's Android, and Xiaomi's MIUI compete by attracting the best software developers to create apps, which, in turn, draw consumers to buy their smartphones and platform businesses are everywhere, appearing in a wide range of industries. Mobile application for voting purposes might attract the South African youth.

According to Aljarrah et al (2016:862), the Technology Acceptance Model (TAM) has been used in research to explore the acceptance of new e-technology or new e-services (Davis, 1989; Davis & Venkatesh, 1996). The study will adopt the TAM framework and its constructs to assess the prospect of using mobile application integrated with biometric authentication that might improve the South African's youth participation in elections.

Users' opinions of a technology's utility and their attitude toward and intention to use it have been proven to be related (Aljarrah et al., 2016). Aljarrah et al (2016:862) further posit that A perceived usefulness shows more harmonious relationship with usage than did other model's variables. The perceived usefulness of using mobile application to cast vote online might also influence the intention of youth to participate in elections.

Mathe, (2022:15) mainly argues that the low voter turnout should be attributed to several factors, including manual voting itself, whereby the traditional ballot box in South Africa has also been flawed by allegations of double voting, slow vote counting, delays in the distribution of election material, and expensive ballot papers also citing (EISA, 2019). The dilemma with IEC that Mathe, (2022:15) is deliberating and arguing is that on the election day, it proceeds with voter verification at the polling or voting station, the ticking of the voter's details, marking a fingernail with indelible ink, issuing

the ballot papers, marking the ballot papers in a cubicle; and casting the ballot paper into a sealed ballot box which is a very tedious process that can be easily flawed or fiddled with (Mathe, 2022).

It is thus important to explore a mobile application for South African youth that might improve the low voter turnout and address the issue of double counting reason being that the mobile application integrated with unique biometric authentication as a unique identifier for each voter and might curb the issues and concerns as discussed.

Mathe (2022:19) argued that young people are under-represented on South African voter's rolls, and the IEC specifically wanted to attract more young voters via digital voter registration (Mathe, 2022).

To enable this, the government need to partner with one reliable telecommunication company of South Africa so that during voting period the youth voters have good network coverage. The pre-planning of erecting additional voters registers with their full Names, Surnames, ID No, Cell phone numbers, the profiles and voting will be authenticated by the voter's fingerprint and their facial recognition. Moya Application (App) developed by biNu, an Australian company that launched its services in South Africa in 2014 has a reverse billing agreement with four South African major mobile network operators – MTN, Vodacom, Cell C and Telecommunication, which means that biNu will pay those mobile network operators for all the mobile messaging data costs (Olowookere, 2018). Olowookere further stated that the Moya Messenger is the world's first data-free mobile messaging app that is rapidly becoming a rival to WhatsApp in South Africa. (Olowookere, 2018).

1.2 Research problem

Digital technology at the Electoral Commission, as election management, presents challenges especially on youth who take the digital technologies as instruments that will facilitate and introduce convenience in their lives. This convenience demands has risks involved and opportunities, thus this study is exploring or assessing the digital platform framework that will help Electoral Commission enhance the youth political participation.

The research problem is:

There is a lack of youth participation in democratic elections due to the traditional manual voting process.

Against the background provided, this research will explore the practicability of using mobile application integrated with biometric authentication (fingerprint scanners and facial recognition), to attempt to improve the South African youth vote participation in the electoral matters.

1.3 Research question

Would there be a significant positive change in youth Participation in Electoral matters if the Framework for Mobile Application integrated with biometric authentication in South Africa is introduced versus the current Framework of traditional voting?

This research question is attempting to determine the research's independent and dependent variables. The independent variable of this study is the expected number of youth respondents (18 to 35 years old) South Africans in the Gauteng region and while the dependent variable will be the positive change in youth participation while voting online versus the current traditional methods of voting.

1.4 Research objectives

1) To identify the digital technology enablers for youth to participate in electoral matters.
2) To determine the extent to which youth voters have trust in internet and the ability for the national government to conduct online elections using framework for Mobile Application integrated with Biometric Authentication.
3) To evaluate the youth voters ICT accessibility and skills to participate in online elections using framework for Mobile Application integrated with Biometric Authentication
4) To determine the attitudes, perceptions as well as intention to participate in online elections using framework for Mobile Application integrated with Biometric Authentication.

1.5 *Research outcome*

The research explored the trust in internet that the youth have to use mobile phones for online voting.

Conceptual framework was applied to indicate the youth's intention to use mobile phones for online voting.

The research evaluated the youth voters' accessibility and skills in information technology to improve the youth's participation on online voting using framework for mobile application integrated with Biometric Authentication.

The research explored the youth attitude and perception towards the use of mobile phone for online voting.

The proposed research or study findings of mobile application integrated with Biometric authentication will attempt to provide a framework to improve the election fairness in South Africa through the identified factors.

1.6 DELIMITATIONS of the study

It can be argued that delimitations are in the researcher's control. Thus, the delimitations are mostly concerned with the study theoretical background, research objectives, variables under study and study sample. There might be well sound reasons to rejecting them, primarily the research methodology or the sampling technique chosen, and this should be clearly presented. The study will be conducted online, in the Gauteng Province and the response of youth will be captured online as well.

1.7 Definition of terms

Digital Technology. According to Tulinayo et al. (2018) digital technology facilitates services or activities by electronic means to create, store, process, transmit and display information. Tulinayo et al. (2018) further stated and cited Vuorikari et al. (2016), (Rice, 2003), that Broadly, digital technologies include the use of personal computers, digital television, radio, mobile phones, robots etc.

Mobile Application. It is a software application (App) that is been used on portable computing devices with wireless capabilities, including smartphones and tablets. (Techopedia dictionary, 2020).

Biometric authentication. This is a technique for identifying the person accessing a secured computer software or hardware by comparing their unique biological features such as fingerprints, palm print, retina scan, or voice pattern recognition with their corresponding features in the database and to grant the person access only when there is a match (Subramanian, 2011).

Internet of Things (IoT). This is a network of connected smart devices and sensors that communicate seamlessly over the Internet – transforming how we live and work (Lee, 2019:5). It happens when the single object become part of a larger system where data is assimilated providing meaningful output (Lee, 2019:5).

Big Data Analytics. According to consensual definition that was proposed by De Mauro et al. (2016) Big Data is the Information asset characterized by such a High Volume, Velocity and Variety to require specific Technology and Analytical Methods for its transformation into Value.

Digital Transformation. This refers to the continuously increasing interaction between digital technologies, business, and society, which has transformational effects and increases the change process's velocity, scope, and impact (Van Veldhoven & Vanthienen, 2019:24).

Digital Business Management. This refers to the initiation as well as the partial or full support, transaction, and maintenance of service exchange processes between economic partners through information technology (Wirtz, 2021:15). The digital business management will enable and transform the mobile application framework of this study.

1.8 Assumptions

In conducting this study, the following assumptions are made:

1. *The participants in the study will freely provide the researcher with responses objectively.*

2. The respondents will fully understand the questions that they will be asked.

3. The instruments used will elicit reliable responses from the youth respondents.

CHAPTER 2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 INTRODUCTION

Organisations have increasingly digitised their operations and processes (Yeow, Soh & Hansen, 2018, p.44). The IEC is not different from the business community hence the need to align with the international technological paradigm shift.

Nikolaeva et al. (2020) state that digital technologies are intrinsically entrenched in and have so powerfully affected; all domains of modern life that it allows us to refer to this process as digital transformation, or Digitisation. They describe Digitisation/Digital Transformation as not only the act of bringing in digital technologies to an organisation but instead transforming the structure of affected items and domains as well as their central models in an organisation.

Many sectors indicate a high level of Digitisation according to Villalba (2020), he cites as an example the financial services sector which he argues has a large number of digital tools, and processes in place used to add value to clients, and how employees in the sector utilise digital media among other measures that improve strategy, company results and efficiency. The digital technology in the electoral matters remains a challenge and as such urges all electoral commission to develop an appropriate digital technology framework pertaining the issues of youth participation, double counting of votes, to deliver fair elections with integrity.

This literature review will serve to critique and analyse relevant scholarly literature about digital technology, mobile applications and/ digital strategies and how it can assist in usage of the framework and determine the prospect of using mobile application integrated with biometric authentication.

2.2 Definition of topic or background discussion

Digitisation can be best described by contrasting it with a similar although entirely different term in meaning, digitisation. Digitisation is essentially the process of converting an analogue signal into a digital one of binary code in order to allow for the storage, processing and transmission of that signal/information by computers, while Digitisation refers to the use of digital technologies to change a business model and provide new revenue and value producing opportunities. (Bloomberg, 2018:1**)**

According to Bloomberg (2018:1) the nature of organisations changes as different entities make use of digital technologies defined in an organisational context as computers and other information technology (p.1). Zakharchenko and Hazrat (2018:44) on their research paper about the formation of a digital strategy by modern enterprises writes those digital technologies are changing the world and as such a digital technology and strategy must form part of the basic activities of an organisation, and its business strategy and digital transformation.

Forming and implementing a successful digital technology and strategy bring with it enormous benefits including an increase in process efficiency, improving data transparency, and boosting revenues, profitability and market share (Bloomberg, 2018:1). Many scholars concur with the preceding statement, as most scholarly research according to Zakharchenko and Hazrat (2018:44) indicate that the efficiency of organisations tend to increase exponentially from advancing digital transformations as well as leading to GDP growth.

Although there are potential numerous benefits of successfully forming, adopting, and implementing a digital technology, many enterprises still fall short and are unable to execute an effective digital transformation in their organisations, one of the main reasons for this is a lack of information about the advantages of the formation and implementation of a digital technology and the state and prospects of development of the digital economy (Zakharchenko & Hazrat, 2018:24).

The phenomenon of digital technology across businesses and industries has come to be known as the fourth industrial revolution, which Müller and Däschle (2018) define as an ongoing Digitisation of industrial value creation, especially relating to aspects such as vertical and horizontal interconnection across humans, machines, and products.

2.2.1 South Africa Voting Operations Digital Transformation

According to Nikolaeva et al. (2020) the speed of Digitisation is different across different sectors and industries of the economy and that some industries are not leading sector in this process, rather are among the catching-up industries. The Digitisation of the South African voting processes, formulate the Framework for Mobile application which are adopting digital technologies and processes, including the deep penetration of digital technologies in the electoral matters.

The technique mentioned above work using the 4IR concept of the Internet of Things (IOT), which is increasingly accepted throughout the digital world (Avramović et al., 2019, p.20). All these advancements from the Digitisation of the voting processes, delivers exceptional tools to improve the efficiency and are catalysts that are speeding up the evolution to an innovative level of sector development. (Avramović et al., 2019).

2.2.2 Framework (Technology Acceptance Model and Trust and risk in e-government adoption Model)

One of the fundamental components of the digital economy is trust, which acts as a catalyst for the development of effective markets. (Uche et al., 2021). Uche et al. (2021) further posit that Trust is integrated with essential constructs from well-known technology acceptance models, such as the Technology Acceptance Model (TAM) or the more recent Unified Theory of Acceptance and Use of Technology (UTAUT)

model. The trust constructs will be identified and discussed to understand its importance to technology acceptance constructs.

According to Uche et al. (2021), significant theoretical and empirical progress in explaining and predicting user adoption of Information Technology (IT) has been made. The TAM and trust constructs will be used to assess the prospect of using mobile application integrated with biometric authentication that might improve the South African's youth participation in elections. Uche et al. (2021) stated that through the mediating variables perceived utility and perceived ease of use, the TAM has become well-established as a model for predicting IT acceptance, usage intentions, and behavior. Based on this statement, the TAM has two main constructs as independent variables which are perceived ease of use and perceived usefulness and its important constructs for the intention to use the mobile application integrated with biometric authentication by youth to vote online.

The use of information technology and user acceptance of such technology are critical variables in the success obtained following Digitisation adoption of new technology. (Uche et al., 2021). The application of TAM framework factors will assist to assess the youth's acceptance of mobile application to cast their vote online.

Most scholars have proposed a number of theories to describe users' acceptance of information technology, including DTPB (Decomposed Theory of Planned Behaviour) (Taylor & Todd, 1995),IDT (Innovation Diffusion Theory) (Moore & Benbasat, 1991), TAM (Technology Acceptance Model) (Davis, 1989), Extended Technology Acceptance Model (TAM2) (Venkatesh & Davis, 2000), TPB (Theory of planned behaviour) (Ajzen, 1991), TRA (Fishbein et al., 1975) (Theory of Reasoned Action), and UTAUT (Unified Theory of Acceptance and Use of Technology) (Venkatesh, Morris, Davis, & Davis, 2003).

In research, the Technology Acceptability Model (TAM) has been used to investigate the acceptability of novel e-technology or eservices (Davis, 1989; Davis & Venkatesh, 1996). The following online voting constructs or notions were identified: internet trust,

government and electoral institution trust, access to ICT, ICT skills, and perceived utility of ICT. Understanding and tackling these concerns may lead to young people voting online using mobile phones. The table below shows the previous studies undertaken for trusts constructs and TAM.

Trust constructs and Technology Acceptance Models

Table 1 Influencing the Intention of Youth to Adopt Electronic Voting in South Africa

Research Interests	**Sources**	**Models and Framework used**	**Adopted Constructs**	**The link between constructions**	**The role or importance of constructs**
Factors for e-voting adoption	(Adeshina & Ojo, 2017)	Technology Acceptance Model (TAM); Diffusion of Innovation (DOI)	Trust of the internet, trust of the government and electoral institutions, Perceived utility of ICT	The adoption of online voting is influenced by trust structures and perceived utility of ICT.	These constructs will be utilized to examine the impact on voting intention using a mobile application.
Trusting e-voting	(Avgerou, Masiero, & Poulymenakou, 2019)	The model of electoral integrity.	Trust of the internet	Internet trust impact the use of mobile application to cast vote online	The trust construct influences the likelihood of using online voting.

E-voting in Jordan	(Aljarraha, Elrehaila, & Aababneh, 2019)	TAM; DOI	The internet Trust; trust of government and electoral institutions; Attitude towards ICT	The trust constructs and attitudes towards ICT impact on use of online voting and its readiness	The influence of trust and attitude toward ICT constructs on the youth's inclination to use mobile applications to vote online will be tested.
Use of e-participation	(Zheng & Schachter, 2017)	N/A	Access to ICT; Skills in ICT	Access to ICT, skills in ICT impact perceived utility of ICT	Access to ICT and ICT Skills constructs are being explored for their impact on perceived utility of ICT.

E-Participation through Mobile Technology	(Ochara & Mawela, 2015)	Access, skills and attitude framework	Access to ICT; skills in ICT; attitude towards ICT; perceived utility of ICT	Access to ICT, skills in ICT, attitude towards ICT impact perceived utility of ICT	These constructs examine the impact of ICT on perceived utility. The perceived utility of an ICT construct was used to examine the influence on the intention to utilize a mobile application to vote online

Source: Moletsane (2021, March).

According to the literature on TAM, there is a need to research, analyze, and examine the youth's perceptions that influence their attitude toward ICT. The current study implies or investigates the possibility that some perceptions provide an advantage without evidence (Zheng & Schachter, 2017). The TAM will be used in this study to anticipate and thoroughly explain the youth behaviour.

The TAM has capabilities to sequence the flow of the external variable to the actual technology system in place for its usage. These external variables are important because it influences perceived usefulness and ease of use of the digital technology. These variables will influence the youth's attitude towards online voting and then the attitude (positive or negative) will eventually then influence the youth's behaviour that will lead them to online voting through their smart mobile phones and usage of online voting digital platform.

The TAM was utilized in Gambia to validate people' use of e-Government (Lin, Fofanah, & Liang, 2011). The results of perceived usefulness and simplicity of use revealed a favourable association between e-voting system intention and perceived usefulness.

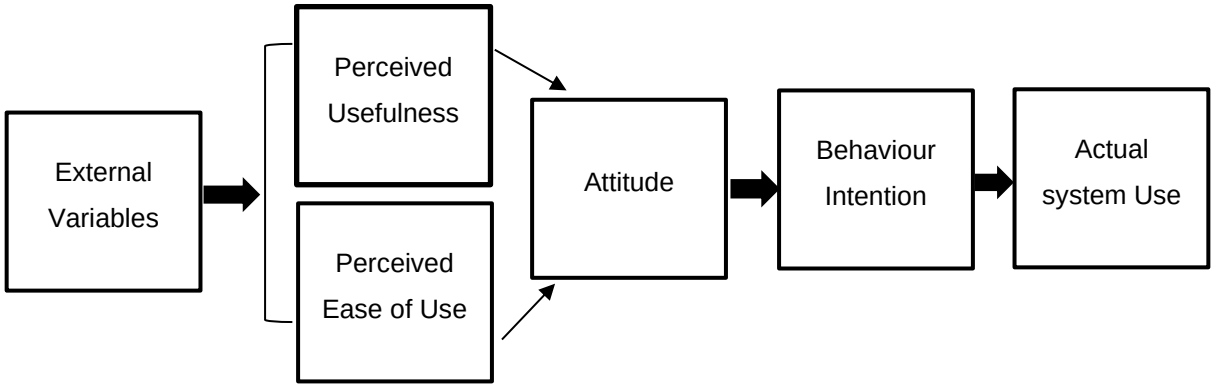

Figure 3. Technology acceptance model

Source: (Davis, 1989; Davis & Venkatesh, 1996)

South Africa's technological breakthroughs have enabled the youth to utilise information and communication technology. Technology has the potential to bridge and transform the interaction between young and the country's governmental institutions, such as the election commission. E-voting can be utilized to reach out to and encourage more South African youth to vote in elections (Rexhepi, Filiposka, & Trajkovik, 2018; Achieng & Ruhode, 2013).

In their research work, Belanger and Carter (2018) advocated that trust and risk in e-government models be researched and investigated for adoption. Their research findings indicate that trust on the internet influences the intention to use e-voting.

2.2.3 Propositions

From the literature above, the TAMS's assessment of the development of the Framework of the mobile application and the risks involved which will inform the risk behaviours of the youth decision to vote online or not with various degrees of uncertainty about the future elections. This study argues that maybe youth don't participate in election because the status quo made them lose confidence in electoral matters. Looking at the failure rate of government services delivery, and low Youth turnout, it is possible that youth participate less and see election as unrealistic, and the subjective framework model need to be adopted. There is a positive or negative relationship between youth participation and youth not participating in the elections.

The concepts that are derived and identified are as follows: the trust of internet and its connectivity to mobile phones, trust of government and its election institutions, access to Information, Communication Technology (ICT) and its reliability, the skills existing in the ICT, the youth perceived utility of ICT and the intention of youth to use mobile phones for online voting. The analogy with the understanding how to address these factors might lead to youth participating in digital elections.

Proposition 1: The high degree of trust on the Internet and its connectivity encourages the intention of young people to vote online using mobile phones.

Proposition 2: High level of trust of the government and its electoral institutions favourably promote the intention of young people to vote online with mobile phones

Proposition 3: Access to ICT improves the youth participation on using mobile phones for online voting

Proposition 4: The youth Skills in ICT will cause the improvement on youth general participation on using mobile phones for online voting

Proposition 5: Attitude towards ICT positively affects young people's decision to vote online using their smartphones

Proposition 6: Youth's willingness to vote online with mobile phones is positively influenced by their perception of the usefulness of ICT.

Proposition 7: The intention of youth to use mobile phones for online voting is an important contributing factor to improve youth participation in elections

Table 2. Proposition summary of the research proposed

Number	**Variables/Constructs**	**Proposition Predictions**
P1	Trust of the internet	The youth's intention to use a mobile application for online voting may be encouraged by their trust in the internet.
P2	Trust of the government and its institutions	Trust of the government and its electoral institutions might favourably promote the youth's intention to use mobile
P3	Access to ICT	Access to ICT improves the youth participation on using mobile phones for online voting
P4	Skills to ICT	The youth Skills in ICT might cause the improvement on youth general participation on using mobile phones for online voting

P5	Attitude to ICT	Attitude towards ICT positively affects young people's decision to vote online using their smartphones
P6	Perceived Utility of ICT	Youth's willingness to vote online with mobile phones is positively influenced by their perception of the usefulness of ICT
P7	Intention to use	The intention of youth to use mobile phones for online voting is an important contributing factor to improve youth participation in elections

2.3.1 Current Voting Methods in South Africa

The traditional paper voting system is currently a common voting process. The process will still be in place prior to the introduction of the digital voting platform. Paper voting is the process that includes paper and folding it at the end which makes a ballot that is referred to as ballot paper voting. This system has limitations and disadvantages, it takes a long process and the costs of renting voting stations (VDs).

The digital transformation will introduce a wider range of voting platforms as compared to the traditional paper voting stations and methodologies. Voters are seen as service requestors and pushes electoral commission to develop a wider range of service offerings. Remote voting needs to be introduced as part of extending and attracting the youth and technological community in voting.

2.4. ANALYTICAL FRAMEWORK

2.4.1 Theoretical Framework

Adom et al., (2018:438) posit that The Importance of Theoretical Framework in research offers several benefits to a research work and further cited (Grant & Osanloo, 2014) that it provides the structure in showing how a researcher defines the study philosophically, epistemologically, methodology and analytically. They further cited Ravitch and Carl (2016) that concur with that the theoretical framework assists researchers in situating and contextualizing formal theories into their studies as a guide. Moreover,

The theoretical framework serves as the focus for the research, and it is linked to the research problem under study (Adom et al., 2018). Therefore, it will attempt to provide guidance in the research design and the data analysis plan. Thus, the theoretical framework assists the researcher in determining the best research approach, analytical tools, and procedures for the research inquiry. The research will then have a basis that will be meaningful rather than distorted results. It is the simplest approach for a researcher to communicate his or her asserted solutions to the problem that has been defined (Liehr & Smith, 1999; Akintoye, 2015). It highlights the prominence and reasons that this research study will be worth studying, the assumptions thereof that the researcher agrees or disagrees with and to how this study will conceptualize the breaking grounds of this research approach.

Akintoye (2015) posits that the conceptual framework is mostly used by researchers when existing theories are not applicable or sufficient in creating a firm structure for the study.

The most basic idea is to enable citizens and, in this regard, the South African youth to connect and interact digitally with the electoral commission from anywhere and at any given time of the voting days.

2.4.2. Electronic Voting

Voting methods can be prone to mistakes, manipulation, and fraud. There are attempts to rig the votes in many countries; in others, the losers request a manual recount. Voting can lead to serious political problems, as it has in various countries. Problems with the US presidential elections in 2000 and 2004 have pushed the trend toward electronic voting. The voting process covers a wide range of technological and social activities, from voter registration and verification to ballot casting and subsequent results counting.

Electronic voting, for example, automates some or all the phases in the process. Because of a variety of important variables, such as the proprietary nature of the software, fully computerized voting systems have sparked substantial controversy. Common concerns include difficulties in marketing the systems to voters, complex auditing, and a lack of competence in some stages of the process.

The risk of fraud in electronic voting is a contentious issue (Madden, 2015). The likelihood of fraud increases when non-paper-trail E-voting devices are employed (Gross, 2016). It may be difficult to hack E-voting systems that are not connected to the Internet but are instead connected to government-protected networks. However, some have alleged that various non-voting systems (e.g., the Democratic National Commission's files) were compromised during the 2016 presidential elections in the United States (en.wikipedia.org/wiki/Electronic voting and the Electronic Frontier Foundation).

2.4.3. Implementing E-Government

Government agencies, like most other organizations, want to go digital. As a result, numerous EC applications may be found in government organizations (Mei Hua and Rohman, 2015).

This section examines and explains the common trends and issues involved in the implementation of digital government. The implementation inhibitors might be the desire of many governments or electoral institutions to maintain control over the use on online voting, how the data might get disseminated and the knowledge thereof.

The transition from traditional government service delivery to full implementation of digital government may be a complex and time-consuming process.

Government agencies can increase the effectiveness of their online activities to satisfy users 'needs at a fair cost by utilizing social media tools and innovative business models, as well as embracing social networks and user engagement.

Government agencies across the world are experimenting with social media tools, as well as their own pages and presence on public social networking sites. Governments primarily use web tools for cooperation, information distribution, e-learning, and citizen participation.

2.4.3. Conceptual Framework

Conceptual frameworks are always constructed by researchers (Polit & Tatano, 2004). Ravich and Carl (2016) posit that the conceptual frameworks are generative frameworks that reflect the thinking of the entire research process. The Conceptual Framework of this study will clearly define the relationship between online voting versus the traditional phenomena and thoroughly explain the variables that influence the study that will be presented or results.

For example, youth might feel that they are not working to afford data, or they have lost hope in politics or are not interested in politics. This study will attempt to provide empirical evidence using quantitative methods, statistics phenomena and tools to prove the relationship between the digital businesses frameworks of mobile applications integrated with biometric authentication versus the traditional methods of voting as they are different variables.

These tools mentioned above will follow the quantitative methods when collecting the data as an input of this study. These inputs will be informed by theoretical framework, mobile application framework and the current framework (traditional voting) and thus will assist this research to attempt to arrive at informed results. Usually, the independent variables are also the inputs to the research. The inputs will include the profile of South African youth eligible to vote as respondents and this will be carried out on an online platform survey. The research procedure will be as follows: data gathering of South African youth profiles in Gauteng, administration of questionnaires, tabulation of youth's responses, statistical analysis of data utilizing statistical tools and MS Excel.

The relationship between the above phenomena and variables of this study will be explained in detail and described using statistical formulas and formplus that using back-end algorithms to interpret results of the survey. The input data will be youth respondents' profile according to sex, school level, age and the social media platform they are using and how active.

The Conceptual Framework identifies the important variables of this study which are independent and the dependent variables. That might be the online platform versus current traditional methods or different political organizations affiliation or Interests Group. The number of youths that managed to complete the survey accurately and their educational background. The independent variable of this study might attempt to manipulate the analysis or results however the rigorous analysis will be considered or consideration because it might affect the dependent variable analysis. The dependent variable will be the resultant variable that this study will measure.

Latham (2017) argues that the entire methodology must agree with the variables, as well as their relationships and context. This research study will use diagrams that will be created so that it will clearly explain and provide definitions of the constructs or above-mentioned variables and its relationships.

Mobile Government (M-government) is the use of wireless platforms and mobile devices, particularly smartphones, to execute E-government applications. (mgov-world.org; Government of Canada Wireless Portal).

Wireless Internet infrastructure and gadgets are used in M-government. It is a value-added service since it allows governments to reach a wider number of citizens (through smartphone or Twitter, for example), and it can be less expensive than wireline-based electoral commission platforms. It is incredibly useful for conducting surveys and polls, and it is also very convenient for citizens. Furthermore, governments employ a considerable number of mobile workers who rely on wireless devices.

Table 3. The differences between Theoretical and Conceptual Framework

Theoretical Framework	***Conceptual Framework***
It provides a wide or general collection of concepts to which a study or subject belongs.	It refers to specialized or restricted ideas that a researcher employs in his or her investigation of a study.
It is based on previously published theory/theories that have been tested and validated by other experts or scholars.	It is founded on the concepts that serve as the primary variables in a study.
It takes the shape of a model, with its proponents and the findings of their research.	It is a researcher's own model that he or she employs to describe the link that exists between the study's major variables.

It is well-developed, well-designed, and widely accepted.	Its design is not acknowledged, but it is a proposal of the researcher's solution to the research topic that he or she has described.
It provides a focus for approaching undiscovered research in a certain topic of study.	It is the framework that demonstrates logically how the research inquiry will be conducted.

Source: Adom et al., (2018:440)

There are many designs of the conceptual frameworks that this research can adopt or have been developed or designed by many other researchers previously and have been used. The proposed conceptual framework for this study will be based on the Model of Trust and risk in e-government adoption and Technology Adoption Model literature.

2.4.4. Proposed conceptual framework

A conceptual framework is created using constructs and theories from the enormous literature on technology adoption. One advantage of the conceptual model is the ability to identify the constructs that are relevant to the research being researched (Adom et al, 2018).

The conceptual framework helps to govern the breadth of the variables to be analysed in a research study, but it has limitations that may exclude some of the emergent concepts from the data being collected. Regardless of this limitation, the conceptual framework was chosen based on the evaluated theories and constructs, with awareness and sensitivity to emergent effects that will be incorporated into the final proposed conceptual framework (Adom et al, 2018; Thomas, 2006).

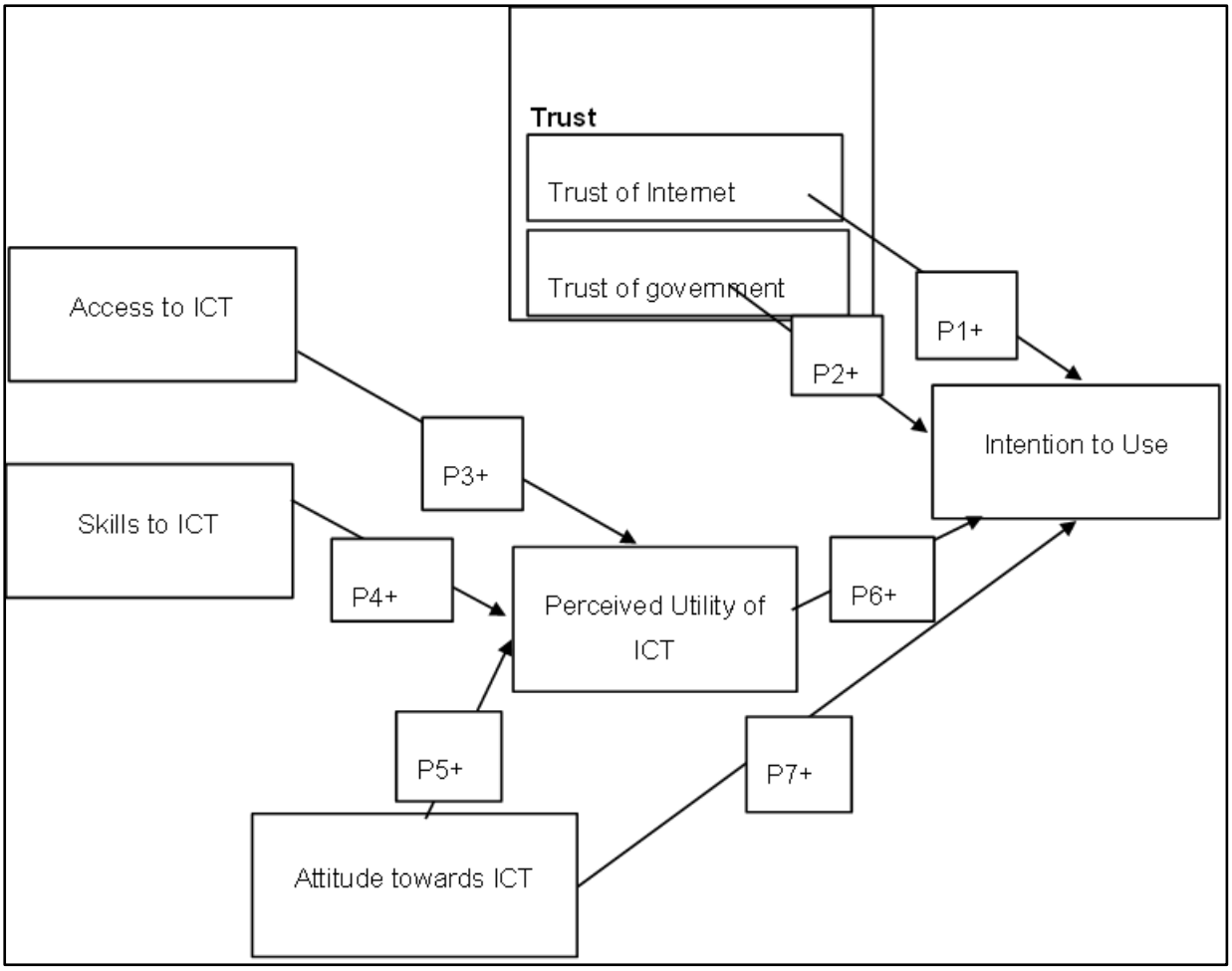

Figure 4. Proposed conceptual Framework

Table 4. Summary of conceptual framework constructs

Constructs	Description	Source
Trust of the internet	The influence of internet trust on the intention to utilise a mobile application for online voting will be tested.	(Belanger & Carter, 2008)
Trust of the government	The influence of trust in the government construction on the intention to utilise a mobile application for online voting will be tested.	(Belanger & Carter, 2008)
Access to ICT	The access to ICT construct will be utilised to examine the impact of ICT on perceived utility.	(Verdegem & Verhoest, 2009; Ochara & Mawela, 2015)
Skills in ICT	The influence of ICT construct skills on perceived utility of ICT will be tested.	(Verdegem & Verhoest, 2009; Ochara & Mawela, 2015)
Attitude towards ICT	Attitude towards ICT construct will be used to examine the effect or impact on perceived utility of ICT	(Ozkan & Kanat, 2011)

Perceived utility of ICT	The influence of perceived utility of ICT construct on intention to utilise mobile application for online voting will be tested.	(Ochara & Mawela, 2015)
Intention to use	The intention of youth to use is an important contributing factor to overall outcome and all other constructs has influence on it.	(Carter & Belanger, 2005; Ochara & Mawela, 2015)

2. 5 Conclusion of Literature Review

In conclusion digital technologies are one of the most beneficial tools impacting businesses today, organizations today irrespective of size or industry, as well as those in the public sector and non-profits are being impacted by digital technologies, this process is referred to as Digitisation/digital transformation.

This process of digital transformation is being driven by a phenomenon known as the 4th Industrial Revolution/Industry 4.0, there is no commonly agreed upon definition of the fourth industrial revolution, but Charles Shwab of the world economic forum has defined it as a culmination of emerging technologies fusion into the physical and biological worlds (Schwab, 2016, p.7)

Like most other industries, scholars believe that the entire Electoral Commissions today are undergoing a digital transformation that drives the implementation of digital technologies, primarily the mobile applications so that they can access many people. As the business environment today undergoes this profound change described above,

industries including the Electoral Commissions are becoming more involved in developing digital platforms and mobile applications and implement successful business strategies to meet the goals and objectives that they set for themselves and be able to improve the youth Participation in future.

CHAPTER 3 RESEARCH METHODOLOGY

3.1 Introduction

In this chapter, the research methodology that was utilized for this research study has been explained; Gauteng province was the place or location where the study was conducted, the research design used was quantitative method and it was conducted using online questionnaire on the Formplus platform. The formplus was the instrument used for data collection and Microsoft excel 2016 was also used for data analysis. Ethical standards that were followed have been explained thoroughly.

3.2 Research approach

Khalid, Hilman and Kumar (2012:16) posited that Quantitative research relies on deductive reasoning or deduction. The quantitative research was confirmed to be the statistics and economics methods that follow mathematical techniques that can measure, quantify and analyse any data collected for decision making through robust economic and statistical modelling.

Quantitative research approach was adopted for this research, an online survey called the formplus platform was used for the purposes of data collection, exported to excel for statistical tools, data analysis, interpretation and results.

The quantitative methods included experiments, observations recorded as numbers and online surveys with closed-ended questions. Data was gathered and interpreted that assisted on building a conceptual framework of mobile application.

3.3 Research Design

The study followed the descriptive quantitative methodology and the quantitative study, according to Zainal (2007, p1) allows the exploration and understanding of complex issues (and was thought to be a robust research method particularly when a holistic, in-depth investigation is required (p.1).

Due to the methodology's inherent advantages listed above, the descriptive quantitative study strategy was used to find out the success thereof led to electoral commission improvement on youth electoral participation.

3.4 Data collection methods

The formplus platform was used to collect data for this study. Questionnaires were described as documents that include a series of open and closed questions to which the respondent is invited to provide answers (Rowley, 2014, p.308).

The main rationale for using a closed-ended questions in this study was as stated by Rowley (2014) notes in designing and using research questionnaires, employing a questionnaire for the purpose of data collection helps a researcher identify the frequency of occurrence of opinions, attitudes, experiences, processes, behaviours, or predictions (p.309). This was helpful in answering the study's research question as a result of the implementation of the electoral commission framework of mobile application integrated with biometric authentication.

Rowley (2014: 310) recommended the use of closed-ended questions survey when enough was already known about the situation being investigated and it was easy to include meaningful questions in the questionnaire itself, then the investigation on how a successful implementation of the electoral commission framework of mobile application integrated with biometric authentication will be improved.

An online closed-ended questions survey was also recommended when willing respondents were identified, who were able to provide meaningful data about a topic

Rowley (2014:310). The willingness of the respondents was identified in this study and elaborated further in the next section on population and sample.

3.5 Population and sample

The population refers to the youth of Gauteng province in South Africa, before and post-election events, or things of voting interest that this study has quantified. According to Cooper and Schindler (2003) a sample refers to a demonstrative share of a specific population that is carefully chosen to participate in a research study. 209 youth participants participated on the online platform survey to answer the questions that assisted the study.

The study used a purposive sampling technique. The purposive sampling technique, also called judgment sampling, is the deliberate choice of a participant due to the qualities the participant possesses, and it is a non-random technique that does not need underlying theories or a set number of participants Etikan et al (2016: 2). Purposive sampling is a type of non-probability sampling in which the researcher makes decisions about which individuals to include in the sample based on a variety of criteria such as specialist knowledge of the research issue or capacity and willingness to participate in the research.

The technique was found relevant due to the sampling size as compared to the probability sampling technique. The research did not intend to produce the results that may be used to make broad generalisations about the entire youth population. Purposive sampling was used to better match the sample to the research's objectives, improved the study's rigour and the reliability of the data and outcomes. Purposive sampling was relevant as the subject matter experts of youth and ordinary youth from Gauteng province represent the different voting and political ideologies.

3.5.1. Case site

This study was conducted online on the Formplus platform, Gauteng region, South Africa. The Electoral Commission has acknowledged that to ensure that it attains its vision of being pre-eminent election management body, it must continuously seek improvement and innovation through the use of technology (Electoral Commission of South Africa, 2021:33). The Gauteng province was selected out of the other eight provinces because it is the main South African economic hub, with diverse socio-economic and political dynamics. Gauteng was also relevant because the youth in this province are from different backgrounds capturing the townships, urban areas and the city hub. Therefore, Gauteng provided the completeness of population dynamics.

3.5.2. Sample and sampling method

The sample consisted of a total number of 209 participants, i.e., young people who are between the age of 18 and 35 years old. According to mid-year 2019 projections, youth (aged 18-34) account for about one-third of South Africa's population (17,84 million), with 9,04 million men and 8,80 million females. (StatsSA, 2019). Gauteng is home to about 30% of the country's youth (5,10 million or 28.6%). (StatsSA, 2019).

The questionnaire was distributed through National youth Development Agency (NYDA) to 2 400 Gauteng youth. Due to the POPI Act and regulations the questionnaire was sent on the behalf of the researcher. Hence the participants name list is not reflected in the research. 209 out of the 2 400 participants responded to the questionnaire, which is 9% response rate.

As such, this particular set of young people are those that are most qualified to respond to descriptive questions about digital platform for elections (online voting). It was comprised of the young people eligible to vote in South African context, then selected 2400 young people from the age of 18 to 35 years and drawn from a population of total young people in the Gauteng Province.

3.6 The research instrument

Statistical tools and software such as formplus, Qualtrics, SPSS, and excel were the ones most widely used as way or means of collecting the quantitative data.

Data was collected as Mathebula (2017) noted, it allows for the respondents to take part in or respond to a set of questions freely and in a timely manner, using a set of standardized questions the purpose of which is to permit the researcher to comprehend the prevailing or present condition being investigate. In this case it referred to South African mobile application integrated with biometric authentication concerning their interpretations and views about South African voting operational inefficiencies, long ques to vote, the time it took them to voting stations and exercise their constitutional rights fairly which enabled the collection of rich data that was used to answer this study's research questions.

An online closed-ended questionnaire survey was chosen as it allowed the research to gather feedback through responses from a relatively large number of young people which assisted in increasing the amount of data a researcher had and its utilisation thereof.

The study was conducted in English, and the respondents' names/identities were treated with anonymity and privacy when the data was collected.

3.7 Procedure for data collection

A procedure for data collection or related to a research paradigm is defined by Yin (2009) as a complete structure or system that informs the research and practice in a specific way. Data collection was essential in research since the data was intended to contribute to a deeper understanding of a theoretical framework. The data collection process included various decisions, such as the type of research design employed,

the use of purposive sampling processes, the absence of control variables and there was no missing data.

The formplus platform was utilized to create the research questionnaire, which included three sections: consent, demographics, and conceptual constructs. The conceptual constructs were evaluated using a 5-point Likert scale, with a low score of not supporting and a high score of supporting the statement or question, i.e., Strongly disagree (1), Disagree (2), Neutral (3), Agree (4), and Strongly Agree (5).

The online questionnaire was distributed through National Youth Development Agency (NYDA) to 2 400 Gauteng youth, using the formplus platform link to respond to the questionnaire and the data was collected through the platform.

3.8 Data analysis and interpretations

In data analysis, the researcher investigated three main objectives: get to know the data, testing how good and accurate the data was and then evaluated the propositions developed for the research. Knowing the data has assisted in preparatory ideas of how good the data is, the coding and entering of data. The second objective was to test the goodness and accuracy of the big data. It was achieved by submitting the data for factor analysis so that the study obtains the Cronbach's alpha or the split-half reliability of measure following correct statistical methods. The third objective was to choose relevant and appropriate statistical software programs and other statistical tools to analyse and support each of these propositions. The results obtained and available were analysed to inform the study to whether it support the propositions and South Africa to adopt the framework for mobile application for online voting.

3.9 Validity and reliability

Noble and Smith (2015) noted that assessing the quality of research is vital if its conclusions are to be used in a real-world setting, they wrote how dissimilar to quantitative research, which uses mathematical methods for proving validity and reliability of research results, qualitative research on the other hand tried to design and integrate methodological strategies to ensure the 'trustworthiness' of the findings (p. 34).

Scholars agreed that the widest framework of the terms (validity and reliability) were applicable. Validity denotes the truthfulness and submission of the research methodology assumed and the exactness to which the results precisely mirror the data, while reliability defines consistency of the proposed analytical measures (Noble and Smith, 2015). The reliability analysis that was undertaken for this study was to test the Cronbach Alpha, standard deviation and mean. Cronbach Alpha is a statistical phenomenon that is used to assess the reliability and consistency of data collected for research purposes mostly in quantitative surveys.

3.10 Ethical considerations

In terms of ethical clearance for this study, the main ethical principles of research were; **consent**, **autonomy** and **permission**, these were further elaborated upon below:

- **Consent**: All the participants in this study was voluntarily agreed to take part in the proposed research/the respondents were not coerced into doing the questionnaire.
- **Autonomy**: After they have agreed to take part in the research, the participants completed autonomy and it was up to them whether they decide to finish with the study or not.

- **Permission**: Before the study was commenced, permission was obtained from NYDA, where the database of youth was used, and the study was conducted.

Other ethical principles pertaining to this study were:

- **Confidentiality**: The information/data shared by the participants with the researcher was shared with any other parties.
- **Anonymity**: All the respondents were given a choice to remain anonymous.
- **Privacy**: Proper measures was taken to ensure that the questionnaire is completed in a private manner.

3.11 Research instrument

3.11.1 Coding Data

Neuman (2014:393) defines data coding as systematically reorganising data into a format that is familiar and easy to investigate using computerised statistical software. He further points out that coding is a simple clerical task when data is recorded as numbers on an organised Spreadsheet. Therefore, in this section coding procedure and data records are outlined with aim of condensing data into simplified and readable format. The conceptual framework constructs were assessed using a 5-point Likert scale, with a low score of not supporting and a high score of supporting the statement/question, i.e., Strongly disagree (1), Disagree (2), Neutral (3), Agree (4), and Strongly Agree (5). Constructs were evaluated to ensure that the proposed or suggested framework was reliable.

Formplus was used to build and analyze the online research questionnaire, which contained three sections: consent, demographics, and conceptual model constructs. The demographics and conceptual model constructs questions were separated. Respondents were given options for the demographic questions, which were closed-ended. To solicit responses from young people, the conceptual constructs-related questions were graded on a 5-point Likert scale. Previous research publications'

questionnaires were used, including Belanger and Carter (2008), Karavasilis, Zafiropoulos, and Vrans (2010), Lallmahomed, Lallmahomed, and Lallmahomed (2017), Lin (2007), and Ochara and Mawela (2015). This is summarised below.

Constructs	**Question**	**Options**
Demographic	This questionnaire was intended for South African youth aged 18 to 35. By clicking accept, you acknowledge that you are a South African and that you are participating willingly. All information will be kept strictly confidential and used only for the purposes of this study. There will be no individual names recorded or publicised. You have the option to withdraw from the study at any time for any reason.	Agree. Disagree
Demographic	Age	18-20, 21-25, 26-30 and 31-35 years

	Gender	Male, Female and Prefer not to disclose/say
	Province	Gauteng
	Qualification level	Postgraduate degree, Degree, Diploma, grade 10-12 and Grade 9 or less;
	Employment status	Employed, Unemployed and A student
Trust of the internet **(**Belanger & Carter, 2008;Karavasilis, Zafiropoulos, & Vrana, 2010;Lallmahomed,	The internet has risk safety measure to make me feel comfortable to use mobile application for online voting during the elections.	Strongly disagree to Strongly agree on a 5-point scale
	I feel assured that the internet technology	Strongly disagree to Strongly agree on a 5-point scale

Lallmahomed, & Lallmahomed, 2017)	will adequately protect me from potential problems associated with online voting with mobile phone integrated with biometric authentication during elections.	
	In general, the internet and its connectivity are reliable and safe environment to use for online voting using mobile application for elections	Strongly disagree to Strongly agree on a 5-point scale
Trust of the Government **(**Belanger & Carter, 2008;Karavasilis, Zafiropoulos, & Vrana, 2010;Lallmahomed, Lallmahomed, & Lallmahomed, 2017)	I trust the Independent Electoral Commission (IEC) to manage online voting for elections freely and fairly	Strongly disagree to Strongly agree on a 5-point scale
	I trust the national government to administer online voting for elections freely and fairly	Strongly disagree to Strongly agree on a 5-point scale

	I trust the local government to administer online voting for elections freely and fairly.	Strongly disagree to Strongly agree on a 5-point scale (Likert scale)
Access to ICT (Ochara & Mawela, 2015)	I will take part in voting online if the mobile application and proper facilities are Provided.	Strongly disagree to Strongly agree on a 5-point scale (Likert scale)
	I have access to the digital technology (internet enabled mobile phone) necessary to take part in online voting.	Strongly disagree to Strongly agree on a 5-point scale (Likert scale)
	I have access to reliable internet to enable my participation in online voting.	Strongly disagree to Strongly agree on a 5-point scale (Likert scale)
	Using mobile device to access online voting services would not be expensive to me.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)

Skills in ICT (Ochara & Mawela, 2015)	I can easily use mobile device to process my vote using online mobile application for elections.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)
	I have no problem using the Internet by myself to get to online voting for elections.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)
	I do not need someone to explain how to use Online voting to me.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)
	My friends and family will come to me for advice concerning the use of mobile application integrated with biometric authentication for elections.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)
Attitude towards ICT (Karavasilis, Zafiropoulos, & Vrana,	I would like to use online voting for elections.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)

2010)		
	It is preference for me to use online voting for Elections.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)
	I am willing to learn how to use mobile application for elections.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)
Perceived Utility of ICT (Karavasilis, Zafiropoulos, & Vrana, 2010)	Using mobile phone to vote online would enable me to process my voting more quickly.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)
	The benefits of using online voting are clear to Me.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)
	Using online could cut travelling expenses and ques at voting stations.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)

Intention to use (Belanger & Carter, 2008; Karavasilis, Zafiropoulos, & Vrana, 2010; Lallmahomed, Lallmahomed, & Lallmahomed, 2017)	I would use online voting for elections should it become available.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)
	I would use online voting provided over the mobile application.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)
	Voting online is something that I would do.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)
	Using mobile application to vote online would enhance my efficiency in voting.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)
	Using online would make it easier to vote.	Strongly disagree to Strongly agree on a 5-point scale

		(Likert Scale)
	Using online voting on mobile device would give me greater control over voting.	Strongly disagree to Strongly agree on a 5-point scale (Likert Scale)

The survey was done online therefore the process entailed the preparation of the questionnaire, coding procedure, cleaning data then entering it into Formplus, then finally testing it. Thereafter the data was prepared for analysis by organising it into tables and statistical measures as Neuman (2014:426) posited.

Therefore, in following principles of Neuman's analysis of quantitative data and for purposes of data presentation and interpretation, data was entered into Microsoft Excel 2016 then transferred for purposes of providing descriptive statistics of frequency, mean, standard deviation, percentage and cumulative percentage. In conducting descriptive statistics, the study used demographic frequencies of age, gender, qualification and employment status with aim of determining to the full extent characteristics of the youth participating in this research.

Chapter 4: Presentation of data

4.1 Introduction

This chapter 4 summarises in sections 4.2. to 4.3 reflecting on the targeted participants' detail demographic from age, gender and employment status then sections 4.3.1 to 4.4.1 present statistical data. The overall picture of the data collected through online questionnaire will be presented graphically, in tabular form and then analysed statistically. The data collection process commenced in February 2023 to March 2023, where 2400 questionnaires were distributed to youths using Formplus. Of the distributed questionnaires, only 209 participated by completing the online questionnaires through Formplus, which is an online platform that allows creation of questionnaires and surveys to be created and be shared online to audiences. The questionnaires were sent to South African youth within Gauteng province between the ages 18 – 35 to the National Youth Development Agency (NYDA). The Microsoft Excel 2016 application was used, and descriptive analysis of data collected. The questionnaire consisted of 23 questions inclusive of four additional demographic questions.

4.2 Demographics

This section reflects the targeted participants detail demographic from age, gender and employment status.

Table 5 gives a breakdown of respondents by age group. Age group 31 – 35 had highest participation with 32% (66). 21- 25 and the lowest participants were age group 21-25 with 21% (44). Age group 26-30 had 25% (52) compared to age group 18-20 with 22% (47).

Table 5. Age distribution

Age	Frequency	Mean	Standard Deviation	Percentage (%)
18-20	47	52	10	22%
21-25	44	52	10	21%
26-30	52	52	10	25%
31-35	66	52	10	32%

The breakdown of respondents by age group indicate that the majority of youth between the age of 31 and 35 years old participated on online questionnaire and the lowest participation are the youth between the age of 21 and 25 years old. The youth above 25 years have participated more than the youth between 18 and 25 years.

4.2.1 Gender distribution

Table 6 shows the gender breakdown of responders. Males had 45% (95) more respondents than females, who had 43% (89).

Three respondents with 12% (25) decided not to disclose or rather not reveal their gender.

Table 6 Gender Distribution

Gender	Frequency	Percentage (%)
Female	89	43%
Male	95	45%
Rather not say	25	12%

The respondents indicate that the majority of youth that participated on online questionnaire, are males with 45% as compared to low female participants with 43% and lowest percentage of 12% of rathe not say.

4.2.2 Qualification level

Table 7 shows the breakdown of respondents by qualification. Respondents with a Diploma had the largest percentage (35%), followed by those with a Grade 10-12 education (23%, 49). Those with degrees were 21% (44), followed by those with Postgraduate degree were 17% (35) and the least were those with Grade 09 or less 3% (7).

Table 7 Qualification Level

Qualification Level	Frequency	Percentage (%)
Degree	44	21%
Diploma	74	35%
Grade 10-12	49	23%
Grade 9 or less	7	3%
Postgraduate degree	35	17%

4.2.3 Employment status

Most of the respondents were full-time employed which were 41% (85). The part time employed were 21% (43). Those that were unemployed were 39% (81). See Table 8 and Figure 8.

Table 8 Employment status

Employment status	Frequency	Percentage (%)
Fulltime employed	85	41%
Part time employed	43	21%
Unemployed	81	39%

4.3 Summary of the demographics

Based on the demographics presented from questionnaires collected, summary can be drawn which outlines characteristics of the youth that participated in this research data collection. The age distribution has mean participation of 52 with the smallest standard deviation of ten among the four demographics of employment, gender and qualification level. The participation age variability is significant, reflected by the standard deviation of ten, and this phenomenon of significant variability among the demographics is consistent through all demographic variables. The exercise of establishing standard deviation was to assess the variability of all demographic variables within the Gauteng Province in the data collected, where highest participation age is 31 to 35, those with diploma qualification level had higher participation of 35%, those with full employment had 41% participation percentage and in terms of gender, males had highest participation of 45%.

The researcher looked into demographics to outline the type of youth participation on the research and to assess whether this type of youth reflects that of Gauteng Province.

4.4 Constructs

4.4.1. Access to device with internet distribution

Table 9 and Figure 9 provide a breakdown of respondents who have internet connection on a device. With 99% (207), respondents who own a mobile phone with internet access had the most respondents. 1% (2) of respondents had internet access through a family member or friend.

Table 9 Access to device with internet distribution

Do you have accessibility to mobile phone with reliable internet connectivity?	**Frequency**	**Percentage (%)**
a) Yes, I own a mobile phone	207	99%
b) Yes, I have limited access through friends or family members	2	1%

The outcome is that over 95% youth respondents have internet connection on a device which means that the youth can use mobile application to participate on elections and

cast their vote online as they also have reliable internet connectivity. According to Okediran et al (2020:144) the mobile phones are in the forefront of ICTs for development, have been the most accepted and used medium of communication over the world with its infiltration and diffusion more than all other information and communication devices summed together.

4.4.2. Trust of Internet

The Trust of internet construct had three questions and were on a 5-point Likert scale as per the below table 10. The total consolidated responses for Trust of internet, the Agree scale being the highest with 419 responses, followed by 80 strongly agree responses. There are 72 neutral responses, 37 disagree responses and those who strongly disagree are 19.

Table 10 Trust of internet

Trust of Internet	Agree	Disagree	Neutral	Strongly Agree	Strongly disagree
I feel assured that the internet technology will adequately protect me from potential problems associated with online voting with mobile phone integrated with biometric authentication during elections.	166	13	24	29	6
In general, the internet and its connectivity are reliable and safe environment to use for online voting using mobile application for elections.	167	15	23	24	4
The internet has risk safety measure to make me feel comfortable to use mobile application for online voting during the elections.	166	9	25	27	9
	499	**37**	**72**	**80**	**19**

4.4.3. Trust of Government

The Trust of government construct had two questions and were on a 5-point Likert scale as per the below table 11. The total consolidated responses for Trust of government, the agree scale being the highest with 254 responses, followed by 70 neutral responses. There are 45 disagree responses, 41 strongly agree responses and those who strongly disagree are 8.

Table 11 Trust of Government

Trust of Government	Agree	Disagree	Neutral	Strongly Agree	Strongly disagree
I trust the Independent Electoral Commission (IEC) to manage online voting for elections freely and fairly.	156	18	31	23	4
I trust the national and local government to administer online voting for elections freely and fairly.	139	27	39	18	4
	295	**45**	**70**	**41**	**8**

4.4.4. Access to ICT

The Access to ICT construct had four questions and were on a 5-point Likert scale as per the below table 12. The total consolidated responses for Access to ICT, the Agree scale being the highest with 579 responses, followed by 114 strongly agree responses. There are 87 neutral responses, 48 disagree responses and those who strongly disagree are 8.

Table 12 Access to ICT

Access to ICT	Agree	Disagree	Neutral	Strongly Agree	Strongly disagree
I will take part in voting online if the mobile application and proper facilities are provided.	174	13	20	34	2

I have access to the digital technology (internet enabled mobile phone) necessary to take part in online voting	176	11	20	31	2
I have access to reliable internet to enable my participation in online voting.	173	12	22	25	2
Using mobile device to access online voting services would not be expensive to me.	170	12	25	24	2
	693	**48**	**87**	**114**	**8**

4.4.5. Skills in ICT

The skills in ICT construct had four questions and were on a 5-point Likert scale as per the below table 13. The total consolidated responses for Skills in ICT, the Agree scale being the highest with 565 responses, then followed by 118 strongly agree responses. There are 98 neutral responses, 46 disagree responses and those who strongly disagree are 9.

Table 13 Skills in ICT

Skills in ICT	**Agree**	**Disagree**	**Neutral**	**Strongly Agree**	**Strongly disagree**
I can easily use mobile device to process my vote using online mobile application for elections.	175	10	22	36	2
I have no problem using the Internet by myself to get to online voting for elections.	172	14	21	33	2
I do not need someone to explain how to use online voting to me.	172	10	24	28	3
My friends and family will come to me for advice concerning the use of mobile application integrated with biometric authentication for elections.	164	12	31	21	2
	683	**46**	**98**	**118**	**9**

4.4.6. Attitude towards ICT

The attitude towards ICT construct had three questions and were on a 5-point Likert scale as per the below table 14. The total consolidated responses for attitude towards ICT, the Agree scale being the highest with 405 responses, then followed by 117 strongly agree responses. There are 60 neutral responses, 33 disagree responses and those who strongly disagree are 12.

Table 14 Attitude towards ICT

Attitude towards ICT	Agree	Disagree	Neutral	Strongly Agree	Strongly disagree
I would like to use online voting for elections.	173	11	21	40	4
It is preference for me to use online voting for elections.	174	12	20	42	3
I am willing to learn how to use mobile application for elections.	175	10	19	35	5
	522	**33**	**60**	**117**	**12**

4.4.7. Perceived Utility of ICT

The Perceived utility of ICT construct had three questions and were on a 5-point Likert scale as per the below table 15. The total consolidated responses for perceived utility of ICT, the Agree scale being the highest with 431 responses, then followed by 100 strongly agree responses. There are 52 neutral responses, 32 disagree responses and those who strongly disagree are 12.

Table 15 Perceived Utility of ICT

Perceived Utility of ICT	Agree	Disagree	Neutral	Strongly Agree	Strongly disagree

Using mobile phone to vote online would enable me to process my voting more quickly.	175	10	19	35	5
The benefits of using online voting are clear to me.	176	11	18	26	4
Using mobile phone to vote online could cut travelling expenses and ques at voting stations.	180	11	15	39	3
	531	**32**	**52**	**100**	**12**

4.4.8. Intention to Use

The Intention to Use construct had four questions and were on a 5-point Likert scale as per the below table 16. The total consolidated responses for Intention to Use, the Agree scale being the highest with 538 responses, then followed by 160 strongly agree responses. There are 74 neutral responses, 52 disagree responses and those who strongly disagree are 12.

Table 16 Intention to Use

Intention to use	**Agree**	**Disagree**	**Neutral**	**Strongly Agree**	**Strongly disagree**
I would use online voting provided over the mobile application.	173	14	19	44	3
Voting online is something that I would do.	175	13	18	43	3
Using mobile application would make it easier to vote.	176	12	18	43	3
Using online voting on mobile device would give me greater control over voting.	174	13	19	30	3
	698	**52**	**74**	**160**	**12**

4.5. Mean and standard deviation per Construct

All seven constructs mean and standard deviation were calculated from the data collected as per the below figure 10. The mean was calculated from all questions under each construct and questions were on a 5-point Likert scale, where 1 was strongly disagree, 2 was disagree, 3 was neutral, 4 was agree and 5 was strongly agree. Trust of government construct being the lowest with the mean of 3.569 and the intention to use construct being the highest with the mean of 3.891. Trust of internet construct's mean is 3.775, skills in ICT construct's mean is 3.848, access to ICT construct's mean is 3.853, attitude towards ICT construct's mean is 3.861 and perceived utility of ICT construct's mean is 3.885.

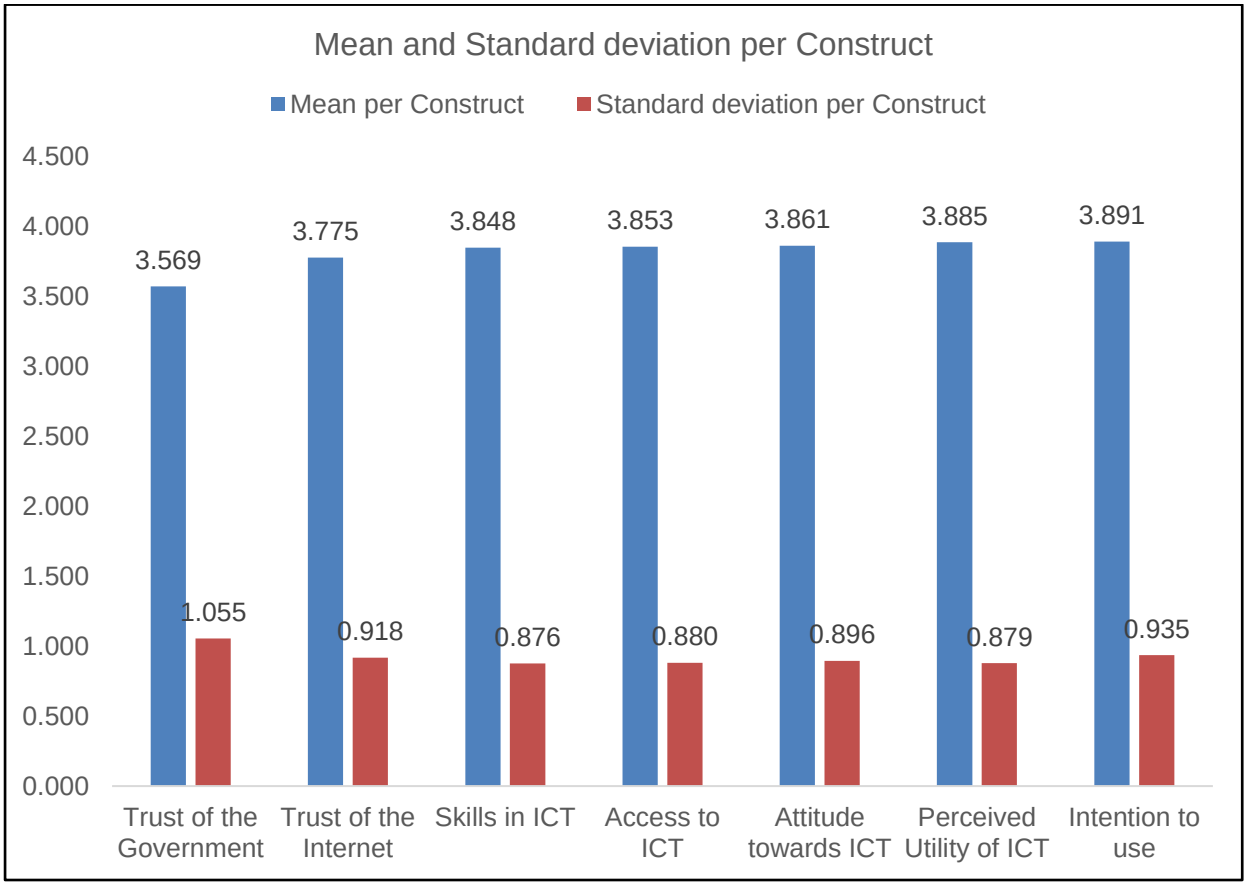

Figure 5 Mean and standard deviation per construct

Trust of government construct being the highest with the standard deviation of 1.005 and the perceived utility of ICT construct being the lowest with the standard deviation of 0.879. Trust of internet construct's standard deviation is 0.918, skills in ICT construct's standard deviation is 0.876, access to ICT construct's standard deviation is 0.880, attitude towards ICT construct's standard deviation is 0.896 and intention to use construct's standard deviation is 0.935.

5. Analysis of data and findings

The preceding sections 4.1 to 4.5 illustrated collected data in terms of demographics and constructs. Neuman (2014:393) posits that research report or article based on quantitative data has many charts, graphs and tables full of numbers as the aim is to present condensed picture. Condensed picture aims to grant the reader opportunity to clearly see data collected and be able to investigate it. Neuman further posit that to reveal meaning of data, the quantitative data be organised and manipulated to (1) reveal what is inside data, and (2) disclose things of interest about the physical world. However, in conducting research care must always be taken to guard against probable errors so that true inferences may be deduced according to Neuman (2014:427). Neuman further point out that there is always a probability of error in the phases of research- in the design, measurement, data collection, coding procedure, calculations, graphs and tables or in interpretation of results.

Neuman (2014:212) introduces measurement reliability as quantitative outcome do not vary because characteristics of the measurement instrument itself. Therefore, to assess reliability in this research will apply Cronbach's Alpha (α) as statistical measure. The anticipation is that this statistical measure must produce consistent results across all seven constructs for our data to be reliable.

5.1. Reliability Analysis

Neuman (2014:213) argues that to improve reliability four things must be done (a) develop unambiguous and clear constructs: this research is uses the following constructs- trust of the internet, trust of the government, access to ICT, skills in ICT, attitude towards ICT, perceived utility of ICT and intention to use. (b) Use a precise level of measurement- South African youth in Gauteng province between the ages of 18 – 35 through the NYDA. The level of measurement is refined, exact and precise to ensure improved reliability. (c) Use multiple indicators- each construct has at least two variables, i.e. - trust of the internet (**three** questions), trust of the government (**two**

questions), access to ICT (**four** questions), skills in ICT (**four** questions), attitude towards ICT (**three** questions), perceived utility of ICT (three questions) and intention to use (**four** questions), and (d) use pilot tests- the online questionnaire was tested before was finally accepted. The colleagues doing internship were asked to do the questionnaire after receiving the link through WhatsApp and email.

The study has attempted to answer the reliability of a response on a scale in questions that the respondents provided in the questionnaire and the validity in a scale question. The reliability measures the consistency of the responses and the validity measure the precision. The validity and precision of the Likert scale was measured using the Cronbach's Alpha and factor analysis.

5.2. Cronbach Alpha

This study used reliability analysis to examine the Cronbach Alpha, standard deviation, and mean. Cronbach Alpha is a statistical phenomenon that is used to measure the consistency and reliability of data collected for study purposes mostly in quantitative surveys. Cronbach Alpha values range between -1 and 1, with 1 being the most trustworthy and consistent. This study's constructs' reliability was rated using the following rule: >0.9 excellent; >0.8 good; >0.7 acceptable; >0.6 dubious; >0.5 poor; and 5 unacceptable (Gliem & Gliem, 2003).

All constructs in the study had Cronbach Alpha values greater than 0.75, which is considered acceptable; no construct had a Cronbach Alpha value less than 0.60, which is considered doubtful. Other research suggests that a Cronbach Alpha of greater than 0.60 can be employed when the number of qualities in a construct is three or less. There was also no Cronbach that was poor and unacceptable in this study.

Table 17 Cronbach Alpha

Constructs	No of Questions	Covariance of Constructs	Cronbach's Alpha (α)
Trust of the Internet	3	0,843	0,898
Trust of the Government	2	1,116	0,855
Access to ICT	4	0,768	0,956
Skills in ICT	4	0,802	0,952
Attitude towards ICT	3	0,775	0,951
Perceived Utility of ICT	3	0,764	0,975
Intention to use	4	0,875	0,976

5.3. Factor Analysis

In the preceding section, we presented Cronbach's Alpha calculation for this research. All seven Cronbach's Alphas are satisfactory and imply clearly that they met the terms of reliability criterion since they are within range of 0.8-0.9, According to (Gliem & Gliem, 2003), the following rule is used to grade the constructs' reliability: >0.9 great; >0.8 good. The second reliability method employed is factor analysis, and according to DeCoster (1998:1) factor analysis is a collection of methods used to examine how underlying constructs influence the responses on a number of measured constructs by investigating the pattern of correlations between these constructs. In other words, if the attributes of a construct are highly correlated the range will be between 1 and 0.5 either positive or negative with likelihood that constructs are influenced by the same factors.

Contrarily, if the range is less that range of 1 and 0.5 it means constructs are relatively uncorrelated with likelihood that they are influenced by different factors. (Wetzel & Tavakol, 2020) argue that factor analysis simplifies a matrix correlation so that the researcher can easily comprehend the relationship between constructs in a scale and the underlying factors that the constructs may have in common. (Wetzel & Tavakol,

2020) further argue that factor analysis is commonly applied and widely promoted procedure for developing and refining quantifiable assessment methods to produce evidence for the construct validity of the measure.

5.4. Correlation of matrix

This study employed correlations matrix tables to evaluate the degree of strength of a relationship between constructs. Most of the constructs demonstrate moderate to strong relationships among themselves.

5.4.1 Correlation of matrix- Trust of the internet

Table 18 Correlation of matrix- Trust of the internet

	I feel assured that the internet technology will adequately protect me from potential problems associated with online voting with mobile phone integrated with biometric authentication during elections.	In general, the internet and its connectivity are reliable and safe environment to use for online voting using mobile application for elections.	The internet has risk safety measure to make me feel comfortable to use mobile application for online voting during the elections.
I feel assured that the internet technology will adequately protect me from potential problems associated with online voting with mobile phone integrated with biometric authentication during elections.	1,00		
In general, the internet and its connectivity are reliable and safe environment to use for online voting using mobile application for elections.	0,85	1,00	
The internet has risk safety measure to make me feel comfortable to use mobile application for online voting during the elections.	0,80	0,87	1,00

5.4.2. Correlation of matrix- Trust of the Government

Table 19 Correlation of matrix- Trust of the Government

	I trust the Independent Electoral Commission (IEC) to manage online voting for elections freely and fairly.	I trust the national and local government to administer online voting for elections freely and fairly.
I trust the Independent Electoral Commission (IEC) to manage online voting for elections freely and fairly.	1,00	
I trust the national and local government to administer online voting for elections freely and fairly.	0,70	1,00

5.4.3. Correlation of matrix- Access to ICT

Table 20 Correlation of matrix- Access to ICT

	I will take part in voting online if the mobile application and proper facilities are provided.	I have access to the digital technology (internet enabled mobile phone) necessary to take part in online voting	I have access to reliable internet to enable my participation in online voting.	Using mobile device to access online voting services would not be expensive to me.
I will take part in voting online if the mobile application and proper facilities are provided.	1,00			
I have access to the digital technology (internet enabled mobile phone) necessary to take part in online voting	0,80	1,00		
I have access to reliable internet to enable my participation in online voting.	0,72	0,78	1,00	

Using mobile device to access online voting services would not be expensive to me.	0,84	0,76	0,73	1,00

5.4.4. Correlation of matrix- Skills in ICT

Table 21 Correlation of matrix- Skills in ICT

	I can easily use mobile device to process my vote using online mobile application for elections.	I have no problem using the Internet by myself to get to online voting for elections.	I do not need someone to explain how to use online voting to me.	My friends and family will come to me for advice concerning the use of mobile application integrated with biometric authentication for elections.
I can easily use mobile device to process my vote using online mobile application for elections.	1,00			
I have no problem using the Internet by myself to get to online voting for elections.	0,77	1,00		
I do not need someone to explain how to use online voting to me.	0,81		1,00	
My friends and family will come to me for advice concerning the use of mobile application integrated with biometric authentication for elections.	0,76	0,85	0,74	1,00

5.4.5. Correlation of matrix- Attitude towards ICT

Table 22 Correlation of matrix- Attitude towards ICT

	I would like to use online voting for elections.	It is preference for me to use online voting for elections.	I am willing to learn how to use mobile application for elections.
I would like to use online voting for elections.	1,00		
It is preference for me to use online voting for elections.	0,90	1,00	
I am willing to learn how to use mobile application for elections.	0,89	0,87	1,00

5.4.6. Correlation of matrix- Perceived Utility of ICT

Table 23 Correlation of matrix- Perceived Utility of ICT

	Using mobile phone to vote online would enable me to process my voting more quickly.	The benefits of using online voting are clear to me.	Using mobile phone to vote online could cut travelling expenses and ques at voting stations.
Using mobile phone to vote online would enable me to process my voting more quickly.	1,00		
The benefits of using online voting are clear to me.	0,75	1,00	
Using mobile phone to vote online could cut travelling expenses and ques at voting stations.	0,69	0,77	1,00

5.4.7. Correlation of matrix- Intention to use

Table 24 Correlation of matrix- Intention to use

	I would use online voting provided over the mobile application.	Voting online is something that I would do.	Using mobile application would make it easier to vote.	Using online voting on mobile device would give me greater control over voting.
I would use online voting provided over the mobile application.	1,00			
Voting online is something that I would do.	0,91	1,00		
Using mobile application would make it easier to vote.	0,80	0,95	1,00	
Using online voting on mobile device would give me greater control over voting.	0,76	0,86	0,69	1,00

5.5 Descriptive Analysis

In the quantitative research, according to Sauders et al (2016:527) researcher must use statistical methods to describe and compare variables numerically. The purpose of these methods according to Saunders is to describe variables through frequencies, central tendencies and dispersion. In this section, tabular presentation is provided where data is analysed by means of central tendency (i.e. mean, median and mode), frequencies and measures of dispersion (i.e. standard deviation, skewness and kurtosis).

Sauders et al (2016:529) defines measures of central tendency individually as *value that occurs most frequently (mode), middle value or mid-point after the data have been ranked (median) and then value, often known as the average, that includes all data values in its calculation (mean).* In addition, Saunders et al posit that a researcher must be able to describe how variables are dispersed around the measures of central

tendencies, most common of ways is where the extent to which variables differ from the central tendency (i.e. mean) is called standard deviation.

Values of standard deviation higher than the mean implies that the degree of variability is higher. The distances between points are high thus demonstrating inconsistencies whilst when numbers are closer to the mean means the data set has degree of consistency which is likely to produces positive results.

Table 25 Descriptive Analysis presenting the measures of centrality and dispersion in data collection.

Variable	Mean	Median	Mode	Frequency of Mode	Standard deviation	Skewness	Kurtosis
Trust of Internet- I feel assured that the internet technology will adequately protect me from potential problems associated with online voting with mobile phone integrated with biometric authentication during elections.	3,79	4,00	4,00	182,00	0,88	-1,53	2.72
Trust of Internet-In general, the internet and its connectivity are reliable and safe environment to use for online voting using mobile application for elections.	3,78	4,00	4,00	180,00	0,94	-1,58	2.98
Trust of Internet-The internet has risk safety measure to make me feel comfortable to use mobile application for online voting during the elections.	3,75	4,00	4,00	185,00	0,94	-1,70	2.88

Trust of Government- I trust the Independent Electoral Commission (IEC) to manage online voting for elections freely and fairly.	3,67	4,00	4,00	186,00	1,00	-1,49	1.97
Trust of Government- I trust the national and local government to administer online voting for elections freely and fairly.	3,47	4,00	4,00	191,00	1,11	-1,21	0.62
Access to ICT- I will take part in voting online if the mobile application and proper facilities are provided.	3,86	4,00	4,00	175,00	0,91	-1,76	3.69
Access to ICT- I have access to the digital technology (internet enabled mobile phone) necessary to take part in online voting	3,88	4,00	4,00	178,00	0,86	-1,84	4.45
Access to ICT- I have access to reliable internet to enable my participation in online voting.	3,82	4,00	4,00	184,00	0,87	-1,88	4.32
Access to ICT- Using mobile device to access online voting services would not be expensive to me.	3,80	4,00	4,00	185,00	0,87	-1,83	4.10
Skills in ICT- I can easily use mobile device to process my vote using online mobile application for elections.	3,90	4,00	4,00	173,00	0,86	-1,73	4.21
Skills in ICT- I have no problem using the Internet by myself to get to online voting for elections.	3,84	4,00	4,00	176,00	0,93	-1,73	3.39

Skills in ICT- I do not need someone to explain how to use online voting to me.	3,85	4,00	4,00	181,00	0,84	-1,77	4.21
Skills in ICT- My friends and family will come to me for advice concerning the use of mobile application integrated with biometric authentication for elections.	3,76	4,00	4,00	188,00	0,86	-1,76	3.79
Attitude towards ICT- I would like to use online voting for elections.	3,89	4,00	4,00	169,00	0,91	-1,62	3.32
Attitude towards ICT- It is preference for me to use online voting for elections.	3,90	4,00	4,00	167,00	0,93	-1,65	3.34
Attitude towards ICT- I am willing to learn how to use mobile application for elections.	3,89	4,00	4,00	174,00	0,88	-1,69	3.72
Perceived Utility of ICT- Using mobile phone to vote online would enable me to process my voting more quickly.	3,89	4,00	4,00	174,00	0,88	-1,69	3.72
Perceived Utility of ICT- The benefits of using online voting are clear to me.	3,84	4,00	4,00	183,00	0,86	-1,89	4.38
Perceived Utility of ICT- Using mobile phone to vote online could cut travelling expenses and ques at voting stations.	3,93	4,00	4,00	170,00	0,89	-1,82	4.23
Intention to use- I would use online voting provided over the mobile application.	3,89	4,00	4,00	165,00	0,97	-1,62	2.90

Intention to use-Voting online is something that I would do.	3,90	4,00	4,00	166,00	0,95	-1,67	3.24
Intention to use-Using mobile application would make it easier to vote.	3,92	4,00	4,00	166,00	0,93	-1,69	3.98
Intention to use-Using online voting on mobile device would give me greater control over voting.	3,85	4,00	4,00	178,00	0,89	-1,81	4.25

The table above indicate the collected data that was analysed by means of central tendency (i.e. mean, median and mode), frequencies and measures of dispersion (i.e. standard deviation, skewness and kurtosis). The values of standard deviation for each question per construct are not higher than the mean which implies that the degree of variability is accepted. The table demonstrates that the data set has the degree of consistency which is likely to produce positive results.

5.6. Data Analysis: Purposive analysis

The purposive sampling technique, also called judgment sampling, is the deliberate choice of a participant due to the qualities the participant possesses, and it is a non-random technique that does not need underlying theories or a set number of participants Etikan et al (2016: 2). The Gauteng youth have provided the information about a framework for mobile application integrated with biometric authentication by willingly answering the questionnaire to improve their participation in elections. The idea behind purposive sampling is to concentrate on people with characteristics who will better be able to assist with the relevant research Etikan et al (2016: 3).

The study has specifically targeted the youth (18-35 years) to assist the research that will improve their participation in elections. The questionnaire was distributed through National Youth Development Agency (NYDA) to 2 400 Gauteng youth which is the

study sample frame. 209 out of the 2 400 participants responded to the questionnaire and the data collected is used for analysis and to interpret the results.

The researcher must be able to examine relationship, differences and even establish patterns by asking question as observed by Sauders et al (2016:532-533) that how does a variable relate to one another?. The researcher answers the question using the purposive analysis to establish whether data collected will predictably follow the generally accepted theoritical frameworks.

5.7. Discussion: Factors with supported Propositions

The aim of this research was to explore or assess a framework for mobile application to improve the youth participation on elections. The research conceptual framework proposed all these factors. The study framework has seven constructs and seven propositions that were proposed. The propositions were supported by data collected results.

5.7.1 Discussion: Trust of Internet Construct

Eighty percent of the youth respondents have indicated that they trust the internet to use mobile applications for online voting during the elections. Eighty-three percent of the youth respondents have indicated that they have intention to use online voting provided over the mobile application. The high percentage of youth response indicated that it positively encourages the proposition (P1), thus high degree of trust in the Internet and its connectivity encourages the intention of young people to vote online using mobile phones. Trust issues can be handled by ensuring that the system in use has suitable security mechanisms that can generate audit reports and safeguard the system from any possible attack and manipulation (Avgerou, Masiero, & Poulymenakou, 2019). To assist to improve the trust of internet, the security systems like biometric authentication can be deployed on voting mobile application.

5.7.2 Discussion: Trust of government Construct

Seventy-one percent of youth respondents have indicated that they trust the government for mobile applications to cast their votes online. The proposition (P2) of trust of the government and its electoral institutions favorably promotes the intention of young people to vote online with mobile phones is important factor and respondents indicated that high level of trust will promote their participation.

Under section 4.5, page 70 of Presentation of data the mean of trust of government is 3.569 being the lowest from all other constructs. The mean was calculated from all questions under the trust of government construct and questions were on a 5-point Likert scale, where 1 was strongly disagree, 2 was disagree, 3 was neutral, 4 was agree and 5 was strongly agree. The youth respondents have indicated that they trust the government for mobile applications to participate on online voting, the mean being between neutral (3) and agree (4), it also suggest that the trust of government still need to be improved.

To help to improve the trust of government, the government and electoral institutions must be more transparent, promote and support the use of mobile applications for online voting.

The use and adoption of ICT in governance aim to provide better information and services to citizens while using fewer resources by optimizing available resources and infrastructure (Okediran et al., 2020). Okediran et al (2020:143) further posit that this could only be achieved through effective e-participation between the governed and the government.

5.7.3 Discussion: Access to ICT Construct

Eighty-three percent of the youth respondents have indicated that they have access to the digital technology (internet enabled mobile phone) necessary to take part in online voting. The proposition (P3) of Access to ICT improves the youth participation

on using mobile phones for online voting was supported and it improves the youth participation on online voting. Access to ICT is useful for youth to achieve the participation in online voting. Under section 4.4.1, page 64 and 65 of Presentation of data, 99% of youth respondents indicated that they have reliable mobile phones with internet distribution, which further support that youth have access to ICT.

5.7.4 Discussion: Skills to ICT Construct

Eighty-two percent of youth respondents have indicated that they have skills to use mobile applications to process online voting, know how to use internet and they don't need someone to explain how to use online voting. The proposition (P4) of youth skills in ICT will cause the improvement on youth general participation on using mobile phones for online voting and the youth responses have indicated that being skilled in ICT will improve their participation.

5.7.5 Discussion: Attitude towards ICT Construct

Eighty-three percent of youth respondents have indicated that they would like to use online voting for elections, it is preference to them and willing to learn how to use mobile application for elections. The proposition (P5) of Attitude towards ICT positively affects young people's decision to vote online using their smartphones was supported and youth are willing to vote online. Individual attitudes play a significant effect in ICT adoption, which will assist in increasing youth involvement or participation in elections. (Okediran et al., 2020).

5.7.6 Discussion: Perceived utility of ICT Construct

Eighty-five percent of youth respondents have indicated that using mobile phones to vote online would enable them to process their voting more quickly and the benefits of using online voting are clear to them. The integration of people and institutions into political processes is made easier and more convenient by the use of mobile devices in political engagement. (Okediran et al., 2020). The proposition (P6) of Youth's willingness to vote online with mobile phones is positively influenced by their perception of the usefulness of ICT was supported.

5.7.7 Discussion: Intention to use Construct

Eighty-four percent of youth respondents have indicated that voting online is something that they would do, and they would use online voting provided over the mobile application. Under section 4.5, page 70 of Presentation of data the mean of intention to use construct is the highest from all other constructs, the mean being close to 4. The youth respondents have indicated that they agree and have intention to use the mobile application to participate in online voting. The proposition (P7) of the intention of youth to use mobile phones for online voting as an important contributing factor to improve youth participation in elections was supported.

Chapter 6: Recommendations and Conclusions

This research paper aimed to investigate and assess the factors that influence the intention of youth to adopt a framework for Mobile Application integrated with Biometric Authentication to Improve youth participation in Elections. The research also aimed to assess how the Gauteng youth perceive the use of mobile application for online voting. The deductive approach was used with a conceptual framework, the constructs were adopted from the Technology Acceptance Model (TAM), and it was also extended with trust constructs. An online questionnaire on formplus platform was used to collect data from Gauteng youth (18-35 years); 209 participants had valid responses and the responses were analysed.

The study used the Cronbach Alpha to test the strength, reliability and correlation matrix to evaluate the degree of strength of a relationship between constructs.

The main objectives, research outcome as outlined under section 1.4 and 1.5 and seven factors were identified as factors that has effect or influence on the objectives and the outcome.

The factors determined the influence that trust in internet and the ability for the national government to adopt the online elections using framework for Mobile Application integrated with Biometric Authentication has on youth voters. The trust of internet based on the data collected is positive, however the online voting system must be reliable, safe and secure so that it is not easily manipulated or to avoid voting fraud. The trust of government even though is positive, the electoral institutions must be independent from government and be transparent to the voters about the online voting processes.

The factors determined the influence of ICT accessibility and skills on youth to participate in online elections using framework for Mobile Application integrated with Biometric Authentication. The research determined the influence that attitudes, perceptions as well as intention of the youth to participate in online elections using

framework for Mobile Application integrated with Biometric Authentication. Based on the data collected from access to ICT, skills in ICT and attitude towards ICT for this study, the perception of Gauteng youth on using mobile application integrated with biometric authentication for online voting is positive. These factors have positively influenced the perceptions of youth voters in Gauteng. The perceived utility on using mobile application for online voting has positive effect on the youth's intention to use the mobile application for online voting.

On attitude towards ICT, 83% of youth participants indicated that if mobile application for online voting become available, they prefer to use it and they do not have a problem using it. Eighty- four percent of youth participants indicated that they are also willing to learn how to use mobile application for online voting.

The research question of would there be a significant positive change in youth Participation in Electoral matters if the Framework for Mobile Application integrated with biometric authentication in South Africa is introduced versus the current Framework of traditional voting, the responses from the youth participants support this question and therefore a framework for mobile application for online voting can improve the youth participation in elections.

6.1 Research contribution

This study is providing a new data and significant contribution to the information regarding adoption of mobile application for online voting as means of positively influencing the youth participation in election and youth non-participation in election. The research contributes towards the comparative research on youth participation in elections considering the digital technology era. In addition, the research utilized Conceptual research Model framework based on the Technology Acceptance Model (TAM) framework as a backbone of the research that can be used in adoption of mobile application for online voting and e-voting research.

6.2 Research limitations

The study initially was to collect data from a big sample size and get better high responsive rate, the online questionnaire to be send to different online platforms. This could not happen due to time constraint and load shedding in South Africa.

The research was limited as the online questionnaire could only be collected in Gauteng province context. The research was limited only to Gauteng province which means it was not spread across all South African provinces and the results is difficult to generalize for the South African context.

6.3 Future research

The research is only focused on youth category (18–35-year-olds), it can be extended to all other age groups eligible to vote in South African with access to mobile phones and internet. The participation of all age groups would capture all the views from South African age groups and improve overall research results. The qualitative data can also be collected to ensure that different realities are explored through interviews, the political parties can also be interviewed and the interest groups that hold different views about the adoption of mobile application for online voting.

The future research can also include the implementation of mobile application for online voting system and ensure that the mobile application has improved biometric authentication and features that can strengthen the security, enable the online voting by being user friendly and trusted. This will enable that the online system to be able to improve the overall voters participation.

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