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Utilisation of smartphone apps for business by Grade 1-4 emerging construction contractors

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BUQS7027A Research Report

Utilisation of Smartphone Apps for Business by Grade 1-4 Emerging Construction Contractors



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A research report submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Building.

July 2021

Declaration

I declare that this Research Report (course code BUQS 7027A) is my own, unaided work. It is submitted in partial fulfilment of the degree of Master of Science in Building (MSc) in the field of Project Management in Construction at the University of the Witwatersrand, Johannesburg.

It has not been submitted before for any degree or examination in any other university.

Signature of Candidate:



Date: 25 July 2021

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Abstract

Smartphone apps have brought about a paradigm shift to modern society; a fundamental change from adopting traditional mainstream technologies to utilizing apps for business rather than relying on desktop computers, laptops, tablets, and other devices.

The purpose of this research report is to explore the apps utilized by contracting businesses in South Africa. The main objective of the research report is firstly, to identify the various popular apps available for business usage. Secondly, assess the extent of use and how widespread particular apps are utilized and for what purpose. Lastly, assess the adoption trend of apps for business operations amongst emerging contractors and understand the adoption trend.

The empirical research collects data from telephone interviews with 89 contractors in Gauteng with CIDB Grading of 1-4 GB, randomly selected from the Central Supply Database of Government (CSD). The qualitative data was transcribed and analyzed through a thematic narrative approach; quantitative data was analyzed using a Pearson's product moment correlation coefficient assessing the strength of relationships between pairs of variables.

The research report argues that there is a trend towards adopting apps by contractors in the business environment and the respondents similarly reported a substantial shift from utilizing the desktop computers, and laptops to using smartphone devices for business. Key findings reveal that utilization of apps is correlated to educational background, financial capability, and CIDB grading. Other factors impacting adoption include the age of respondents, the company profile, the company's years of existence, and the number of employees in the company.

Further findings show that firms with higher CIDB grading and better financial resources still prefer, and rely on, desktop computers and laptops and less on smartphone devices. In contrast, respondents with limited financial resources fully embraced the trend and utilize apps for business purposes. Notably, specialist construction apps are not utilized by the respondents for business; instead, reliance is on generic chat and instant messaging apps for communication compared to traditional voice messages and email. Findings reveal that the utilisation of WhatsApp outweighs the decreasing traditional voice calls and SMS. Recommendation for further quantitative research to be conducted to measure the extent of the perceived improvement to the firm profitability and performance utilizing apps for business.

Keywords: apps, business, contractor, construction, communication

Dedication

I dedicate this research report to God Almighty for having granted me the spirit of wisdom to guide me through completing the research paper. In memory of both my parents who have now passed on my father Sipho William Phailane 1946 – 2012 and my mother Ntsekiseng Thalitha Phailane 1960 – 2009; your soul lives on and you are always with me. Thank you for your teaching and sacrifice.

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Throughout the study my wife, Kamogelo, has been the pillar of my strength, supportive and loving; thank you for listening and encouraging me to overcome. My two amazing children, Sakhumuzi and Zenande who have inspired me to reach for greater heights; this one is for you.

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List of Acronyms

App	downloaded mobile software Application
BIM	Building Information Modelling
BMS	Building Management System
CE	Civil Engineering
CIDB	Construction Industry Development Board
CSD	Central Supplier Database (government)
EB	Electrical Engineering Works – Building
EP	Electrical Engineering Works – Infrastructure
GB	General Building Works
Gmail	Google Mail
GPS	Global Positioning Satellite System
ICT	Information and Communications Technology
iOS.	iPhone Operating System (Apple)
LTE	Long Term Evolution
LOSC	Labour-Only Sub-Contractors
MCC	Mobile Cloud Computing
ME	Mechanical Engineering Works
NBR	National Building Regulation
NQF	National Qualifications Framework
OECD	Organisation for Economic Co-operation and Development
PC	Personal Computer
PMCC	Pearson's product moment correlation coefficient
SA	South Africa
SANS	South African National Standard
SME	Small and Medium Enterprises
SMS	Short Message Service (mobile phone text messaging)
SW	Specialist Works
VoIP	Voice over Internet Protocol
WEB	World Wide Web (internet)
Wi-Fi	Wireless Fidelity
3G	Third-Generation Cell-Phone Technology

1. Introduction

1.1 Background to the Study

This research report examines the trends in the utilization and adoption of smartphone 'apps' (downloaded software applications) for business purposes amongst emerging contractors with a Construction Industry Development Board (CIDB) contractor grading 1 to 4 in South Africa (SA). These are the small firms; micro-enterprises, which are able to engage in business with the government on the basis of turnover and technical capacity.

With the advent of the fourth industrial revolution, there is a phenomenon where a shift occurs in society from adopting Information Communication Technologies (ICT) to Smartphone apps for managing business operations (Ehrenhard, Wijnhove, Van den Broek, & Stagno, 2016; Mbuyisa & Leonard, 2015; Liu, Mbachu, Mathrani, Jones, & McDonald, 2017; QWERTY, 2017). Ibrahim, Ros, Sulaiman, Nordin and Yuan (2014) argue that apps grow business revenue and are more effective than desktop to engage viewers on mobile websites, apps help business product expansion worldwide. Angelova (2019) notes that apps for business increase visibility of business to customers and creates a direct marketing channel, increase customers' awareness of the business brand and improves customer engagement. Ehrenhard et al. (2016) reaffirm that apps for business increase efficiency supports knowledge sharing and improves competitiveness.

The SA economy recorded a third consecutive quarter of economic decline falling by 2.0% in June 2020 with the SA Construction Industry registering a 7th consecutive quarter of economic decline slipping by 4.7% (STATSSA, 2020). The construction sector is suffering from poor output due to decreased activity relating to construction works in residential and non-residential buildings. Abrahams and Lotriet (2011) have argued that improved performance for the SA construction sector can be achieved through the adoption of innovative technological solutions. These ICT technologies can improve communication, resource coordination and hence improve the company's performance. ICT technologies are also increasingly used for coordination, collaboration, costs scheduling and to improve the quality of construction works (Sargent, Hyland, & Sawang, 2012; Hosseini, Chileshe, Zuo, & Baroudi, 2012).

ICT technologies adoption has also not been adopted by small emerging contractors due to the historic costs associated with them in terms of computing devices, software costs and

connectivity issues. More recently exponential smartphone device penetration in SA has caused apps to emerge as an alternative to traditional ICT technologies. Thus, understanding how ICT adoption may be affected by the adoption of apps is worthy of investigation.

The apps adoption trend amongst small emerging contractors for business purposes has major concerns and problems; emerging contractors with limited financial resources and no formal education are compelled to use generic apps for business as a means to an end. It is suspected that the lack of education is problematic because the use of sector-specific apps is not well understood by small emerging contractors. Some of the emerging contractors are adopting the trend and therefore improve their firm's performance whilst other firms are not benefiting from the trend because they have limited education to understand the use of sector-specific apps. It is suspected that the adoption trend is not widespread enough with some emerging contractors who do not understand the trend are not gaining all the competitive advantages associated with the adoption of apps whilst others are gaining all the benefits.

It is important for the research report to investigate and understand the decisions of small emerging contractors to adopt apps for their businesses. How apps are adopted can help organizations and software developers understand how small emerging contractors make decisions, how demographics are changing, where attention is directed, and how to meet the emerging contractors where they are. To have a better understanding and make offerings and programs that are relevant to them.

SA is at the forefront in the continent in terms of adoption of general apps for personal usage (QWERTY, 2017). However, it is suspected that the lack of education in the construction industry is a serious problem because the understanding of the use of apps, both generic and sector-specific for business purposes is not well understood by small emerging contractors in SA and they are therefore not advancing their firms performance. There is a serious problem that persists amongst the small emerging contractors as the majority use ordinary apps which are used by others in society to support the business. It has been argued that some emerging contractors are not aware of fourth industrial revolution construction concepts and are not utilizing apps for business operations intended specifically for the management of construction industry firms (Osunsanmi, Aigbavboa & Oke, 2018; Amusan, Oloniju, Akoomolafe, Makinde, Nkolika-Peter, Farayola, & Osawaru, 2018).

Emerging contractors are, by definition, owned, managed and controlled by previously disadvantaged persons (CIDB, 2017). In SA emerging contractors, specifically at the lower

grades, have limited financial capabilities and the firms are mostly managed by owners who lack formal education and training (Thwala & Phaladi, 2009; Thwala & Mvubu 2008; Waziri, Ali, Aliagha, 2014). These owners have been reported as being reluctant and slow adopters of ICT technologies (Sargent et al., 2012; Hosseini et al., 2012); therefore, their firms may lack competitive advantage in performance compared to more established firms. However, due to their lack of financial capability and formal education, they may tend to prefer an alternative and cheaper ICT technologies that do not require specialist training. One of the characteristics of apps is that they are designed to be easy to use and adopt, they are inexpensive to download and install into a smartphone device and often supplied free. Apps are accessed remotely and the emerging contractor can use the apps for a variety of construction-related activities; such as schedule activities onsite, monitor and manage construction works.

1.2 Substantiation of the Problem

ICT has become more prevalent in the 21st century, there is a phenomenon where a shift from ICT technologies to apps is occurring (Ribiero, 2012). There is an explosion in the society of adopting apps as compared to using ICT technologies such as using desktop computers and laptops for business (Angelova, 2019; Phokeer, Densmore, Johnson, & Feamster, 2016; Osunsanmi, Aigbavboa & Oke, 2018). Ibrahim et al., (2014) notes that there is a growth of business revenue due to the use of mobile apps. Ehrenhard et al. (2016) inform that the business benefit from improved brand reputation.

A smartphone is defined by ICASA as a “mobile phone with advanced features: it has Wi-Fi connectivity, web browsing capabilities, a high-resolution touchscreen display and the ability to use apps. Uses mobile operating systems such as Android, Symbian, IOS, BlackBerry OS and Windows Mobile” (ICASA, 2019: 25). Ebrahim, Ezzadeen & Alhazmi (2015: 71) citing Lenhart, Purcell, Smith and Zickuhr (2010) defines mobile apps as “software applications that are made for mobile phone operating systems that increase the capabilities of the cell phone by allowing users to do specific tasks”. Nagappan and Shihab, (2016) further define an app as an application developed for mobile devices, smartphones.

Apulu (2011) describes ICT as various computer technologies, enabling communication, electronic storage of data, process and transmit data. Technologies are electronic machines including computers, mobile devices, intranet and software. In this research report, ICT refers to computer technologies, apps and electronic communication devices. Apps have become increasingly relevant; Ribiero (2012) notes that mobile devices are more present, traditional

phone calls and text messaging are overshadowed by GPS, google maps, video and audio recording. The built-in features make mobile devices such as smartphones and tablets desirable and popular resulting in their adoption globally. Mbuyisa & Leonard (2015) indicate that during 2001 and 2007 in SA per capita cellular subscription increased by 364%; small and medium-size contractors (SME) use mobile technologies as compared to fixed telephone lines which are in decline. Smartphone device penetration in SA for the year 2018 has increased two-fold at 81.72% compared to that for the year 2016 (ICASA, 2019). Whereas the total number of Telkom fixed connections have declined from 2,267,000 in March 2019 to 1,602,000 in March 2020; declining by 29% in fixed-access line customer base due to competition from mobile services (Mybroadband, 2020)

There is a shift in society towards the widespread adoption trend of apps for business amongst contractors (Angelova, 2019; Ehrenhard et al. 2016; Ibrahim et al., 2014). Mbuyisa & Leonard (2015) reports on a study conducted by Ismail, Jeffrey, & Belle, (2011) that Small and Medium Enterprises (SMEs) in SA invest in ICT technologies such as the internet, bulk SMS, VoIP, websites and intranets. Mbuyisa & Leonard (2015) reveal that ICT adoption trends in SA indicate that smartphone devices have overtaken desktop computers as tools in supporting SMEs business as apps are widely accessible and adopted. Given that this was recognised in 2007, it is inevitable that this phenomenon has only become more prevalent.

1. 3 Problem Statement

Extensive research has been conducted in first world countries on the positive benefits associated with the adoption of apps to enhance business performance. However, there are gaps and limited research conducted in developing countries, such as SA, on the different apps used for business amongst emerging contractors. SA has not particularly been left behind by the rest of the world in terms of adopting general apps for personal usage; SA a developing country may be in the forefront leading the pack. However, it is suspected that the lack of education in the construction industry is a serious problem because small emerging contractors use generic apps for business. This is problematic because the use of sector-specific apps is not well understood by small emerging contractors. Some are adopting the trend and others do not understand the use of sector-specific apps relying on generic apps used by ordinary SA. Limited formal education causes a serious problem to persist amongst the emerging contractors as the majority do not understand the fourth industrial revolution construction concepts and are not utilizing apps for business operations intended specifically for the management of

construction industry firms. The unique characteristics of emerging contractors in SA in terms of financial capabilities and lack of educational qualifications is a serious problem as it contributes to the misunderstanding and low adoption of sector-specific apps for business.

1. 4 Primary Research Question

How are small emerging contractors in SA using apps to improve their business performance?

1. 5 Secondary Research Questions

Arising from how the adoption of apps for business operations improves performance amongst emerging contractors are a list of specific research questions unpacking the primary research question:

- What are the trends around ICT devices for emerging contractors?
- What is driving the apps adoption trend for emerging contractors?
- Is there reliance on specialist or generic apps by emerging contractors?

1. 6 Research Aim

The research report aims to explore the use of apps uses by small emerging contractors in SA to improve their business performance.

1. 7 Research Objective

The primary research objectives linked to empirical questions on how apps are utilized for business are listed below

- Identify various popular apps available for business usage
- Assess the extent of use and how widespread particular apps are utilized and for what purpose
- Assess the adoption trend of apps for business operations amongst emerging contractors in SA and understand the adoption trend.

The primary research objective to be achieved in the report relating to the literature review on apps adoption trend are listed below.

- Understand the context of emerging contractor in SA in terms of classification and categorization.
- Explore preferred ICT devices for personal and business usage among ordinary SA.

- Explore SA construction professionals concerning the fourth industrial revolution construction concepts.
- Establish and understand the trend towards App-based computing devices for SMEs
- Understand the nature of shift towards App-based devices globally and in SA.
- Explore instances of used apps and mobile devices in the construction industry.

1. 8 Research Proposition

The research report is exploratory focusing on clarifying the understanding on the decisions of small emerging contractors to adopt apps for business. The research report uses a proposition instead of hypothesis because of the difficulty and complexity to conduct a valid experimental test in assessing the adoption trend of apps for business. The proposition is selected in the research report because it proposes a correlation between variables in the use of apps for business and the association may not be verified by an experimental test. The research report is exploratory thus the proposition is used to suggest further research to be undertaken on the research problem so the evidence and experimental method are discovered to make a testable hypothesis.

The first research proposition is that *"small emerging contractors with limited financial resources are not adopting ICT technologies to support business"*.

The second research proposition is that *"small emerging contractors with limited formal education and lacking financial resources are adopting apps to manage the business in place of ICT technologies"*.

1. 9 Limitations

The research report does not measure the performance, productivity, efficiency and quality which is attained from the adoption trend and utilization of apps. The research report uses a mixed methodology both qualitative and quantitative approach to analyse the data. Firstly, qualitative data is analyzed through thematic narrative approach investigating how the widespread adoption trend of apps amongst emerging contractor is utilized to support business operations. Secondly, quantitative data is analyzed using the correlation coefficient to assess the strength of relationships between pairs of variables. The research report only investigates emerging contractors who are based in Gauteng province; Gauteng province has the highest number of formal and informal business sector SMEs in SA. The research report does not

investigate how apps are developed by software developers, but only limited to identifying various apps available to support business operations.

1. 10 Assumptions

The research assumption in this report based on theory is that emerging contractors have limited financial capabilities. The report believes to be true that the majority of emerging contractors in SA have no construction-related educational qualifications, lack training, they are unskilled and are reluctant slow adopters of ICT technologies. It is believed that the majority of emerging contractors in SA are unilaterally owner-managed small business and lack formal business premises and equipment.

The common-sense assumption in the research report is that apps are easily accessible and mostly used by ordinary SA compared to using desktop computers, laptops, tablets and other devices. The research report believes to be true that majority of SA own smartphone devices such as iOS, Android, tablets, Apple Windows and they use the devices for personal and business usage.

The research report further believes to be true that emerging contractors use ICT technologies and devices to manage their business operations. Emerging contractors are registered on the Central Supplier Database (CSD) and the CIDB register of contractors.

1. 11 Structure of Research

The research is structured as follows:

Chapter 1: Introduces the background of the study, identifies the problem, research questions, research proposition, research aim and objectives concerning apps adoption trend amongst emerging contractors in SA.

Chapter 2: The literature review covers the context of emerging contractor in SA, exploring the use of apps amongst construction professionals concerning the fourth industrial revolution construction concepts globally and in SA.

Chapter 3: Presents the research design and the argument for its suitability to answer the research questions.

Chapter 4: Presents the research findings on both qualitative and quantitative data analysis captured from the respondents establishing how apps are utilized by emerging contractors. Presents the discussion of the data draws findings to answer research questions.

Chapter 5: Presents the conclusions that can be drawn from the findings linking the research objectives and research questions to the findings of the study, and makes recommendations for future research.

2. Literature Review

2. 1 Introduction to the Literature Review

A critical literature review provides the context and theoretical framework for the research establishing the importance of the research report. Relevant literature enhances subject knowledge and clarifies research question. The literature review shows what is known and what is not yet known about the research topic and provides reasons for the choice of the research topic as there may be gaps within the body of knowledge. The subsequent sections report on the findings of prior research, discussing theories of related prior research and how they inform the choice or research topic and methodology which has been adopted in this research report.

The approach to theory development is deduction, deductive reasoning is a logical process in which a conclusion is based on the concordance of multiple premises that are generally assumed to be true (Saunders, Lewis, & Thornhill, 2016). The deductive approach is used in the research because the objective is to confirm the existing theory and not to establish a new theory.

2. 2 Methodology of Literature Review

The research report adopts the systematic review methodology to critically review the literature; Saunders et al. (2016) define the term as a review which uses a pre-planned strategy to analyse existing research which is aligned to the research questions to allow for conclusions to be made about what is known. The structure of the literature review is based on the funnel; starting at the broad general topic then narrow down to specific research questions and objectives. To establish what is known and not yet know about the apps adoption trend for business amongst emerging contractors.

The critical literature review focuses on the research questions and objectives and relates these to prior related research. How are small emerging contractors in SA using apps to improve their business performance? The subtopics and themes have been outlined in a logical order from the broad theme to the specific focus of the current research. The subtopics which form part of relevant literature review enhance the subject knowledge and clarify the research question; starting at the general level and narrowing to research questions and objectives. The subtopics and themes are emerging contractor phenomenon in SA, ICT and smartphone devices utilisation trend in SA; ICT in the construction industry in SA; apps in the construction

industry; apps usage in SA and concluding the chapter with key findings of the literature review.

2. 3 Emerging Contractor Phenomenon in South Africa

This research report seeks to understand the decisions of small emerging contractors in the SA construction industry to adopt apps for their businesses. It is logical and important for the first subtopic to discuss the context in which the small emerging contractors operate and how they are categorised and classified in the construction industry. It is also relevant to review the literature on factors influencing their decision to adopt apps for business. The first subtopic is important as it contextualizes what is known and not yet know about emerging contractors as this relates to the research question and objectives of this research report. The literature on the emerging contractor phenomenon in SA will be discussed in this section; literature will be reviewed on the classification and categorization of the contractors. The literature on emerging contractors will enhance the broader general knowledge of what is known about the topic. Furthermore, the literature will inform this research report on the approach and methodology to be adopted and also clarify the research questions in the report.

An emerging enterprise (SMEs, contractor) is defined by the CIDB Act of 2000 as an "enterprise which is owned, managed and controlled by previously disadvantaged persons and which is overcoming business impediments arising from the legacy of apartheid" (CIDB, 2016: 12). A "small enterprise" is defined by National Small Business Act (1996: 1) as a separate and distinct business entity, including cooperative enterprises and non-governmental organisations. SMMEs are managed by one owner or more; these SMMEs are classified and categorised as a micro-enterprise, a very small, a small or a medium enterprise by satisfying the criteria used in the construction industry. The criteria used to categorise the enterprise is based on the number of employees, annual turnover and value of assets.

Table 1: Classification of construction SMMEs

Sector or sub-sector in accordance with the Standard Industrial Classification	Size or Class *less than:*	Total full-time equivalent of paid employees *less than:*	Total annual turnover *less than:*	Total gross asset value (fixed property excluded) *less than:*
Construction	Medium	200	R 20.00 m	R 4.00 m
	Small	50	R 5.00 m	R 1.00 m
	Very small	20	R 2.00 m	R 0.40 m
	Micro	5	R 0.15 m	R 0.10 m

Source: Republic of SA government gazette number 102 of 1996: National Small Business Act (1996: 2).

National Small Business Act (1996) separates enterprises according to categories: survivalist firms, micro-enterprises, small firms, medium firms and large firms. The categories are informed by the operational structure and how the firms are constituted. Emerging contractors are classified and fall under the group micro-enterprises and very small firms (CIDB, 2017). These are firms with a total annual turnover of less than R2 million and the number of paid employees are not more than 20 workers. The emerging contractors are generally very small with a gross asset value of R 400 000; these firms as illustrated in table 2 below are categorised as having limited capital bases lacking formal business premises, non-tax compliant and mostly operating without permits (CIDB, 2017).

Table 2: Categories of construction firms and characteristics

Categories
1. Survivalist firms a) Predominantly informal b) Generate lower than minimum incomes c) Little capital investment d) Little skills and training e) Limited opportunities for growth f) Transient or labour-only sub-contractors (LOSCs)
2. Micro-enterprises a) Owner-managed small businesses b) Few employees/family members c) Operate on the fringe of formality d) Lack: tax (VAT) registration, formal business premises or operating permits e) Lack of formal accounting procedures f) Have limited capital bases g) Have basic technical or business skills h) Can make the transition to viable formal small businesses
3. Small firms a) Usually owner-managed b) Employ between 5 and 50 people c) Operate from formal business premises d) Meet formal registration requirements
4. Medium firms a) Usually owner-managed b) Employ up to 200 people c) Have capital assets of up to R5 million
5. Large firms a) Employ 200 or more people b) Have capital assets of over R5 million c) Have activities outside of South Africa

Source: Republic of SA government gazette number 102 of 1996: National Small Business Act (1996).

CIDB contractor grading designation is determined by the firm's financial capability and the capabilities of the work. Financial capabilities rely on the firm's historic annual turnover and available working capital to finance a works contract. The works capability relates to the largest contract completed within 5 years in the class of construction works. The contractor grading is used by government entities to qualify a bidder in the procurement of construction works (CIDB, 2016). The emerging contractors are firms with a total annual turnover of less than R2 million, less than 20 employees and available working capital less than R400 000 (CIDB, 2017). Based on the CIDB classification and categorisation firms with a total annual turnover of less than R2 million, the literature informs that these firms are considered to be emerging contractors. Table 3 below illustrates the CIDB contractor grading designation, the firms with a total annual turnover of less than R2 million are classified with a designation grading of 1 to 4 (CIDB, 2016). The classification and CIDB grading designation for emerging contractors are important for this research report as it informs the research methodology on the target population to be sampled in the report. The literature clarifies the broader general topic relating to the classification of emerging contractors within the SA construction industry.

Table 3: CIDB contractor grading designation determining financial capabilities

Designation Grading	Upper limit of tender value range	Best annual turnover	Largest contract	Available capital
1	R200 000	-	-	-
2	R650 000	-	R130 000	-
3	R2 000 000	R1 000 000	R450 000	R100 000
4	R4 000 000	R2 000 000	R900 000	R200 000
5	R6 500 000	R3 250 000	R1 500 000	R650 000
6	R13 000 000	R6 500 000	R3 000 000	R1 300 000
7	R40 000 000	R20 000 000	R9 000 000	R4 000 000
8	R130 000 000	R65 000 000	R30 000 000	R13 000 000
9	No limit	R200 000 000	R90 000 000	R40 000 000

Source: (CIDB, 2016).

A research report by CIDB (2017) examines factors influencing CIDB grade 1-4 emerging contractors to register as contractors and establish whether they are legitimate contractors. The research uses a comprehensive review of the literature to understand the profile of contractors; the research approach uses qualitative interviews. The research findings have shown that emerging contractors with CIDB grade 1-4 register on CIDB database with the hope and

likelihood of good financial returns, the need to earn an income due to unemployment and need to empower the community. However, the reality on the ground is that emerging contractors are challenged by financial issues, sourcing funding for works, steady reliable work, frequent cash flow and being paid for work done by government entities. Aigbavboa and Thwala (2014) citing CIDB (2010) notes that 95% of all registered contractors on CIDB register are micro-enterprises and SMEs falling within CIDB grading 1 to 4.

Extensive research studies have been conducted by the researchers Thwala and Phaladi (2009), Thwala and Mvubu (2008), Waziri et al. (2014) and Thwala & Mofokeng (2012) on the plight of emerging contractors in SA. The research finding mostly reveal that emerging contractors in North West Province, Free State, Johannesburg and Swaziland do not have financial capabilities, construction companies are unilaterally managed by incompetent organizational leadership who are unskilled and not trained adequately. The reality of emerging contractors is that they are struggling to find work in the competitive construction industry. Mofokeng and Thwala (2013) findings on research conducted in Free State on emerging contractors reveal that financial factors are leading cause to company failures. Educational qualifications and experience in the construction industry contribute to the failure or success of the firms. Similarly, in a research conducted in Johannesburg by Ake, Aigbavboa and Thwala (2015) reaffirm and agree with Mofokeng & Thwala (2013) that the causes of failure are attributed to managerial skills, financial management, general administration of the business, skills shortage, loss of trained employees, state of the economy, legislation compliance, resource scarcity, crime and corruption and rapidly changing technology.

The findings of this section reveal what is known and not yet known about emerging contractors in the SA construction industry. Literature reveals that construction contractors in SA are categorized and classified according to the CIDB contractor grading designation. Emerging contractors that fall under the category of micro-enterprises are classified under CIDB contractor grading designation of 1 to 4. It has been widely reported by research on the difficulty and challenges emerging contractors are faced with; the biggest of these challenges faced by emerging contractors are lack of financial capabilities and educational qualifications. Concerning this research report, the preceding section is important as it clarifies the research question and objectives. Furthermore, it paints a picture of the circumstances that emerging contractors operate in the management of their businesses in SA. It is of importance for the research report to note the challenges of emerging contractors as it provides and understanding

on the decisions to adopt the apps for business. Furthermore, the challenges identified in literature provides a better understanding of the research problem.

The subsequent section focuses on subtopic theme on ICT and smartphone devices utilization in SA. The subtopic is important as it relates to the research question and clarifies what is known or not yet known concerning ICT devices utilization in the context that emerging contractors operate in SA.

2. 4 ICT and Smartphone Device Utilisation Trend in South Africa

The topic on device utilisation in SA is important as it contextualizes this research and shows the links with the research questions and objectives to previous related research. The research relates to the utilization of apps for business amongst emerging contractors. The literature on device utilization trend is important to put into context the research questions and objectives as it seeks to understand how far existing published research goes in answering the research questions and what is known and not yet known about the topic.

Alkhalaileh, Calheiros, Nguyen, and Javadi (2019) report that the improved smartphone device speed is enhanced by mobile cloud computing (MCC) which integrates mobile computing and cloud computing; offering computation, storage services and enhancing mobile devices computing capabilities through cloud-based resources. Yao (2019) informs that mobile cloud computing is popularly adopted due to the rapid growth of mobile services and affordability; information can be managed, shared and stored on remote servers hosted on internet rather than on a desktop computer. Computation offloading optimises smartphone devices by moving from a mobile device to cloud resource-intensive computations via wireless communication (Alkhalaileh et al., 2019).

Angelova (2019) informs that mobile communications are divided into various generations: 1G, 2G, 3G, 4G, and 5G. 1G uses the analogue voice-only connection, 2G started in 1991 allowed for use of high-speed mobile internet. 3G started in 2002 provided higher internet speeds enabling video chat, radio and TV reception. 4G allowed for voice transmission over the internet through VOIP protocol. New standard 5G will provide gigabit speeds exceeding existing speeds.

Hung-Joubert and Van Huyssteen (2017) explores and reports on the preferred devices for online shopping in SA. A mixed methodology qualitative and quantitative approach was used by the authors to measure the preferred devices used by SA and the reasons why they opt for

those devices. The devices used by consumers to make online purchases are desktop computers, laptops, tablets and smartphones. The research reveals that amongst these devices the desktop computers are mostly preferred for searching (53%), browsing (58.1%) and buying (71.0%). The laptop was the second most preferred device amongst respondents; searching (48.0%), browsing (48.2%) and buying (59%). Thirdly most preferred device according to the authors is a smartphone; searching (30.6%), browsing (31.0%). The smartphone is the least preferred device for purchases (28.8%) due to the security concerns raised by respondents.

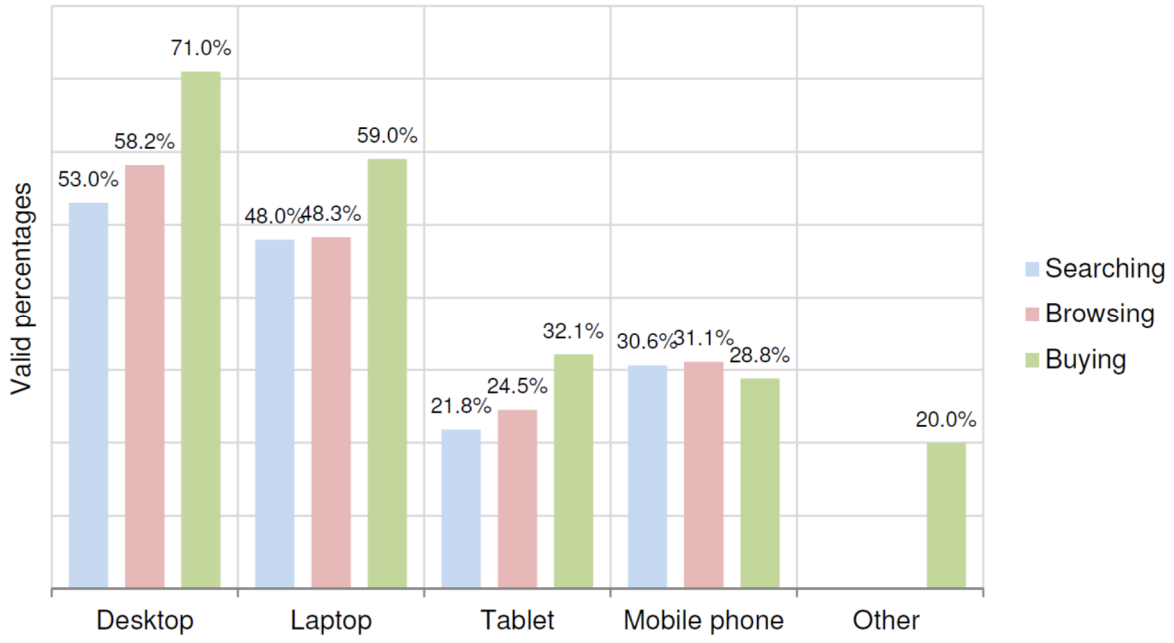


Figure 1: Devices mostly used to make online shopping in SA (Hung-Joubert & Van Huyssteen, 2017)

The research by Hung-Joubert and Van Huyssteen (2017) is import for this research report as it relates to the research question and objectives. How are small emerging contractors in SA using apps to improve their business performance? The research debunks the proposition and belief that SA prefers smartphone devices in the management of the business as a result of the unaffordability of costly equipment, such as computers and laptops. The research demonstrates what is known about the device adoption trend in the SA context. The prior research by Hung-Joubert and Van Huyssteen (2017) further provides a guide on the research methodology to be used. A similar research approach mixed-method both qualitative and quantitative has been adopted in this research to identify the various apps used by emerging contractors for business. Assess the extent of use and how widespread particular apps are utilized and for what purpose.

Assess the adoption trend of apps for business operations amongst emerging contractors in SA and understand the adoption trend.

On the contrary, a white paper by QWERTY (2017) reveals that SA has unique challenges with affordability and accessibility. In SA smartphone devices have the highest penetration rates in the world; since mobile is the only device available for usage and people depend and rely on mobile devices to a great extent.

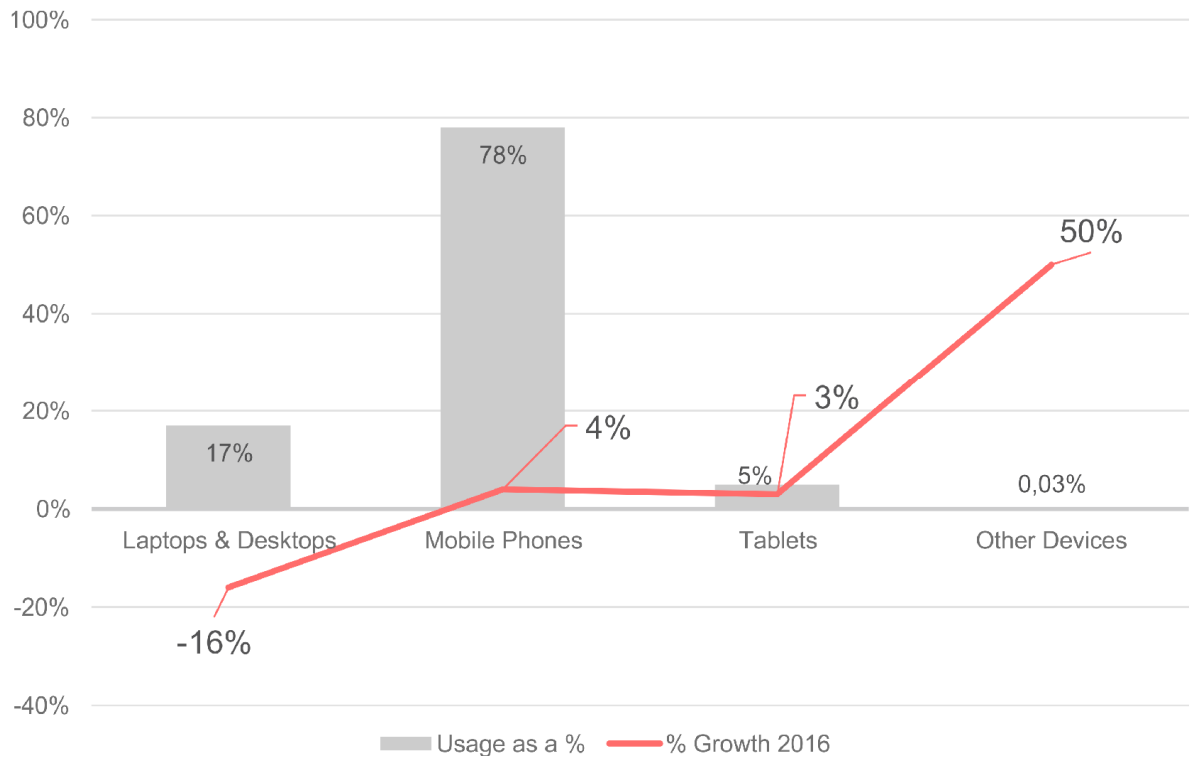


Figure 2: Share of WEB traffic by device in SA 2016-2017 (QWERTY, 2017)

The research findings by QWERTY (2017) relate to the research question and objectives; the prior research demonstrates through empirical evidence collected that SA prefers adopting smartphone devices for business and personal usage as opposed to adopting desktop computers, laptops, and tablets and other devices. The findings are important for this research report as it confirms the proposition that ordinary people, emerging contractors, prefer to adopt smartphone devices as it is readily accessible. Findings by QWERTY (2017) reveal that 75% of all website traffic in SA is done through smartphones. Findings further reveal that SA spends 70% of weekly activities on social media. 41% of SA use Google and search engines, and 33% of the weekly activity is dedicated to checking Email on Gmail account.

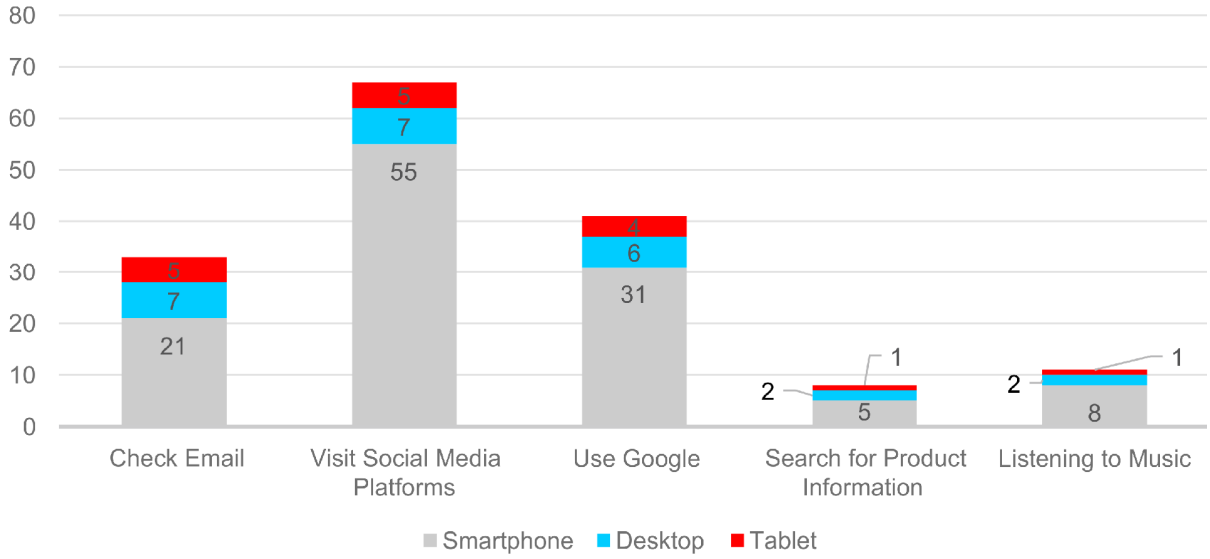


Figure 3: Weekly online activities by device in SA 2016-2017 (QWERTY, 2017)

Further research conducted by Deloitte (2017) relates to the research question and objectives. Deloitte (2017) disagrees with the findings of Hung-Joubert & Van Huyssteen (2017). Deloitte (2017) supports the proposition in this research report that affordability in the SA economy has impacted the shift from adopting desktop computers and laptops to smartphone devices as tools for business. The findings in the Deloitte (2017) research revealed that smartphone device penetration has overtaken other devices as shown in Figure 4 below. The penetration of laptops and tablets is low in SA due to the affordability, mobility and improved internet speed of smartphone devices. Figure 5 below illustrates that smartphone device penetration in SA for the year 2018 has increased two-fold at 81.72% compared to that for the year 2016.

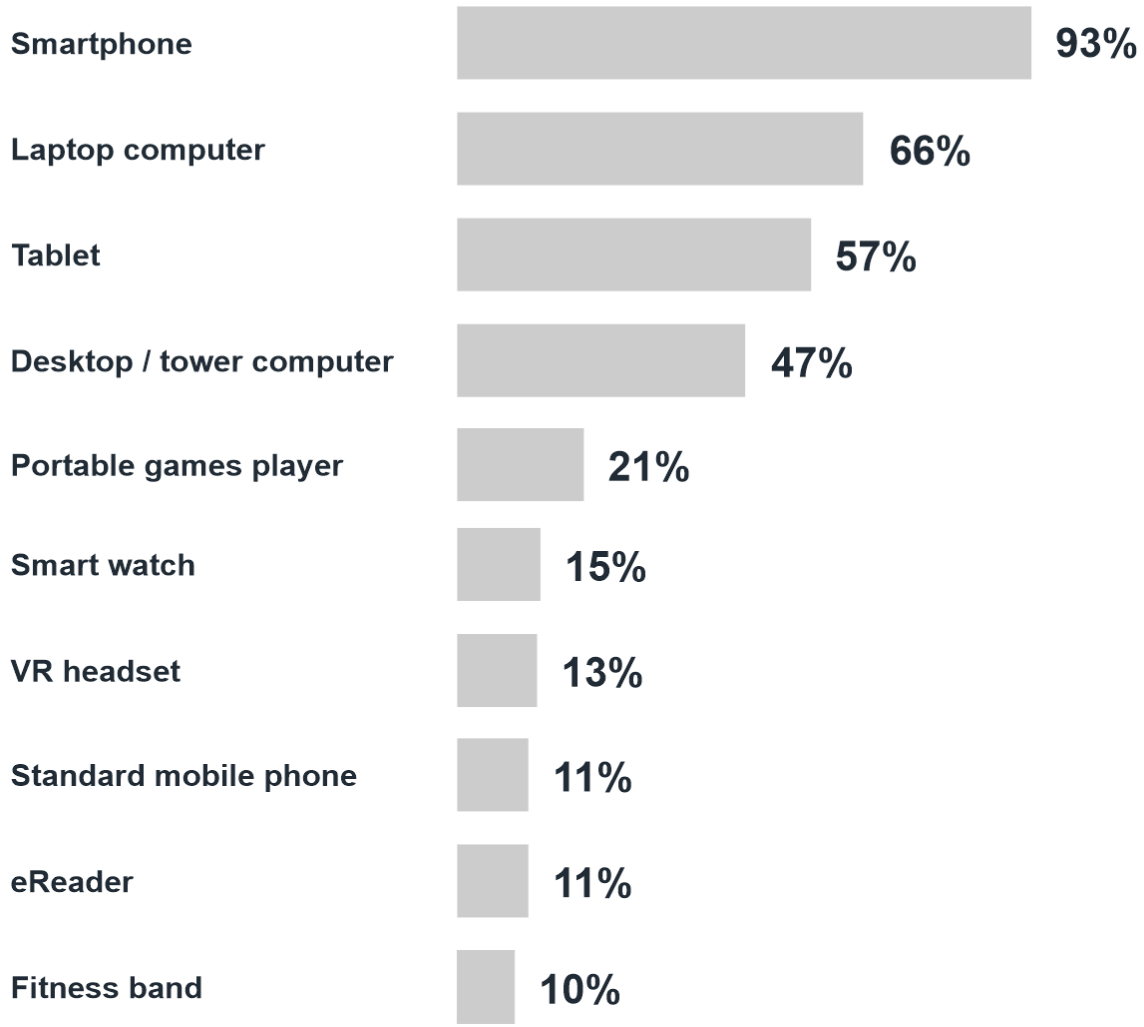


Figure 4: Device penetration SA 2017 (Deloitte, 2017)

Further research that supports the argument that smartphone devices adoption trend has increased is reported in STATS SA general household survey (STATS SA, 2018). The utilization of cellular phone device for communication increased from 85.5% in 2015, 87% in 2016 and 88.2% in 2017. Landlines and cellular device household reduced during the same period, 10.9% in 2015, 9.4 in 2016 to 8.2 in 2017 (STATS SA, 2018). According to ICASA in SA smartphone penetration has been steadily increasing in 2018 it was 81.72%, in 2017 it was 74.5% and 2016 at 43.5% reflecting the increase in adoption trend towards smartphone devices (ICASA, 2019).

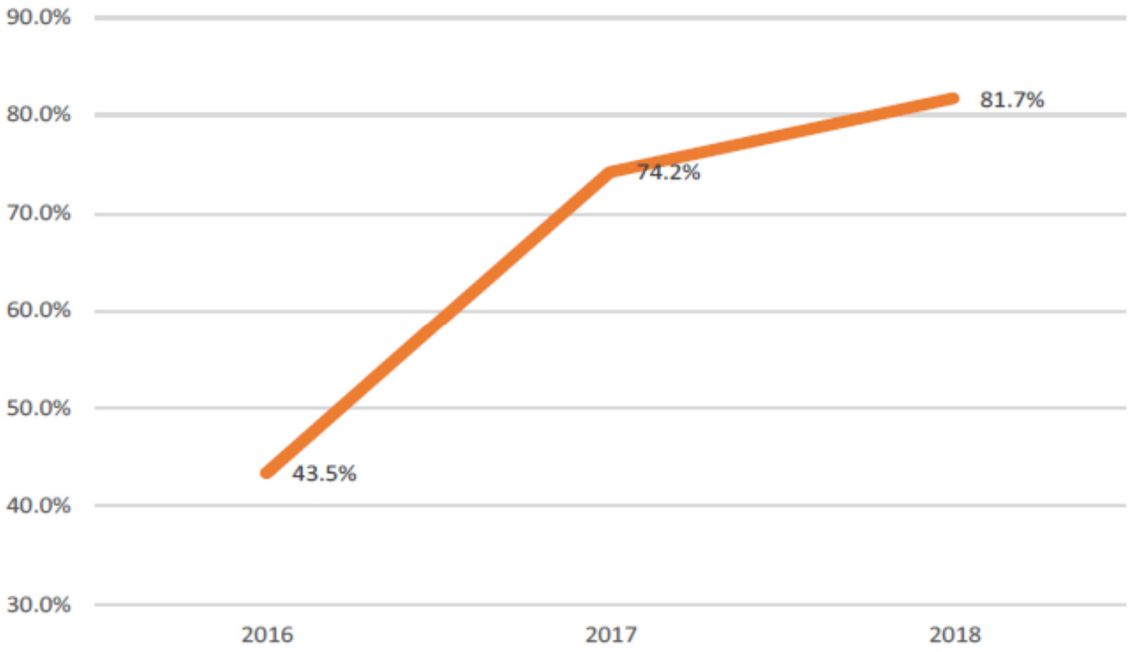
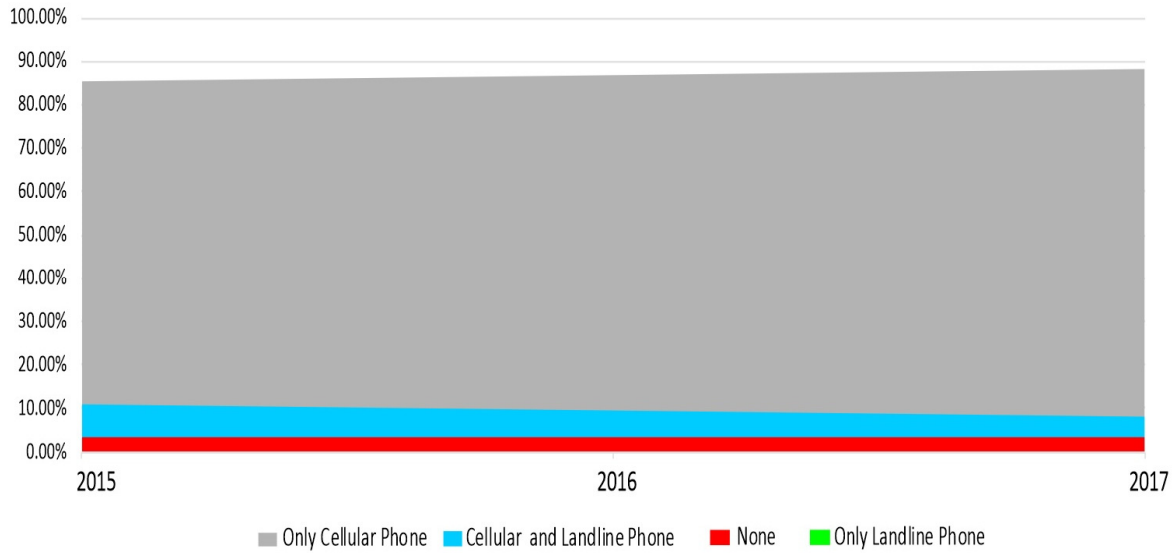


Figure 5: Smartphone penetration in SA, 30 September each year (ICASA, 2019).



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Figure 6: Household Proportion with landline/cell phone in SA 2015 to 2017 (STATSSA, 2018)

Across the globe in a more developed country Fluent (2017) reports on research conducted in America. The research by Fluent (2017) supports the view that smartphone devices are preferred in comparison to desktop computers, laptops, tablets and other devices. The findings on research conducted by Fluent (2017) reveal that smartphone devices are ahead of other devices in terms of online shopping and purchases because of the improvements smartphone

devices provide which are easier navigation and increased speed. Figure 7 below relates to the research questions as it points out the ICT devices that are mostly utilized by American adults, similar inference may be made to the SA context in terms of adoption trend. The adoption of smartphone apps in SA has increased exponentially (ICASA, 2019). Figures 2, 3 and 4 points out that smartphones are preferred ICT devices to be used by ordinary SA for personal and business.

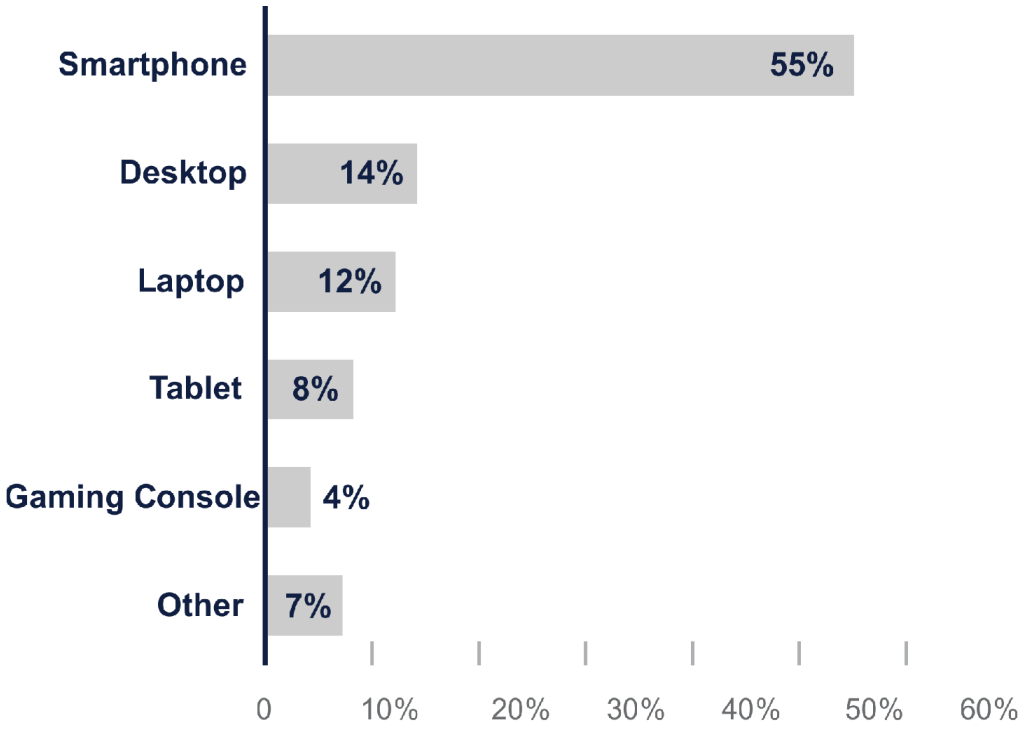


Figure 7: Device used the majority of the time (Fluent, 2017).

ICT has become more relevant in the 21st century, there is a phenomenon where a shift from mainstream ICT to Smartphone devices based computing is happening. There is an explosion in the society of adopting Smartphone devices as compared to using traditional integrated mainstream technologies such as using a desktop computer, laptop, software and equipment in the management of construction projects. Gao, Gutierrez, Rajan, Dreslinski, Mudge, and Wu, (2015) agree and point out that mobile devices, Smartphones, are taking over functions of traditional desktop applications. High definition video playback, interactive games and internet connectivity are supported by Smartphones and tablets. Huang (2011: 1) citing Gartner's (2010) prediction that "mobile devices will overtake PCs as the common Web access devices worldwide by 2013" mobile devices will be more relevant.

This research report suspect that the shift in society towards the widespread adoption trend of smartphone devices for business amongst emerging contractors has overtaken mainstream ICT technologies. In SA ICT adoption trends of Smartphone devices, have overtaken computers as tools in supporting SMEs business as the mobile technologies are widely accessible and adopted (Mbuyisa & Leonard, 2015). Emerging contractors are adopting widespread smartphone devices to improve the firm's performance.

The findings of this section reveal what is known and not yet known about Smartphones devices adoption trend. Literature reveals that the trend has rapidly grown globally and overtaken traditional desktop application functions. Concerning the research questions and objectives the preceding section points out how ICT devices are utilized by ordinary people in society for personal and business usage; similar inference may be made about emerging contractor's adoption trend towards smartphone devices that the trend outweighs desktop computers as a tool used to improve business performance.

The subsequent section focuses on subtopic theme on ICT and the construction industry. The subtopic relates to the research question as it paints an environment on the context of emerging contractor's use of ICT within the construction industry in SA. The topic is important to understand the context of emerging contractors and what is known and not yet known about the construction industry ICT adoption trend.

2. 5 ICT and the Construction Industry in South Africa

This section critically reviews the literature on ICT in the construction industry establishing what is known about the topic and relating to the research questions and objectives. The section will further identify gaps within the body of knowledge on ICT in the construction industry in SA to further inform the research approach in this report.

Extensive research has been conducted in the first world countries like the United Kingdom, America, and Germany on the barriers and benefits associated with the adoption of ICT in the construction industry. However, despite the advantages and benefits of ICT adoption, limited research has been conducted on ICT in the construction industry amongst emerging contractors within the SA context (Osunsanmi, Aigbavboa & Oke, 2018). Literature informs that the construction industry is fragmented lacks integration and has complex process and activities (Martinez-Rojas, Marin & Vila, 2016); construction industry has been a slow adopter and implementer of ICT technologies compared to other industries (Hosseini et al., 2012).

Martinez-Rojas, Marin & Vila (2016) explains that ICT in the construction industry has increased project success through access and management of data. ICT improves completion time of tasks and activities, improves collaboration and coordination in construction firms, and facilitates accessibility, exchange and handling of data (Hosseini et al., 2012). Emerging contractors, organizations, are reluctant and resist the adoption of ICT technologies when implemented, studies show a decline in ICT technologies adoption in construction (Sargent et al., 2012; Hosseini et al., 2012).

The research by Osunsanmi, Aigbavboa and Oke (2018) is important to this research report as it assesses the adoption trends of SA construction professionals towards full digitalization of construction industry 4.0, the fourth industrial revolution. The fourth industrial revolution is characterized by a fusion of technologies that is blurring the lines between the physical, digital and biological spheres (Schwab, 2016). The research by Osunsanmi, Aigbavboa and Oke (2018) is similar and relates to the research questions and objectives in this report as it seeks to evaluate the behaviours of construction professional's adoption trends towards the fourth industrial technologies in SA context. In a similar vein this research aims to explore the use of apps uses by small emerging contractors in SA to improve their business performance. The main objective of the research report is firstly, to identify the various popular apps available for business usage. Secondly, assess the extent of use and how widespread particular apps are utilized and for what purpose. Lastly, assess the adoption trend of apps for business operations amongst emerging contractors and understand the adoption trend.

The authors Osunsanmi, Aigbavboa and Oke (2018) used a quantitative research approach and questionnaires were sent to construction professionals in Gauteng province. The research assessed the awareness of construction professionals based on the evolution of the four stages of the construction industry. The first stage involves the use of basic tools in construction. The second stage involves the use of machinery such as cranes. The third stage involves the usage of ICT such as Building information modelling (BIM) and Revit. The fourth stage is the usage of fourth industrial revolution technologies such as software, drones and the internet.

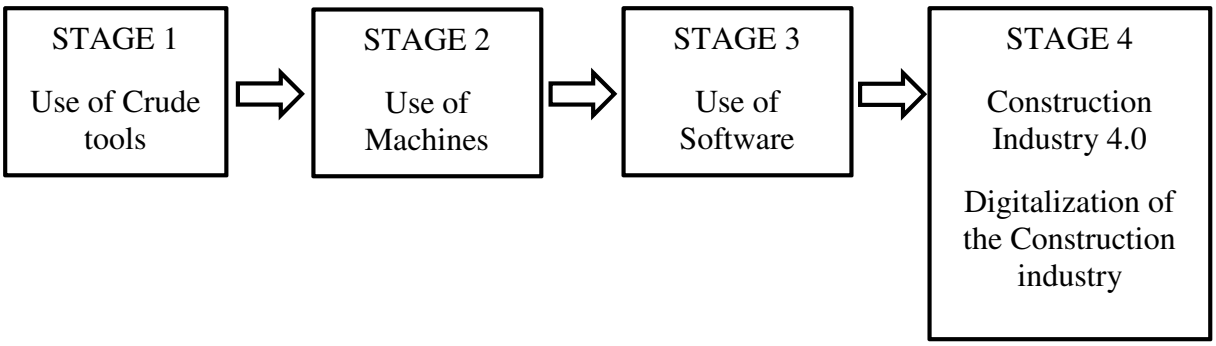


Figure 8: Evolution of the construction industry (Osunsanmi, Aigbavboa & Oke, 2018)

The findings of the research by Osunsanmi, Aigbavboa and Oke (2018) reveal that construction professionals are not aware of fourth industrial revolution construction concepts. Construction professional in SA have low awareness about modern technologies this is partly due to lack of research investment in the construction industry. The research also found that respondents are aware of BIM and prefabrication: Internet of things, automation, mobile computing, product lifecycle management, social media, radio frequency identification, robotics, big data and cloud computing. The findings of the research conducted by Osunsanmi, Aigbavboa and Oke (2018) are important to this research report as it confirms the suspicion that construction professionals are hindered by the lack of financial capabilities and research investment on the fourth industrial revolution construction technologies and are therefore slow adopters.

Similarly, the research survey conducted by Amusan et al. (2018), confirms the belief held or what is thought to be known about the topic in this research report. Amusan et al. (2018) agree with Osunsanmi, Aigbavboa and Oke (2018) research by pointing out the barriers to ICT adoption in the research survey conducted in Nigeria. Amusan et al. (2018) used a quantitative approach in the survey; there are glaring similarities in the findings concerning the factors influencing the use of ICT in the construction industry. The factors and barriers to ICT adoption are budget limit for investment, inadequate knowledge about the benefits and profits associated with ICT investment, high cost of employing professionals, lack of staff with appropriate skills and knowledge in ICT and the cost of training professionals (Amusan et al., 2018). The barriers also include capital and resource constraints, economic and environmental risks, top management and owners have limited education and focus on the short term, licensing, restructuring and facility upgrade (Giotopoulos, Kontolaimou, Korra, & Tsakanikas, 2017; Rajendra, Steinhardt, Manley, & Lamari, 2015). ICT technologies adoption by SMEs improves project planning, managerial operations process, organisational effectiveness, improved customer service, access to business opportunities and competitiveness (Giotopoulos et al.,

2017). However, the poor adoption of ICT technologies by SMEs has been internationally reported (Rajendra et al., 2015). Emerging contractors, organizations, are reluctant and resist the adoption of ICT technologies when implemented; literature also informs that there is a decline in ICT technologies adoption in construction (Sargent et al., 2012; Hosseini et al., 2012). Emerging contractors lack competitive advantage in productivity, performance and managing construction projects efficiently within cost and time.

ICT technologies utilisation and internet access by SMEs has increased according to the Organisation for Economic Co-operation and Development (OECD) survey (Sanchez, Ruiz & Zarco, 2007). ICT technologies and internet utilisation gap between larger firms and SMEs has become smaller.

This research suspect that emerging contractors are influenced by these barriers and therefore adopt alternative ICT technologies, which are not expensive and do not require training and top management investment and interaction. The emerging contractors do not have financial capabilities to invest in costly software. The findings of the section are important for the research report because it relates to the two research propositions. The first research proposition is that *"small emerging contractors with limited financial resources are not adopting ICT technologies to support business"*. The second research proposition is that *"small emerging contractors with limited formal education and lacking financial resources are adopting apps to manage the business in place of ICT technologies"*. The section provides an understanding on ICT adoption trend in SA construction industry and clarifies the research problem. The empirical data collected in this research will clarify the research proposition and the research question.

The findings of this section reveal what is known and not yet known concerning ICT adoption trend in SA construction industry. Literature reveals that construction professionals, emerging contractors, are not aware of the fourth industrial revolution construction technologies. However, due to the lack of research investment on ICT technologies SA construction professionals do not enjoy the full benefits associated with the adoption of ICT technologies in the construction industry. The greatest hurdle to ICT adoption is the high costs and investment required for the fourth industrial revolution construction technologies.

The preceding section has described what is known concerning ICT in the construction industry. The subsequent section moves from the broad general knowledge of ICT adoption and narrows down focusing on the smartphone apps available for usage in the construction

industry. The topic is relevant as it relates to the research question and objectives in this report, the section will further guide the research approach in the assessment of how small emerging contractors in SA are using apps to improve their business performance.

2. 6 Apps in Construction Industry

This section critically reviews the literature on apps in the construction industry establishing what is known about the topic and relates to the research questions and objectives. The section will further identify gaps within the body of knowledge on apps in the construction industry in SA. The body of knowledge will further inform the research approach in this report.

Little is known and there appears to be a gap in the recent literature on apps utilization in the SA construction industry. Similar research on apps in construction has been conducted in Ghana by Ekow and Kofi (2016). The authors evaluate construction project management professionals' utilisation of the apps in the Ghanaian construction industry. The research by Ekow and Kofi (2016) conducts a questionnaire survey of 62 professionals and use a quantitative approach to analyse the data.

The findings of the research by Ekow and Kofi (2016) reveal that the majority of construction professionals in Ghana were not aware of the existence or availability of construction apps. The majority of respondents (58%) in the study owned Android smartphones or tablets devices which can support construction apps. The authors identified construction-related apps used by construction project managers and engineers. The authors categorised and clustered the apps under the group estimation, calculators, CAD, construction site and project management apps. The finding by Ekow and Kofi (2016) identified the top 10 apps used by the construction professionals. The apps identified are site photographs, Microsoft, spirit level, material estimator calculator, AutoCAD WS, Construction Master Pro, Universal estimator, AndCAD, Carpenter's Calculator and painting estimator. The authors reaffirm that integrating smartphones, Android and tablets into construction operations management enhance job site efficiency, quality and productivity (Ekow & Kofi, 2016 citing Azhar & Cox, 2015). The authors echo the findings by Osunsanmi, Aigbavboa and Oke (2018) that construction professionals in Ghana similarly to SA are not aware of fourth industrial revolution construction concepts. Ekow and Kofi (2016) agree with Mofokeng and Thwala (2013) that educational background and qualifications play a huge role in the awareness of construction-related apps and ensuring the sustainability of the firms owned by emerging contractors.

Table 4: Construction Apps

Apps Category	Construction Apps	Apps Uses
CAD, Design and Drawing	AutoCAD WS	Access and edit all of CAD files.
	AndCAD	It supports all AutoCAD files and has features
	Rilievo	It handles architectural surveys and was built to eliminate the need for paper surveys.
	DAKO PRO Civil Engineering	The app is by DAKO software, is built specifically to help meet the design needs of civil engineering.
Calculators	Concrete Design	Calculate the amount of concrete and reinforcement needed for a work. The app has features that check the compression zone and cracking.
	Carpenter's Calculator	The app covers the basic needs of carpenters on the job site. It also used for calculations for roofing and pitch.
	Construction Master Pro	It helps to compute standard construction calculations and trigonometric functions. That means contractors and construction workers can tally estimates for everything from stairs to concrete.
	Roofing Calculator	Calculate material costs.
	Concrete Calculator	Calculation materials of concrete
Estimating	Universal Estimator	Universal Estimator handles multiple types of projects, including painting, flooring, framing, and roofing, right from a single app.
	A Estimate All Pro	Handle all types of estimating – from concrete, painting and remodeling to other construction estimating jobs
	Painting Estimator	Accurately estimate paint projects. Estimate paint cost, material cost and profit and overheads.
	Material Estimator Calculator	Estimate materials and cost of concrete, fences, desks, bricks, tiles, flooring, gravel, painting, drywell and paneling
Construction site	Spirit level	Checking levels at construction site
	Site Boss	Checking Site Diary, Request for Information, Purchase Order, Change Orders/Variations, Back charge Notice, Site Instructions, Meeting Minutes, Tender Request, and Extension of Time
	Site photos	Picture taking
	Daily construction records	Site records, weather and site conditions
Project Management, Architectural	iConfirm	Keep all of your site documents in order with the iConfirm app, which can manage job site verification forms, change orders and photo documentation. Documentation can be signed directly on your phone, and all documents are legally binding.
	Tradies App	The suite features a site diary, change orders, invoicing, quoting, requests for information, purchase orders and bid requests.
	Construction manager	Use to track of projects and tasks. Get feedback from subcontractor and customer
	Architecture of the Construction Mobile Application	Inspection Report, QA/QC report, Design Intent and Clarification, and site instruction are the data generated by the consultant. Schedule Update, Accident Report, Violation Report, Productivity Information, Progress Photo, Daily Report, and Delay Recording are data produced by the contractor. The data flow between contractor and consultant
	Microsoft Office	Checking word doc, spreadsheet, pdf and power point files and other Microsoft files.

Source: Ekow and Kofi (2016)

An exploratory research by Liu et al. (2017) investigates the utilisation of Smartphone apps by New Zealand construction project managers using a self-administered questionnaire survey. The quantitative data was analysed using descriptive, one-sample t-test, Spearman's rank correlation coefficient and structural equation modelling. The research by Liu et al. (2017) reaffirms the findings of Ekow and Kofi (2016) that iPhone and Android smartphones are widely used by construction professionals. Liu et al. (2017) research findings reveal that the apps that are commonly utilised include: applications for recording site photographs, health and safety reporting and timekeeping. The authors report that the benefits of apps adoption amongst construction professionals are; productivity improvement, better client relationship management and satisfaction (Liu et al., 2017).

Table 5: Popular Construction Apps

Categories	Apps
General Office Productivity	Ustream Broadcaster Prontoforms Toodledo Punch List Crane-Operator Hand Signals OSHA Heat and Safety Tool Dropbox Good Reader Evernote eWeather OSHA Heat Index
Construction Documents & Drawings	On Site Planroom Control Center 7 Bluebeam Revu Tracing Paper Lite
3D Visualization / Drawings	BIMX Turbo Viewer Autodesk Sketch Book Express/Pro
Construction Calculations	Home Builder Pro-Calcs My Measures & Dimensions Drywall Calculator My Dimensions Pro Decibel Ultra Pro

Source: Azhar, Jackson and Sattineni (2015).

The research by Azhar, Jackson and Sattineni (2015) in their examination of popular apps used by professionals within the construction industry. The research methodology used by Azhar, Jackson and Sattineni (2015) uses both a qualitative and quantitative approach; the data is

captured using semi-structured interviews with the project managers. The authors note that there is an excess of 13000 apps on Apple iPad this suggests that the use of construction apps is increasing. The research findings by Azhar, Jackson and Sattineni (2015) reveal that the majority of apps used by construction professionals are not construction apps. Similarly to the research findings of Ekow and Kofi (2016) the lack of training and education is a major problem in the implementation of apps in the construction industry. App adoption can be improved by training of construction professionals. Azhar, Jackson and Sattineni (2015) has compiled a list of popular construction-related apps as presented in Table 5 above.

The literature informs on the associated benefits of apps adoption in the construction industry. Apps in the construction industry help engineers with improving project success through effective and timely exchange of construction information among construction consultants, contractor, client and other stakeholders (Kim, Lim & Kim, 2011). GPS (Global Positioning System) and gyroscope in smartphones assist construction project managers and engineers with construction site management, through integrating location information and construction site information (construction drawings) construction project managers and engineers can easily orientate themselves and understand the construction information aligned with the construction site (Kim, Lim & Kim, 2011).

The findings of this section reveal what is known and not yet known concerning apps in the construction industry. Literature review revealed that construction professionals are not aware of the existence or the availability of construction apps in the construction industry. The research also indicates that construction professionals do not use construction apps instead they use other generic apps which can help them in the management of their businesses. The findings of this section clarify the research problem and points out that the lack of education and training in the construction industry is a major problem amongst construction professionals to adopt sector specific apps for business operations. The findings of the section are important for this research report as it provides a basis for the research methodology to be used. It is of importance to note that the apps popularly utilised by professionals in the construction industry are not construction apps and this relates to the research question and objectives.

The preceding section discussed apps used by professionals in the construction industry; it has also been found that construction professionals do not use construction apps. The subsequent section focuses on apps used by ordinary people in SA. The topic is relevant as it relates to the research question and objectives. The section is important for this research report as it seeks to

understand what is known or not yet known about generic apps used by ordinary people in SA for personal and business use.

2. 7 Apps Usage in South Africa

This section critically reviews the literature on apps usage by ordinary SA. The section will further identify gaps within the body of knowledge on apps usage in SA, the section is relevant to the research question and objectives. The section will establish what is known and not yet known about apps usage. Furthermore, the existing body of knowledge will inform how ordinary people and emerging contractors utilise apps for business operations in SA.

Angelova (2019) in the research conducted on the mobile application for business, the author informs that there are several mobile operating systems (OS) on the market; Android, iPhone OS / iOS, Samsung, BlackBerry, Window and others. Statista (2020) informs that the App markets worldwide as of the first quarter of 2020 show that Apple iOS has 1.85 million available apps and Google Android has 2.56 million apps available. The apps marketplaces portals iOS and Android fostered rapid adoption in apps (Enck, 2011; Xu, Erman, Gerber, Mao, Pang, & Venkataraman, 2014).

Table 6: Mobile Operating System Market Share SA July 2020

Mobile Operating System	South Africa July 2020
Android	84.18
iOS	15.26
Tizen	0.23
Series 40	0.07
BlacBerry	0.05
Nokia Unknown	0.05
Linux	0.04
Samsung	0.06
Unknown	0.02
KaiOS	0.02
Windows	0.01
SymbianOS	0
Other	0

Source: Own table compiled from data obtained from Statcounter (2020)

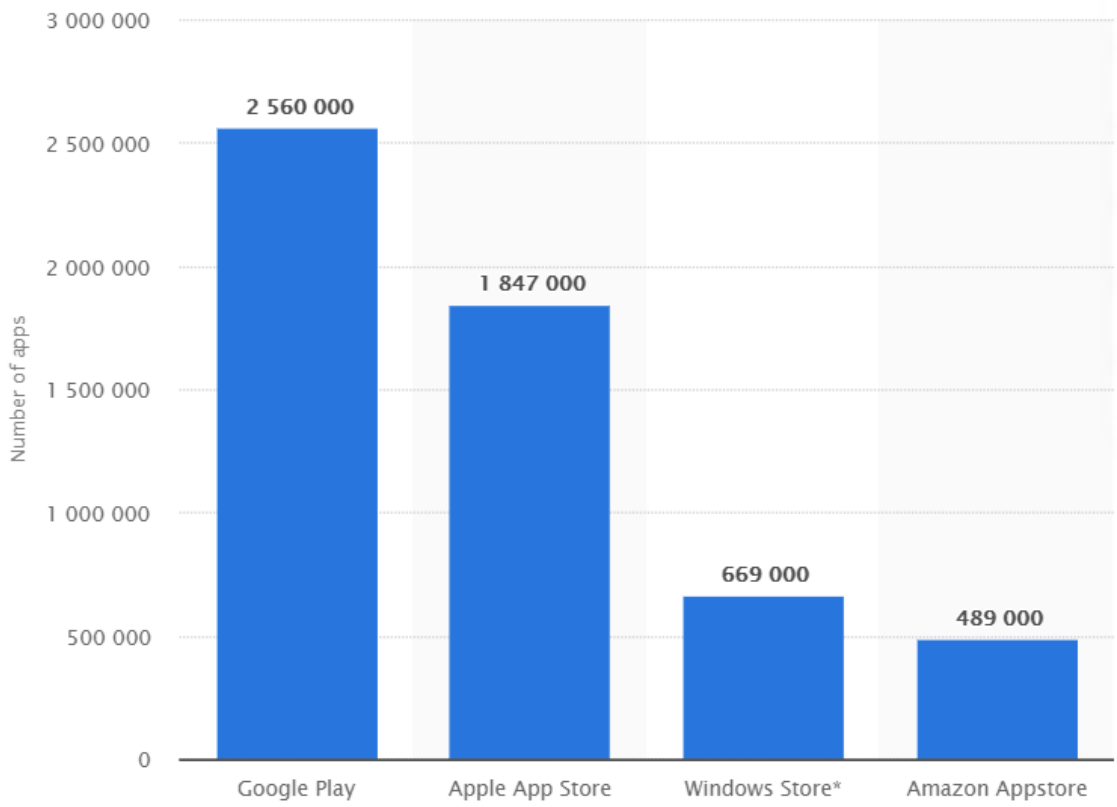


Figure 9: Apps available worldwide on App stores 1st quarter 2020 (Statista, 2020)

Phokeer et al. (2016) report on the research conducted on the mobile data usage in a SA township (Masiphumelele in Cape Town). The research methodology used by the authors is mixed-methods; a combination of quantitative and qualitative methods. The methodology is used to understand the behaviours leading to the adoption and utilisation of apps among township dwellers and also to quantify measurements relating to apps used by respondents.

The findings of the research by Phokeer et al. (2016) reveal that the popular used app is Google Play Store, the apps run in the background for software updates which are downloaded automatically. The second most popular App is Facebook followed by Chrome; other popular apps include gaming apps Hidden City, Gods of Rome and Bingo Blitz (Phokeer et al., 2016). The authors report that on mobile data and Wi-Fi connections Instagram and YouTube apps are not popular amongst ordinary SA living in townships (Phokeer et al., 2016). Qualitative data obtained in the research by Phokeer et al. (2016) through interviews reveals that Facebook and WhatsApp are the most popular apps in terms of usage; followed by YouTube, Gmail, games and ShareIt.

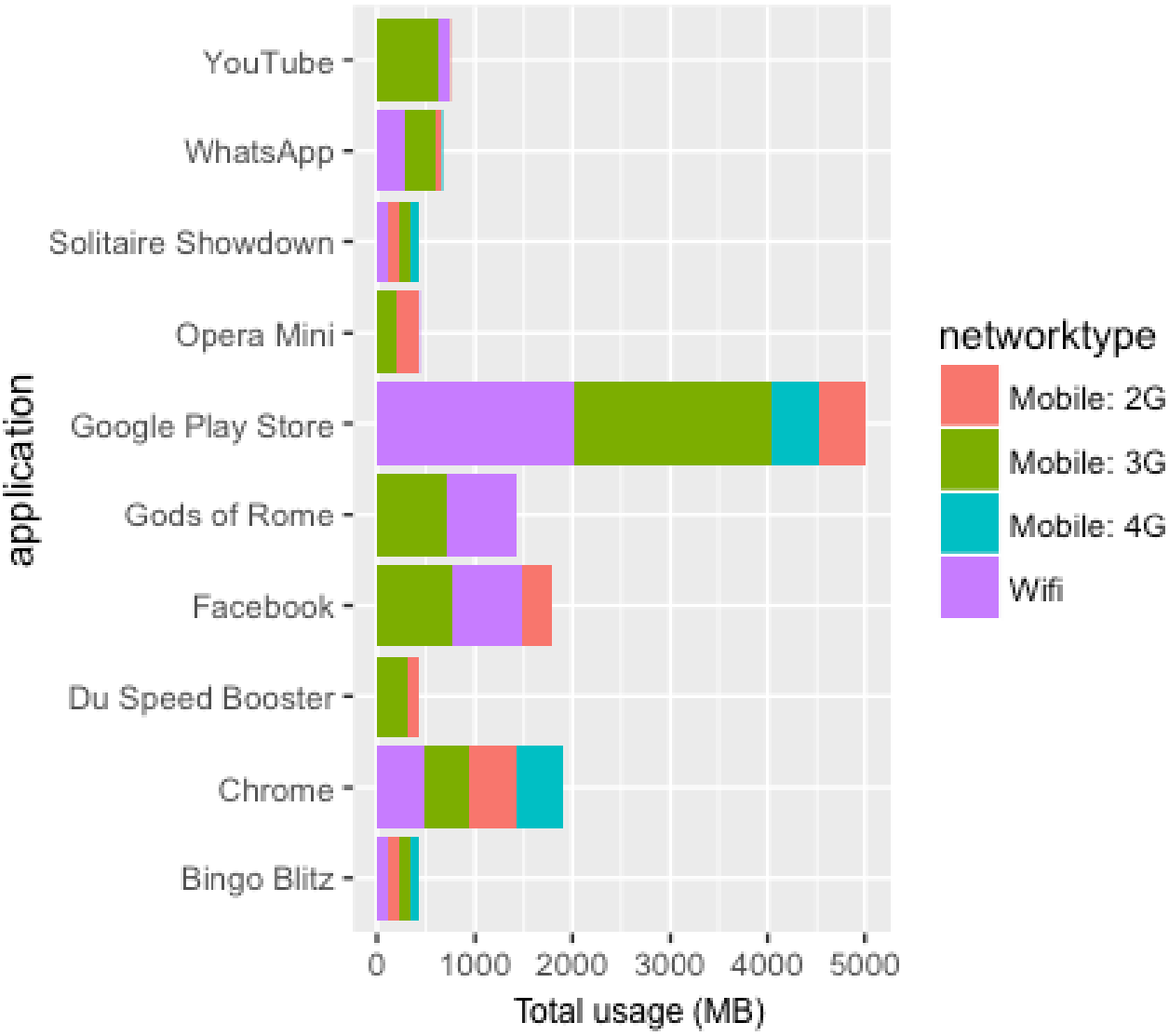


Figure 10: Top ten apps and breakdown in network connection type in SA (Phokeer et al., 2016)

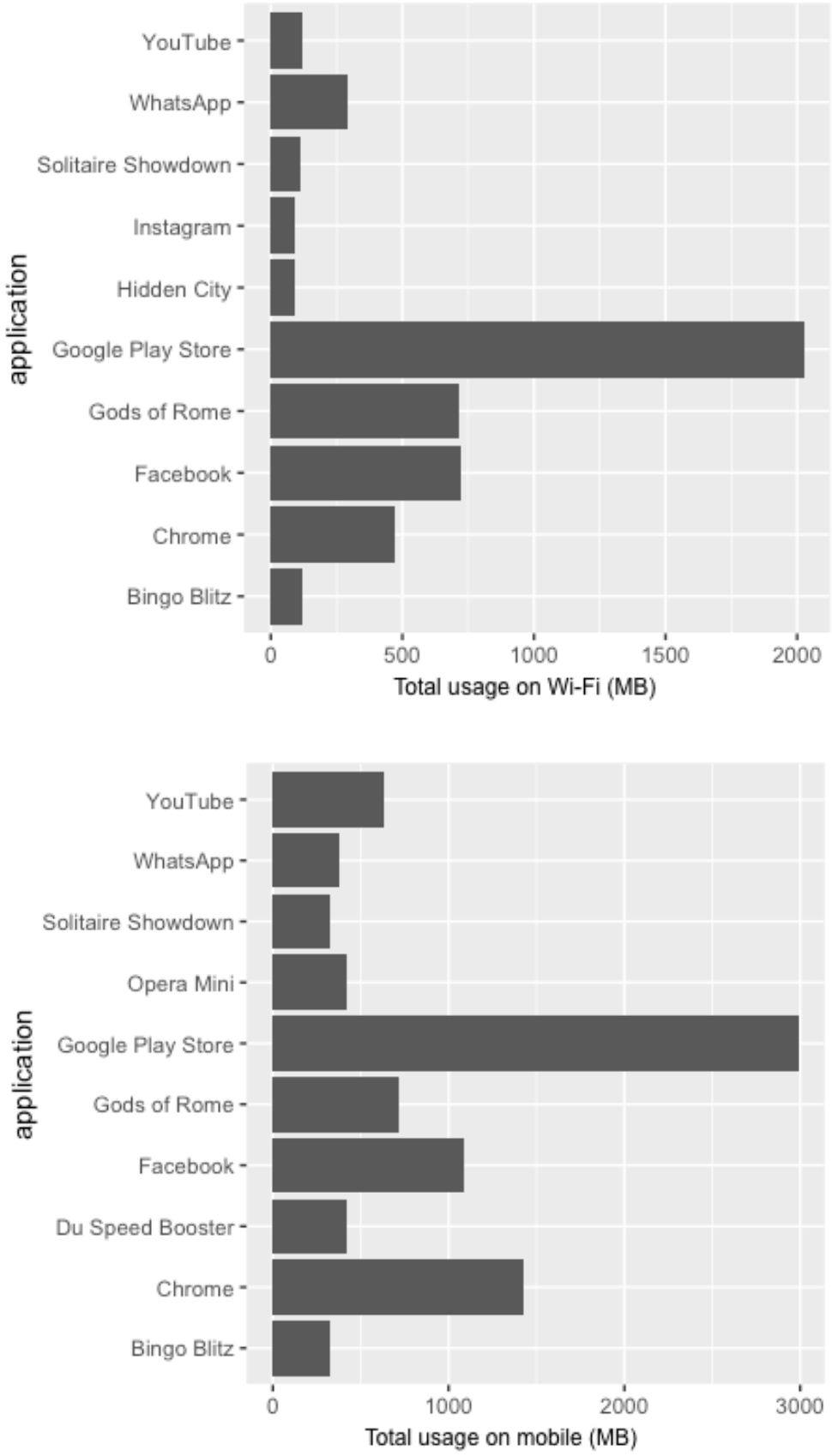


Figure 11: Top ten apps over Wi-Fi and mobile connection in SA (Phokeer et al., 2016)

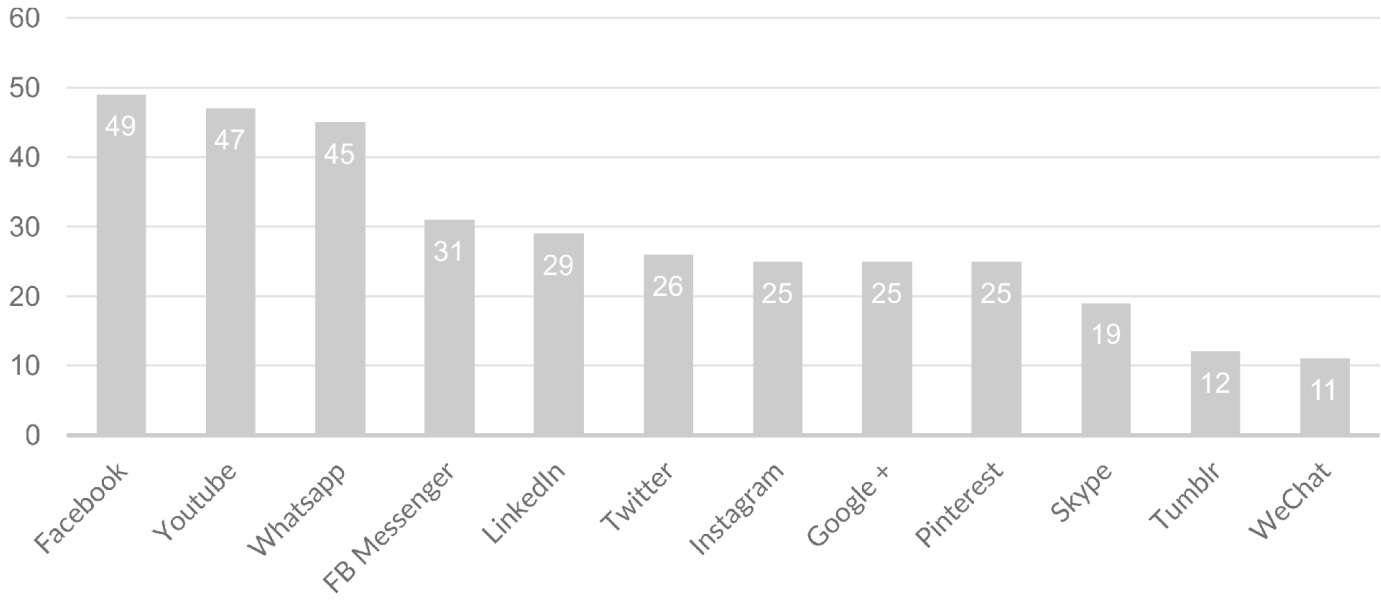


Figure 12: SA popular social platforms percentages 2016-2017 (QWERTY, 2017)

A study by Qwerty (2017), as shown in Figure 12 above, indicates that Facebook is the most utilized App on social media platforms with 49% adoption from the SA population. In contrast to the findings of Phokeer et al. (2016), YouTube has 47% adoption indicating that SA rely upon and watch a lot of YouTube videos. According to Qwerty (2017) the chat app that is mostly utilized by SA is WhatsApp with 45% adoption from the SA population indicating that the app provides a platform for instantaneous communication, networking and chatting for different age groups. The report on the adoption of Facebook and WhatsApp reaffirm the findings by Phokeer et al. (2016) that these social media platforms are the most used apps in SA.

The findings of a consumer survey conducted by Deloitte (2017), Figure 13 below, in SA differs slightly from the research done by Qwerty (2017); whereby WhatsApp is found to be the most utilized chat app in SA instead of Facebook and Facebook Messenger (Deloitte, 2017). Data-driven apps, WhatsApp and Facebook allow for communication and for people to stay connected compared to traditional voice. As shown in Figure 13 below WhatsApp is the most popular messaging platform across age groups in SA (Deloitte, 2017).

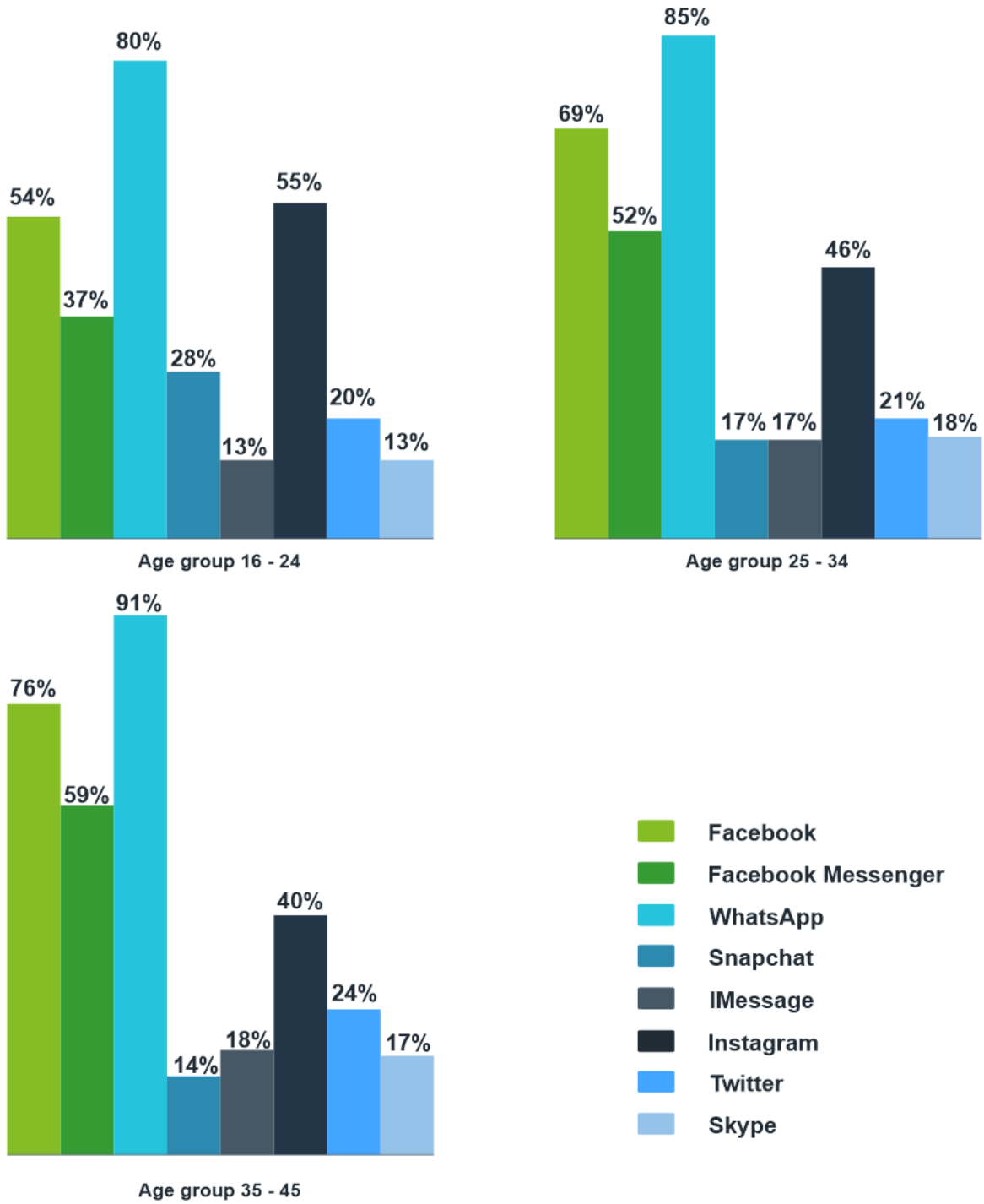


Figure 13: SA smartphone apps utilisation 2017 (Deloitte, 2017)

The findings of this section reveal what is known and not yet known concerning apps in SA. Literature has revealed that the most popular apps in SA in terms of usage are Facebook, WhatsApp, followed by YouTube, Gmail, games and ShareIt. Google Play Store and Chrome are also popular apps, however, these apps are not the mostly utilized by ordinary SA. The section is important for the research report as provides an understanding on the generic apps used by people in society for personal and business usage. The findings of this section are

important for the research report because it relates to the research problem and describes the alternative generic apps used by others in SA. The research report suspects that the emerging contractors are adopting these generic apps instead of sector-specific apps for personal and business usage. The section is important for the research question and the objectives as it provides an understanding on the apps adoption trend. The research methodology, mixed method, used by Phokeer et al. (2016) provides a basis for the research approach to be used in this research report.

2. 8 Key Findings of the Literature Review

The preceding sections have revealed through the critical review of literature what is known and not yet known about the utilization of apps for business amongst emerging contractors in SA. Literature informs that emerging contractors fall within the category of micro-enterprises; emerging contractors are classified and categorized under the CIDB contractor grading designation of 1 to 4. Research has extensively reported on the difficulties and challenges emerging contractors are faced with; the biggest of these barriers are lack of financial capabilities and educational qualifications.

Literature reports on how ordinary SA have adopted smartphone devices for personal and business use. The adoption trend in SA has skyrocketed and exponentially increased; smartphone devices adoption has surpassed and overtaken the use of desktop computers, laptops, tablets and other devices.

Literature reveals that emerging contractors are not aware of the fourth industrial revolution construction technologies. Researchers stress the lack of research investment and the high costs of ICT technologies as a barrier for SA construction practitioners to enjoy the full benefits associated with the adoption of the fourth industrial ICT technologies.

Literature informs that there is an excess of 13000 construction apps; however, construction professionals are not aware of the existence or the availability of construction apps in the construction industry. Construction professionals, emerging contractors, do not use construction apps instead they use other apps which can help them in the management of businesses operations.

Literature has revealed that the most popular apps utilized by ordinary SA are Facebook, WhatsApp, followed by YouTube, Gmail, games and ShareIt.

The primary research objective relating to literature review on apps adoption trend has been achieved by critically reviewing what is known and not yet known on the topic. The literature review has shed light on the context of emerging contractor in SA in terms of classification and categorization. The literature further informed on the preferred ICT devices for personal and business usage among ordinary SA. Research further highlighted the lack of awareness by SA construction professionals concerning the fourth industrial revolution construction concepts. Literature informed the report on App-based computing devices for SMEs and shown through research the nature of shift towards App-based devices globally and in SA. A review of the existing body of knowledge achieved the objectives relating to literature by informing that construction professionals and emerging contractors are not using construction industry-related apps for business operations. Based on literature the research problem persists amongst the emerging contractors as few are aware of apps specifically utilized for business operations. Instead, emerging contractors are utilizing ordinary apps used by SA in general as a means to an end. There is a serious problem that persists amongst the emerging contractors as the majority are not aware of fourth industrial revolution construction concepts and are not utilizing apps for business operations intended specifically for the management of construction industry firms.

The research methodology used by prior research to investigate the use of apps in the construction industry is mixed-method, both qualitative and quantitative to gain a better understanding on the adoption trend. Prior research is exploratory to clarify the understanding on the research problem. The research methods used are important for this research report as it suggests a basis to be adopted for the research approach.

The preceding section has reviewed the literature on what is known and not yet known on smartphone apps utilization amongst emerging contractors for business in SA. The literature topics reviewed are important and relevant as these relate, enhance the subject knowledge and clarify the research questions and objectives of this research report. The subsequent chapter discusses the research design, drawing on lessons learnt from the literature review in terms research approach and methodology to be adopted for this research report.

3. Research Design

3. 1 Research Structure

The objective and rationale of the research report is firstly, to identify the various popular apps available for business usage. Secondly, assess the extent of use and how widespread particular apps are utilized and for what purpose. Lastly, assess the adoption trend of apps for business operations amongst emerging contractors and understand the adoption trend.

Kothari (2004) defines the term research design as the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure; it is the structure that informs how research is conducted, the structure also informs how data is collected and analyzed. In this research report, the research design is based on an exploratory research design which has the flexibility to redefine the research problem. The exploratory research design has been chosen in the report to acquire background information clarifying research problems and proposition. The exploratory research is selected in this report because there are a few studies for reference in apps utilization amongst the small emerging contractors in the SA context. The exploratory research design is conducted for the research report to determine the nature of the problems facing small emerging contractors and assist for further research to be conducted to have a better understanding of the research problem. The research report conducts telephone interviews on small emerging contractors with CIDB contractor grading of 1-4 in SA.

According to Kothari (2004), research methodology is a way to systematically solving the research problem and it is made up of defining the research problem, formulate proposition, data collection and analysis, and reaching findings. The research methodology, techniques and methods implemented to realize the objectives of the research report are further discussed in this chapter.

Saunders et al. (2016) point out the method by which research process has to be informed is based on the research onion. The study is informed by the research onion in pursuit of resolving the research question and problem. Layers of onion are made up of philosophy, approach to theory development, methodological choice, strategies, time horizon and techniques and procedures.

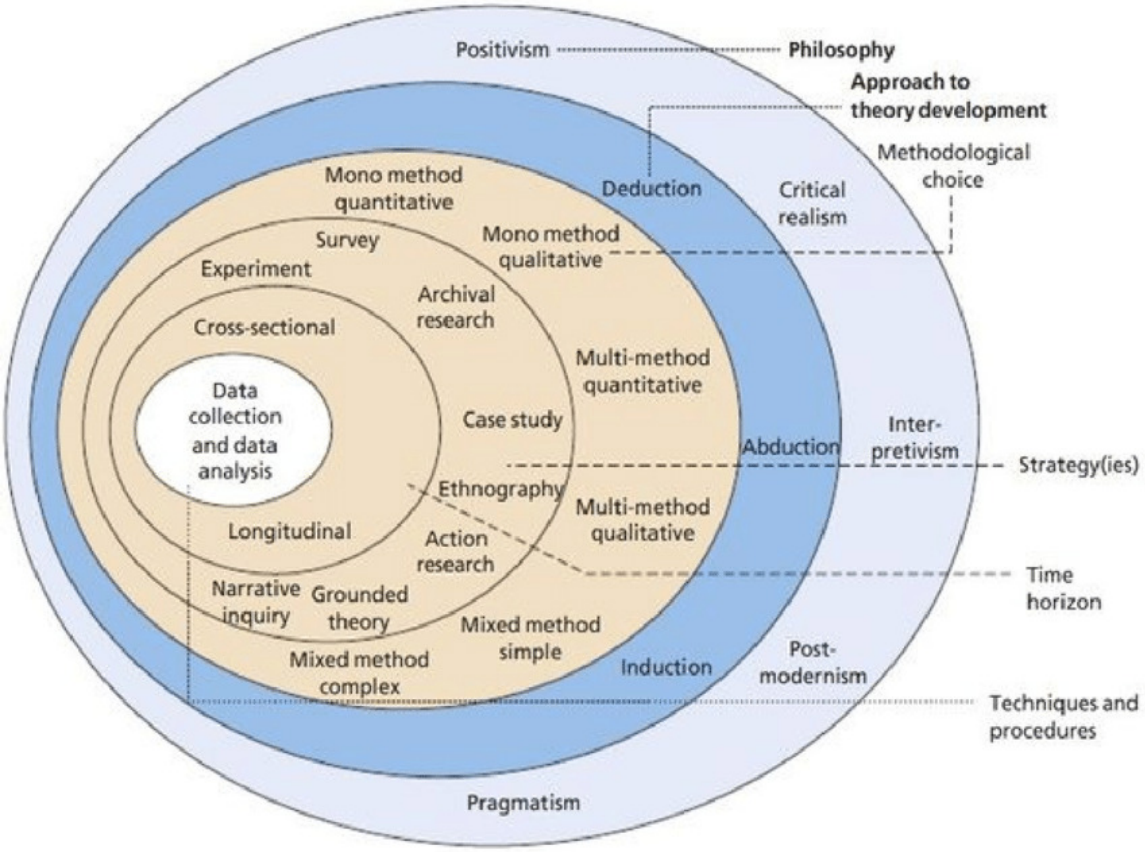


Figure 14: The research onion (Saunders et al., 2016)

3. 2 Research Philosophy and Approach

Research philosophy refers to a system of beliefs and assumptions about the development of knowledge in a particular field. Researchers make assumptions when gathering and analysing data about a phenomenon (Saunders et al., 2016).

Epistemology refers to acceptable knowledge in the field of study, the assumption that you make about the best way of investigating the world and about reality. The epistemological approach chosen for the study is Positivism, the term Positivism relates to the belief that the best way to investigate the world is through objective methods. Positivist epistemology initiates with a proposition, gathering facts through interviews to substantiate the proposition thereby confirming the theory (Saunders et al., 2016). Positivism approach relies on quantifiable data from the telephone interviews leading to statistical analyses. The justification for the research report to select a positivism approach because it is based on facts and considers the world to be external and objective. The research is independent maintaining minimal interaction with the participants.

Further justification for selecting the positivism approach in the research report it is because the positivism approach relies on quantifiable data gathered from the telephone interviews leading to statistical analyses. The research philosophy aligns to the research questions whereby qualitative and quantitative data are drawn through telephone interviews to substantiate the proposition.

The research selects the positivism approach because it relates to the two research propositions. The first research proposition is that *"small emerging contractors with limited financial resources are not adopting ICT technologies to support business"*. The second research proposition is that *"small emerging contractors with limited formal education and lacking financial resources are adopting apps to manage the business in place of ICT technologies"*. The justification to select the positivism approach because the approach is used to assess the strength of the statistical relationship between the variables: the number of apps used by the respondents; the educational qualifications according to National Qualifications Framework levels (NQF); the annual turnover of the companies for the year 2018; and the CIDB grading for the firm.

The approach to theory development is deduction, deduction involves the development of theory and testing of theory thereby generalizing the outcome. Deductive reasoning is a logical process in which a conclusion is based on the concordance of multiple premises that are generally assumed to be true (Saunders et al., 2016). Deductive reasoning is referred to as top-down logic. Deduction starts with the proposition and examines the possibilities to reach a specific logical conclusion.

The justification for the research report to select the deductive approach because the research seeks to establish and explain the relationships between variables in the two research proposition. The relationships between the variables educational qualifications, annual turnover, the CIDB grading and the number of apps used for business. The deductive approach is chosen to measure the variables quantitatively and generalize the research findings to a certain extent.

3. 3 Research Methodology

Kothari (2004) defines the term research methodology as a way to systematically solve the research problem using techniques and methods to understand the objectives of a study. The term encompasses the various steps taken by the researcher in resolving the research problem.

The logic behind methods used in the context of the research report indicates why one uses certain methods and techniques so that research findings can be evaluated by others.

The research strategy refers to the plan of action in achieving the objective, a plan on how to answer the research question. The primary research question is how are small emerging contractors in SA using apps to improve their business performance?

The research report uses a mixed methodology approach to analyse the data. The narrative inquiry strategy has been selected for this research report; the term narrative refers to a story, a personal account interpreting an event. Collecting and analyzing stories of respondents to substantiate the proposition. The research report has chosen the narrative inquiry strategy because the approach is suitable to answer the primary research question which is of qualitative nature. The narrative inquiry strategy is selected to analyze the first-hand personal accounts of the small emerging contractors interpreting how they use the apps for their business. The narrative approach is important to answer the primary research question; the qualitative approach assist to explain the association between variables emerging from the quantitative data analysis. The variables relating to the proposition are the educational background, the annual turnover, the CIDB grading and the number of apps used by the small emerging contractors. Stories captured from the respondents through telephone interviews will provide a better understanding of the research problem on how apps are used.

Saunders et al. (2016) refer to time horizons in research as data collected from the current existing phenomenon or collected from historical data. There are two types of time horizons namely, longitudinal studies and cross-sectional studies. The cross-sectional study refers to the study of a particular phenomenon at a particular time; longitudinal studies are conducted over an extended period. The research report involves the collection of data over a specific time frame and uses cross-sectional studies. The cross-sectional study is chosen in the research report because the research report assesses the characteristics of the small emerging contractors at one specific point in time. The respondents are chosen based on common variables of interest, that is the CIDB grading, the educational background, the annual turnover and the use of a number of apps. The cross-sectional study is chosen because it describes the characteristics that exist amongst small emerging contractors, making statistical inferences about possible associations by providing correlations that may exist between variables at a particular point in time. The cross-sectional study is important for the research report because it provides a better understanding and information on what is currently happening amongst small emerging

contractors. It is important to understand the decisions of small emerging contractors to adopt apps for their businesses at a particular point in time.

3. 4 Research Methods

The two types of research methods are quantitative and qualitative; quantitative research is based on quantifying things. According to Macdonald & Headlam (2009), Quantitative methods are research techniques that are used to gather quantitative data, data that can be sorted, classified and measured. Quantifying the data and generalizing the results from a sample of the population; through measuring the incidence of various views and opinions in a chosen sample. According to Macdonald & Headlam (2009), the qualitative method focuses on the evaluation of social dimension quality information; understanding of reasons for actions establishing how people interpret their experiences. Qualitative methods provide insights into the setting of a problem, generating proposition; informing on how people feel and what they think.

The research focuses on drawing data from small emerging contractors in SA on how they are using apps to improve their business performance. The research report uses a mixed methodology both qualitative and quantitative approach to analyse the data. Firstly, qualitative data is analyzed through thematic narrative analysis investigating how apps are utilized for business. Secondly, quantitative data is analyzed using the correlation coefficient to assess the strength of relationships between pairs of variables. The mixed methodology has been selected in this research report using a deductive approach. Facts will be gathered through telephone interviews drawing on both qualitative and quantitative sources of data. Establishing what constitutes acceptable knowledge concerning apps adoption for business and substantiate the proposition in the research report.

The research report uses a mixed methodology approach because it seeks to provide contextual background and to better understand the research problem. The qualitative method helps the research report to explain and interpret the quantitative data analyzed using correlation analysis of the association between the research proposition variables. The mixed-method approach is important as it provides a better understanding of how small emerging contractors in SA use apps to improve their business performance. The mixed method is used in the research report to achieve the research objectives. The first research objective identifies the various popular apps available for business usage, the objective is achieved through analysis of both qualitative

and quantitative data. The second research objective assesses the extent of use and how widespread particular apps are utilized and for what purpose; qualitative data is analyzed to achieve the second objective. The third objective assesses the adoption trend of apps for business operations amongst emerging contractors and understand the adoption trend relates to the qualitative data analysis. Quantitative data is analyzed to substantiate the association between variables in the research proposition.

3. 5 Population and Sampling

A sample is a subset of the population and is representative of the target population (Acharya, Prakash, Saxena, & Nigam, 2013). The term population refers to a full set of cases or elements from which a sample is taken (Saunders et al., 2016). The sampling techniques enable a researcher to reduce the amount of data one needs to collect by considering only data from a subgroup rather than all possible cases. Sample selecting study represent the full set of cases in a meaningful manner and enables the researcher to answer the research question and generalise statically.

The target population, subset of the population, and focus of the research question are the emerging contractors with CIDB grade 1-4 general building (GB) in Gauteng, SA. There are greater numbers of general building contractors on the CIDB register of contractors with CIDB grading 1-4 (CIDB, 2017). There are far more grade 1 GB contractors on register reflecting the ease of entry for this category of construction contractors within the industry. A larger sample size results in a minimal error in generalizing to the target population, the sample is representative of the entire population.

Table 7: CIDB contractor registration figures

DESIGNATION	CE	EB	EP	GB	ME	SW	Total	Percentage
Grade 1	24,774	1,659	6,018	54,053	5,996	20,274	112,774	88%
Grade 2	1,586	159	169	2,120	311	599	4,944	4%
Grade 3	899	56	95	595	112	196	1,953	2%
Grade 4	907	105	237	845	176	194	2,464	2%
Grade 5	681	118	216	584	158	184	1,941	1%
Grade 6	787	63	181	676	142	104	1,953	2%
Grade 7	433	42	82	330	60	57	1,004	1%
Grade 8	152	11	35	121	39	38	396	0,3%
Grade 9	74	2	26	47	31	24	204	0,2
Total	30,293	2,215	7,059	59,371	7,025	21,670	127,633	100%

Source: Table compiled after CIDB (2017).

The geographical area for the research is based in Gauteng province, the province has the highest number of formal and informal business sector SMEs (Mbuyisa & Leonard, 2015). There are gaps and limited research conducted in Gauteng province on the use of apps amongst small emerging contractors, the research will provide further body of knowledge and a better understanding on the use of apps for business amongst emerging contractors in this province and SA. The CIDB register of construction contractors reflects that Gauteng Province has the second-highest, after KwaZulu-Natal Province, number of general building contractors when compared with other provinces in SA (CIDB, 2017). Gauteng Province is selected in the research as the geographic area of the research, because of the large sample size of CIDB grade 1-4 GB contractors in the Province. ICASA (2019) report on the state of the ICT sector in SA notes that LTE devices subscription nationally is 12,644,364. Gauteng Province leading the pack with 4,304,758 LTE devices, lastly with Northern Cape with lower numbers of LTE devices at 220,700 in the year 2018 as illustrated in Figure 16 below. Gauteng province is also selected as the research geographic area because of the high numbers of LTE device subscription, and this is important for the research report as it aims to explore the use of apps uses by small emerging contractors in SA to improve their business performance. Furthermore, the province to ensure the research obtains high response rate to reduce the risk of non-response bias and ensuring sample is representative of the target population.



Figure 15: Map of Gauteng Province with municipalities (Wikimedia commons, 2006)

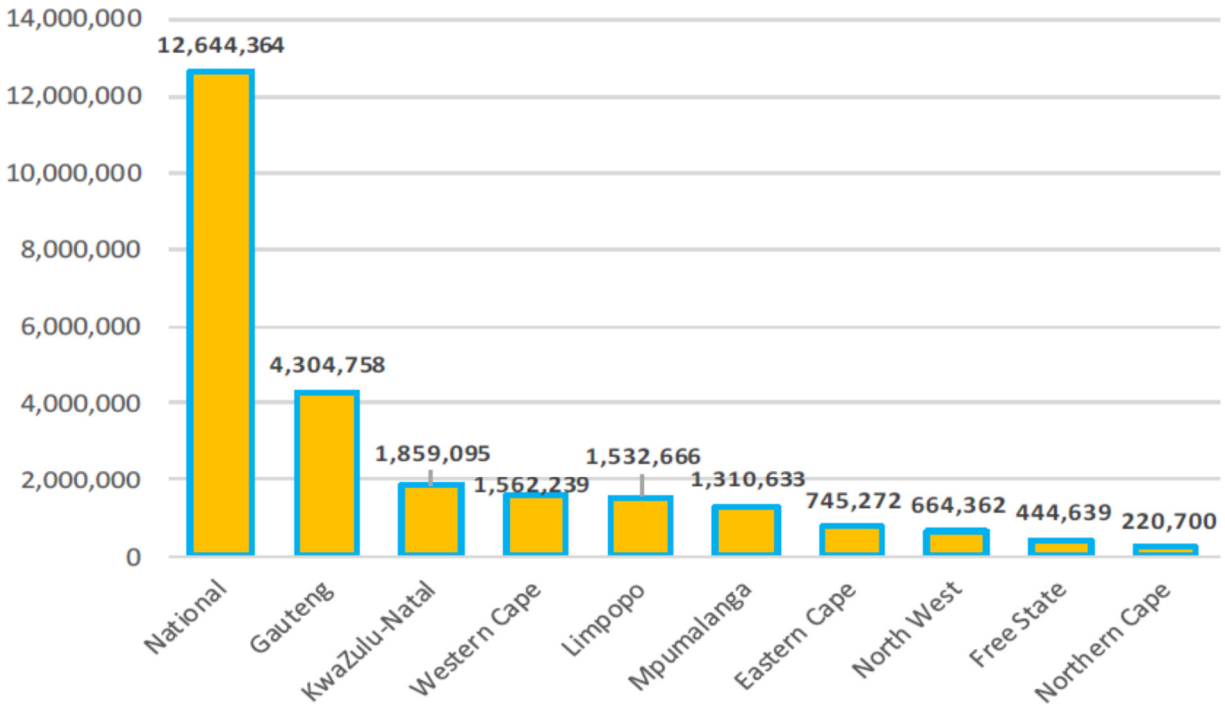


Figure 16: Total number of LTE Devices per Province in 2018, (ICASA, 2019)

There are two types of sampling techniques namely probability or representing sampling and non-probability sampling. Probability sampling, the researcher generalizes sample findings to the target population (Acharya et al., 2013). The probability of sample chosen from the target population is known, the sample is representative of the target population and researcher can estimate statically characteristic of the target population from the sample (Saunders et al., 2016). Non-probability sampling, probability of sample selected from the target population is unknown, and cannot make statistical estimates from the sample about the target population.

The justification for selecting probability sampling in the research report is because the research uses proposition testing through significance testing; testing the probability of a relationship between variables occurring by chance alone. The probability sampling technique is selected because the research makes statistical inference using correlation analysis significance testing, the research seeks to achieve a representative sample from the target population and to minimize sampling bias.

The sampling frame for the research is the Central Supply Database (CSD) of emerging contractors with CIDB 1-4 GB operating businesses in Gauteng Province. Statistical inference is made from the sample about the target population in CSD to answer the research question and generalize about the target population to achieve objectives and aim of the research.

The six techniques used to select probability sampling all utilize the random process for sampling; the techniques are namely: simple random; systematic random; stratified random; cluster; multi-stage sampling and multiphase sampling (Acharya et al., 2013).

The stratified random sampling method is utilized in the research report; stratified random sampling the data collected is divided into sub-groups (strata) with similar characteristics. Random samples were chosen from each stratum; ensure an equal chance of selection from strata and sample is representative of sub-groups in the target population (Acharya et al., 2013). The stratified random sampling technique is selected in the research report to categorize and classify the different CIDB grading of emerging contractors from level 1 to 4; to get a better understanding of apps adoption from different CIDB grades. The stratified random sampling technique is selected to cluster and categorize the respondents in the research report according to the various municipalities they operate within in Gauteng province so the sample is representative of the target population according to regions.

The sampling frame is the CSD of emerging contractors with CIDB 1-4 GB, data is collected from the sample in the target population. The sample is divided into two categories forming different strata; firstly, divided by CIDB grading 1-4. Secondly divided according to geographic location, the sample is selected from the sampling frame of emerging contractors who operate their business in Gauteng Province; the sample is separated into five different municipalities forming strata with similar characteristics. The municipalities within Gauteng Province are Ekurhuleni, Johannesburg, Tshwane, Sedibeng and West Rand; the municipalities are separated to form differing strata with similar characteristics to select a representative sample from the target population.

The population size is the total number of people within a target population (Macdonald & Headlam, 2009). Determining the sample size to be selected from a target population is based on the confidence level in the estimate; the margin of error to be tolerated; the size of target population and data analysis technique utilised in research (Saunders et al., 2016). Larger sample sizes are more representative of the target population this is known as the “law of large numbers” (Saunders et al., 2016: 280). The research uses a 95 per cent level of confidence within the 5 per cent margin of error; a greater proportion of sample represent characteristic of the target population. Higher response rate ensures a reduction of risk of non-response bias and that sample is representative of the target population.

3. 6 Data Collection Protocol

The research report uses a mixed methodology approach primary data collection include telephone interviews and transcribing. The telephone interviews substantiate the research proposition and answer the research questions. Data is collected using telephone interviews and transcribed verbatim. The telephone interview is selected to collect data from the respondents in the research report to provide contextual background and a better understanding of how are small emerging contractors in SA using apps to improve their business performance. The stories and narratives from the telephone interviews will provide both qualitative and quantitative data.

According to Kothari (2004), there are two types of data; primary data, original and collected for the first time; secondary data, have been collected by other researchers and passed the statistical process. The research report collects primary data from respondents through telephone interviews between interviewer and interviewees.

The different types of interview techniques are informal chats, highly structured, formal interviews, taped and transcribed (Macdonald & Headlam, 2009). Interview styles are made up of three types; structured, semi-structured and unstructured. The report uses semi-structured telephone interviews to gather both qualitative and quantitative data. The interview follows a set of specific questions which are worked through systematically, acquiring information to compare responses.

From the sample that was selected through stratified random sampling technique from the CSD of CIDB 1-4 GB in Gauteng; ethics clearance was granted to conduct the research. Invitation to respondents was sent randomly via email and willing respondents signed the consent forms.

Primary data collected from respondents is through telephone interviews; the interview is divided into two sections. The first section collects quantitative data relating to the background information and characteristics of the target population and sub-groups of emerging contractors. Characteristics information relating to the gender, age, highest qualification, firm annual turnover, number of employees, population group, company years in existence operating within the construction industry, and the number of apps installed in smartphone devices. The second section of the interview gathers qualitative data to achieve the objectives of the research and answer the research question.

3. 7 Ethical Risks and Mitigation Strategy

Saunders et al. (2016) define research ethics as standards of behavior that guide the researcher conduct concerning the rights of those who become the subject of research or are affected by it. Collection of primary data is conducted through telephone interviews; access to primary data is informed by the research question.

Types of access are traditional access, internet-mediated access and intranet-mediated access. The research report uses traditional access to collecting data. Traditional access refers to face-to-face interactions for interviews, telephone conversation, and correspondence and through data archives. The level of access is rational access as physical access will be difficult to access. The report uses a hybrid access strategy, a combination of traditional access with internet-mediated access, uses emails to invite respondents to participate in research and telephone interviews to gather data.

Mitigation strategy to ethical concerns in this research report will be addressed by the use of codes of ethics, ethical guidelines and ethical principles. The use of internet-mediated access has to respect the rights of privacy and copyright. Saunders et al. (2016) indicate that ethical concerns occur during access request, data collection, data analysis and reporting on findings. The safety of researcher, data protection, data management, processing, storage and use of personal and confidential data forms part of ethical concern.

3. 8 Validity and Reliability

Reliability is replication and consistency; the research is reliable when the researcher can replicate earlier research design resulting in the same findings. Validity refers to the process of verifying research data, analysis and interpretation to establish their validity/credibility/authenticity. The appropriateness of the measures used, the accuracy of the analysis of the results and generalizability of findings.

Qualitative and quantitative data is collected through telephone interviews and are not necessarily repeated as interview reflects reality at the time conducted. Based on the probability sampling technique and the proposition used in research it is feasible to replicate qualitative, quantitative and non-standardized research findings by other researchers. The sample is

representative of the target population and the researcher can estimate the statically characteristic of the target population from the sample.

Both qualitative and quantitative data is collected through telephone interviews using questions, meanings and different responses to achieve great credibility. In this research report, credibility is achieved by using primary qualitative and quantitative data validated by respondents. The respondents confirm the accuracy of the interview by commenting and correcting the transcribed notes. Researcher shares the transcript of the telephone interview for validation by respondents.

3. 9 Data Analysis

Qualitative data is analyzed using thematic generation and citation technique (Macdonald & Headlam, 2009). Thematic generation refers to the identification and drawing on common themes from telephone interviews; citation refers to directly quoting interviews in the report and information obtain treated confidentially.

The process of data analysis involves data collection and synthesis to address research objectives and answer the research question. Techniques in data analysis involve summarizing and condensing the data, code and categorize the data for grouping into themes. The themes and categories are linked to formulate the structure to answer research question (Saunders et al., 2016). The research report is based on a deductive approach, existing theory informs the qualitative research process and data analysis.

Qualitative data is analyzed based on the narrative analysis technique; refers to the collection of analytical approaches to analyze different aspects of narrative and include preservation of data narrative form and structural elements. The approach to narrative analysis is thematic narrative analysis; referring to identifying analytical themes within narratives, focusing on the content of the narrative. Narratives are analyzed separately and then compared and contrasting the finding across; searching themes across narratives. Colour-coding is used to analyze intact narratives, identifying themes across and comparing narratives. The thematic narrative analysis is chosen in the research report to analyze the data captured through interviews and achieve the objectives of the research and answer the primary research question. The answer to the primary research question on how small emerging contractors in SA are using apps to improve their business performance, is qualitative in nature the thematic narrative analysis is suitable to understand and interpret the narratives of the small emerging contractors. The research

objectives are achieved through qualitative data analysis relating to the assessment on the extent of use and how widespread particular apps are utilized, for what purpose and understand the adoption trend.

Quantitative data is analyzed using Pearson's product correlation coefficient (PMCC) to assess the strength of the statistical relationship between two variable containing numerical data (Saunders et al., 2016). The correlation coefficient is the statistical association quantifying the strength of the linear relationship between two random numerical variables. The coefficient value can vary between +1 and -1; figure +1 represent positive correlation and figure -1 represent a negative correlation. A positive correlation means that the two-variable assessed are related, as the value of the other variable increases the other variable will also increase. A negative correlation means the variable are related; however, as values of the one variable increase the other variable will decrease. A correlation value of 0 means that the variables are independent; a correlation coefficient more than +0.2 and -0.2 mean a weak positive and a weak negative. The research report uses the value of 0.05 (5 per cent) to check for the probability of the correlation coefficient having occurred by chance. The correlation coefficient is statistically significant when the probability of the correlation coefficient is less than or equal to 0.05. The relationship between the variables is not statistically significant when the probability is greater than 0.05.

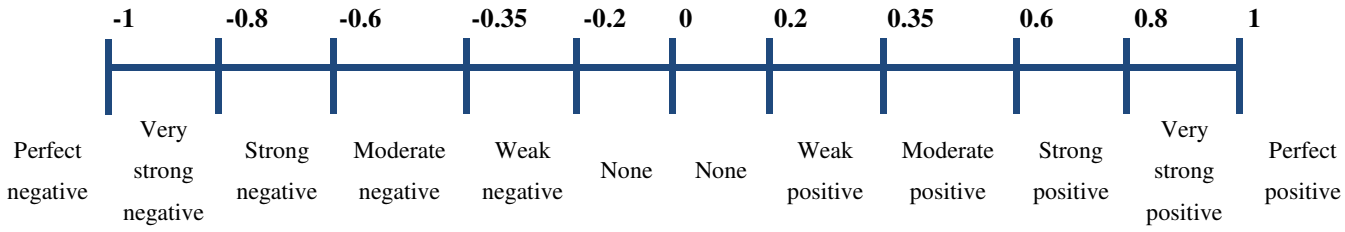


Figure 17: Correlation Coefficient Values (Saunders et al., 2016)

4. Research Findings Presentation and Analysis

4. 1 Introduction

The preceding section, chapter 3, outlines the research methodology to be utilized in the report to meet the objective and rationale of the research. The research report aims to explore the use of apps uses by small emerging contractors in SA to improve their business performance. The main objective of the research report is firstly, to identify various popular apps available for business usage. Secondly, assess the extent of use and how widespread particular apps are utilized and for what purpose. Lastly, to assess the adoption trend of apps for business operations amongst emerging contractors in SA and understand the adoption trend towards apps.

This section discusses the collection and analysis of both qualitative and quantitative data captured from the respondents; the section is separated into two parts. The first part collects statistical data relating to the target population; capturing background information relating to the gender, age, highest qualification, firm annual turnover, number of employees, population group and company years in existence within the construction industry. The second part of the presents an analysis of qualitative and quantitative data to meet the objectives of the research. This chapter aims to present data collected through telephone interviews to answer the research question. The data is analyzed using thematic narrative analysis; narratives are analyzed in-depth separately into themes, then compared and contrasting the finding across. Quantitative data is analyzed using the correlation coefficient to assess the strength of relationships between pairs of variables.

4. 2 Representative Sample of Emerging Contractor

The database of emerging contractors was sourced from a sampling frame, a supplier list from CSD of construction contractors with CIDB grading 1-4 GB operating their business in Gauteng Province. On the CSD sampling frame the target population number of different contractors with CIDB 1-4 grading are as follows: for CIDB grade 1GB contractor = 4677; CIDB grade 2GB = 369; CIDB grade 3GB = 146 and CIDB grade 4GB = 165. The total target population number of CIDB grade 1-4GB is 5357 contractors for all municipalities in Gauteng Province; the recommended or minimum sample size required is calculated using a formula by Saunders et al. (2016) illustrated in Figure 18 below.

$$n = (p\%)(q\%)\left(\frac{z}{e\%}\right)^2$$

Where

n	minimum sample size required
$p\%$	percentage belonging to specified category
$q\%$	percentage not belonging to specified category
z	value of level of confidence required
$e\%$	margin of error required

Figure 18: Formula for calculating the minimum sample size (Saunders et al., 2016)

The target population size is 5357 of emerging contractors CIDB 1-4GB identified from the CSD sampling frame. The research uses 95 per cent level of confidence within 5 per cent margin of error, thus level of confidence z = 1.96; the estimate proportion of responses expected is 40%. To calculate the minimum sample size, the information is put into the formula resulting in calculation reflected in Figure 19 below.

$$n = (p\%)(q\%)\left(\frac{z}{e\%}\right)^2$$

$$n = (40)(60)\left(\frac{1{,}96}{5}\right)^2$$

$$= (2400)(0{,}392)^2$$

$$= (2400)(0{,}154)$$

$$= 369.6 \text{ responses}$$

Figure 19: Calculation of the minimum sample size required (Own calculation after formulae from Saunders et al., 2016)

The minimum sample size is 370 responses to maintain a 95 per cent level of confidence within the 5 per cent margin of error. The adjusted minimum size from the target population of 5357 emerging contractors with CIDB 1-4 GB is thus calculated in Figure 20 below.

$$n' = \frac{n}{1 + \left(\frac{n}{\mathrm{N}}\right)}$$

Where

n' adjusted minimum sample size

n minimum sample size

N total population

Figure 20: Formula for calculating adjusted minimum sample size (Saunders et al., 2016)

$$n' = \frac{n}{1 + \left(\frac{n}{\mathrm{N}}\right)}$$

$$= \frac{369{,}6}{1 + \left(\frac{369{,}6}{5357}\right)}$$

$$= \frac{369{,}6}{1 + 0{,}06}$$

$$= \frac{369{,}6}{1{,}06}$$

$$= 348{,}67$$

Figure 21: Calculation for adjusted minimum sample size (Own calculation after formulae from Saunders et al., 2016)

Figure 21 above illustrates the calculation for adjusted minimum sample size; from the 349 respondents of emerging contractors with CIDB grade 1-4 GB who were invited via email through stratified random sampling technique a response of 89 respondents consented to take part in the research. Thus, 89 responses from 349 potential respondents' results in the total response rate calculated as follows in Figure 22 below.

$$= \frac{\text{total number of responses}}{\text{total number in sample} - \text{ineligible}}$$

$$= \frac{89}{349 - 12}$$

$$= \frac{89}{337}$$

$$= 26\%$$

Figure 22: Total response rate (Own calculation after formulae from Saunders et al., 2016)

Thus, 26 per cent is the total response rate calculated from 89 willing consenting respondents from 349 stratified randomly selected sample that is representative of the target population of emerging contractors; 95 per cent level of confidence within 5 per cent margin of error. Non-responsive emerging contractors were not considered in the sampling frame and were replaced by others through stratified random sampling method until 89 consenting respondents who are a representative sample of the target population was achieved.

4. 3 Profile of Emerging Contractor

In this section, the data relating to the characteristics of the emerging contractors is collected from the respondents and presented in tables, graphs and discussed. The section covers background information relating to the classification and categorization of firms, the company profile, demographics and information of the respondents. Qualitative and quantitative data is collected and analyzed using thematic narrative analysis and correlation coefficient to establish whether the profile of construction companies correlates to the adoption of apps for business operations. Generalizing to the target population and statistical inference are done on the data collected to achieve research objectives.

The stratified random sampling method is utilized in the research report; respondents were sent emails by randomly selecting 349 potential respondents on Gauteng CSD of emerging contractors resulting with 26 per cent response rate. Telephone interviews were conducted with 89 respondents, interviews were transcribed and the data was analyzed.

The sample is divided into two categories, strata; firstly, divided according to CIDB grade 1-4; secondly divided according to geographic location. The sample is further separated into five

different municipalities forming strata with similar characteristics. The municipalities within Gauteng Province are Ekurhuleni, Johannesburg, Tshwane, Sedibeng and West Rand. The municipalities are also separated to form differing strata with similar characteristics to select a representative sample from the target population. The 89 consenting respondents, with 26 per cent response rate, are representative of the category in which respondents are classified; respondents are proportionally allocated on strata in alignment to the total target population so the research is not biased.

Table 8: CSD Database CIDB 1-4 GB contractors in Gauteng Province

Target population CIDB grade 1-4 GB contractors, Gauteng						
Geographic area Gauteng municipalities	CIDB 1-4 GB contractors				Total	%
	CIDB 1	CIDB 2	CIDB 3	CIDB 4		
1. Ekurhuleni	710	50	17	17	794	15%
2. Johannesburg	2324	200	75	91	2690	50%
3. Tshwane	1290	87	41	46	1464	27%
4. West Rand	155	10	5	4	174	3%
5. Sedibeng	198	22	8	7	235	5%
Total	4677	369	146	165	5357	100%
Percentage	87%	6.9%	3%	3.1%	100%	

Source: Own table compiled from Government CSD of emerging construction contractors in Gauteng.

Table 8 above indicates that the number of registered CIDB grade1-4 GB contractors on CSD reveal that CIDB grade 1 contractors comprise 87% from the target population of 5357 general building contractors in Gauteng. The figures of CIDB grade 1 GB contractors on CSD confirm findings of research conducted by CIDB (2017); that grade 1 contractors comprise 80% in 2007 and later increased to 88% in July 2015. This is partly due to the ease of entry into the industry (CIDB, 2017). Grade 1 contractors do not have a barrier to register with CIDB; they are not required to present previously completed projects and financial capability records to register.

The CSD of registered CIDB grade1-4 GB also reveal that CIDB grade 2 contractors comprise of 6.9% of the target population; whilst CIDB grade 3 contractors are 3% and CIDB grade 4 makes up 3.1% of the total targeted population.

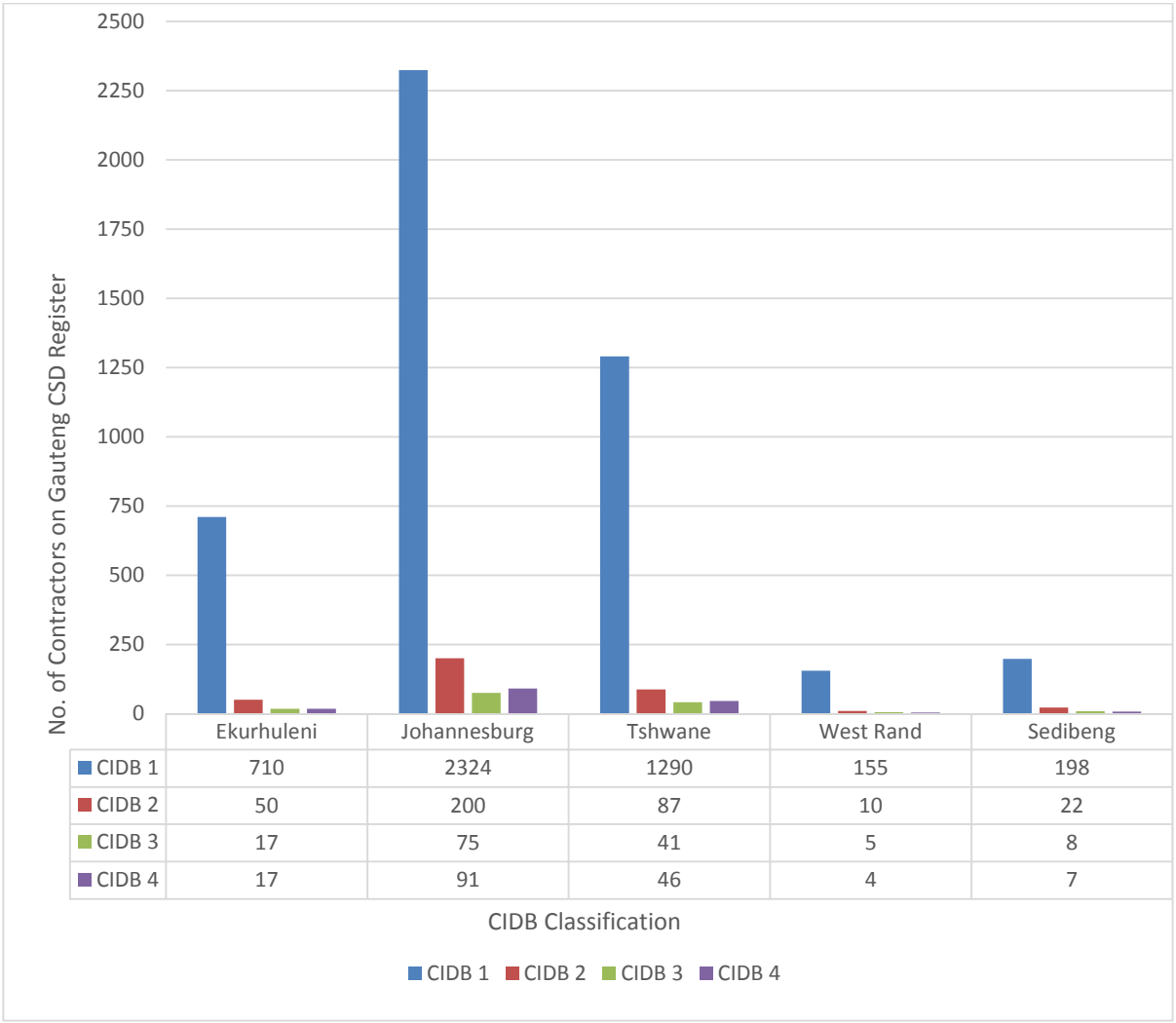


Figure 23: Target population on CSD Database (Own graph compiled from Gauteng Province CSD)

The graph above in Figure 23 indicates that city of Johannesburg municipality has the greatest number of registered contractors in Gauteng Province, comprising 50% of the target population. City of Tshwane municipality has the second-highest number of registered CIDB grade 1-4 GB contractors with 27% of the total target population; followed by Ekurhuleni municipality comprising of 15% of the total target population. Sedibeng municipality comprises of 5% whilst West Rand municipality with 3% has the lowest number of registered contractors in Gauteng from the target population on CSD.

Table 9: Stratified Random Sample of 89 Respondents

89 Respondents CIDB grade 1-4 GB contractors, Gauteng						
Geographic area Gauteng	CIDB 1-4 GB contractors				Total	%
	CIDB 1	CIDB 2	CIDB 3	CIDB 4		
1. Ekurhuleni	11	1	1	0	13	15%
2. Johannesburg	39	3	1	2	45	51%
3. Tshwane	21	1	1	1	24	27%
4. West Rand	2	1	0	0	3	3%
5. Sedibeng	3	1	0	0	4	4%
Total	76	7	3	3	89	100%
Percentage	87%	7%	3%	3%	100%	

Source: Own table compiled from CSD Database; a stratified random sample of the 89 respondents, a representative in proportion to the target population.

Table 9 above indicates the stratified random sample of the 89 consenting respondents who are representative of the total target population of construction contractors grade 1-4 GB from CSD in Gauteng. The 89 respondents are proportionally allocated on strata as per geographic area and CIDB grade 1-4; the strata allocation is aligned to the total target population. The 89 respondents sample size results in a minimal error in generalizing to the target population, the proportion of sample represent characteristic of the target population.

In generalizing to target population the stratified random sample of 89 respondents is aligned to the target population by ensuring that the CIDB grade 1 consenting respondents are comprised of 87% of the total number of respondents. CIDB Grade 2 contractors comprise of 7%; whilst CIDB grade 3 contractors are 3% and CIDB grade 4 makes up 3% of the total number of respondents. The 89 respondents are proportionally allocated on strata as per the geographic area in alignment to the target population on the CSD in Gauteng Province.

4. 4 Respondent's Biographical Data

Primary data was collected from the 89 respondents through telephone interviews; the first section gathered details relating to demographics and background information of the respondents. General background relating to age, gender and population group (black,

coloured, Indian, White or Chinese) of the respondents. Furthermore, highest educational qualification obtained; the role or position held in the company and years of experience in the construction industry.

To further assess the extent of use apps amongst emerging contractors the telephone interviews gathered both qualitative and quantitative data relating to the characteristics of the construction company to ascertain whether company profile impacts the apps adoption trend for business. Company details relating to years of existence as a construction contractor; the company CIDB grade and the number of permanent or temporary employees hired by the company. Furthermore, company previous financial year annual turnover; the typical size of projects executed in the past three years. Company details relating to typical clients; the type of work executed; how the procurement of work is conducted and the geographic location of projects.

The data is presented in tables and analyzed substantiating the research proposition through establishing whether the widespread apps adoption trend for business is occurring amongst emerging contractors with CIDB grading 1-4 GB in Gauteng.

Table 10: Respondent's Gender and Population Group

Population Group	Gender				Total	Percentage
	Male	% of total	Female	% of total		
Black	73	82%	12	13%	85	95%
Colored	1	1%	3	4%	4	5%
Indian	0	0%	0	0%	0	0%
White	0	0%	0	0%	0	0%
Chinese	0	0%	0	0%	0	0%
Total	74	83%	15	17%	89	100%

Source: Own table compiled from CSD Database; gender and population group of 89 respondents

Table 10 above indicates the population group and gender of the 89 respondents; the data reflect that there are 95% of black emerging contractors consenting respondents who form part of the research report; the remaining 5% is comprised of coloured emerging contractors. The other population groups, Indian, white and Chinese, did not form part of the respondents in the research report. The demographic data shows the similarity and the difference between the

sample and the population; in absence of statistical confidence for inference, the sample is broadly representative of the population in Gauteng Province and nationally.

The gender of the respondents is 82% for black males, 1% for coloured males total comprising 83% for males. Females comprise of 13% for black females and 4% for coloured females with a total of 17% for females; the data confirm that the construction industry is mainly dominated by males agreeing with the report by CIDB (2017). However, the respondents' gender representation in table 10 above contradicts with women ownership of emerging contractors on CIDB register which is 48% for grade 1-4 GB (CIDB, 2017).

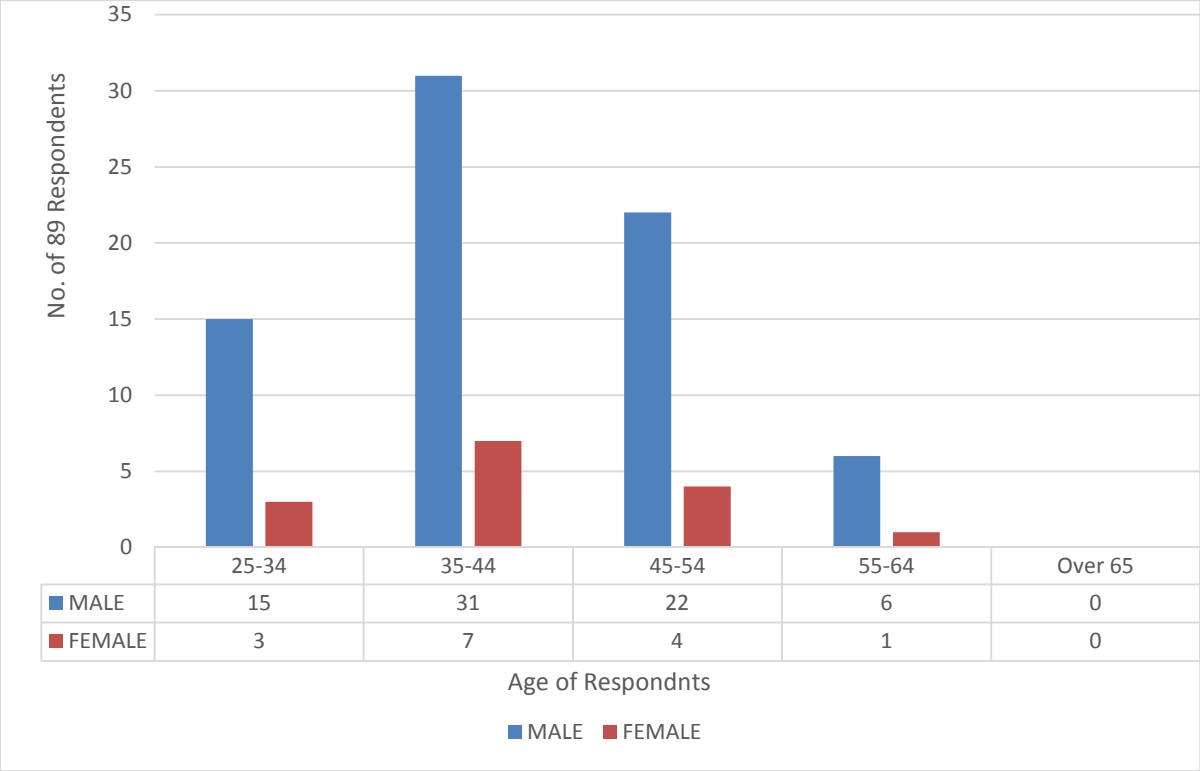


Figure 24: Respondent's Gender and Age (Own graph compiled from CSD Database; gender and age of 89 respondents)

The graph above on Figure 24 indicates the gender and age of the 89 respondents. The number of males in the research report is made up of a total percentage of 83%; out of these 35% is comprised of the age group between 35 and 44 years. Followed by the age group 45 and 54 years comprising of 25% of males; the age group 25 and 34 years is made up of 17% whilst the age group 55 and 64 years has the least number with 7% of the total male respondents. On the other hand, from the total the total number of all the respondents females comprise of 17% of the respondents, 8% is for the age groups 35 and 44 years; trailed by 5% between the ages

45 and 54 years, 3% for age group 25 and 34 years, lastly, 1% for age group 55 and 64 years. There were no respondents over the age of 65 for both male and females; the data also illustrate that the youth has minimal figures from the respondents this could be partly due to experience required to manage a construction company with CIDB grade 1-4. The background information relating to gender and age of the respondents is similar to the data of the target population on the CIDB register; there are low numbers of youth and women with the majority comprising predominantly of males in the age group 35 - 45 (CIDB, 2017). The sample is broadly representative of the target population but the results cannot be statistically inferred to the entire population with any statistical level of confidence.

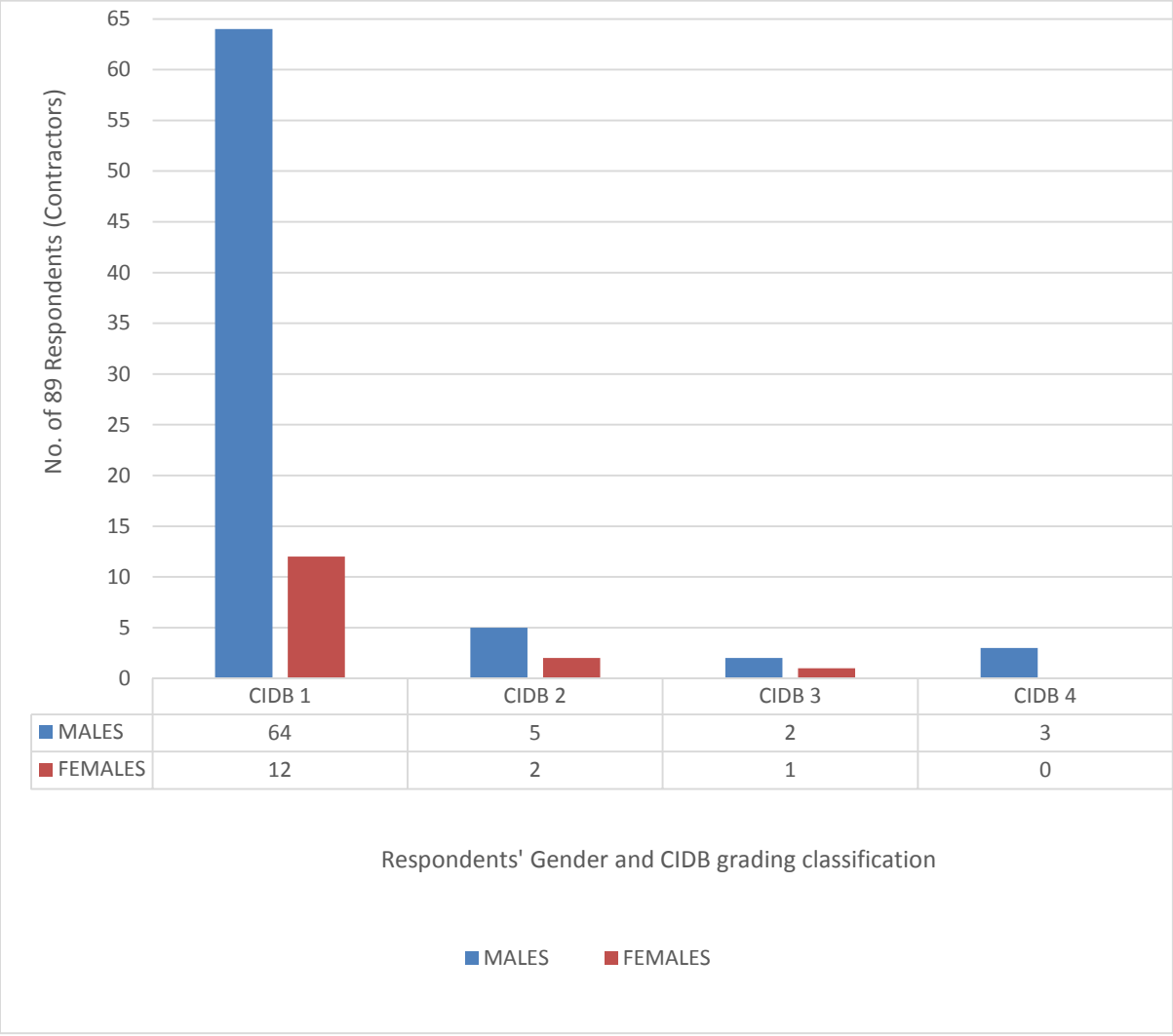


Figure 25: Gender and CIDB Classification (Own Diagram compiled from CSD Database; gender and CIDB grade classification of respondents)

The diagrams in Figure 25 above illustrate the gender and CIDB classification between grades 1-4 of the 89 respondents. CIDB grade 1 comprise of 76 respondents, 64 are males and 12 are females. CIDB grade 2 has a total of 7 respondents consisting of 5 males and 2 females. CIDB grade 3 and 4 contractors each has a total of 3 respondents; for grade 3 there are 2 males and 1 female; grade 4 only consists of 3 males. The data reflects fewer numbers of women ownership in construction companies as compared to males.

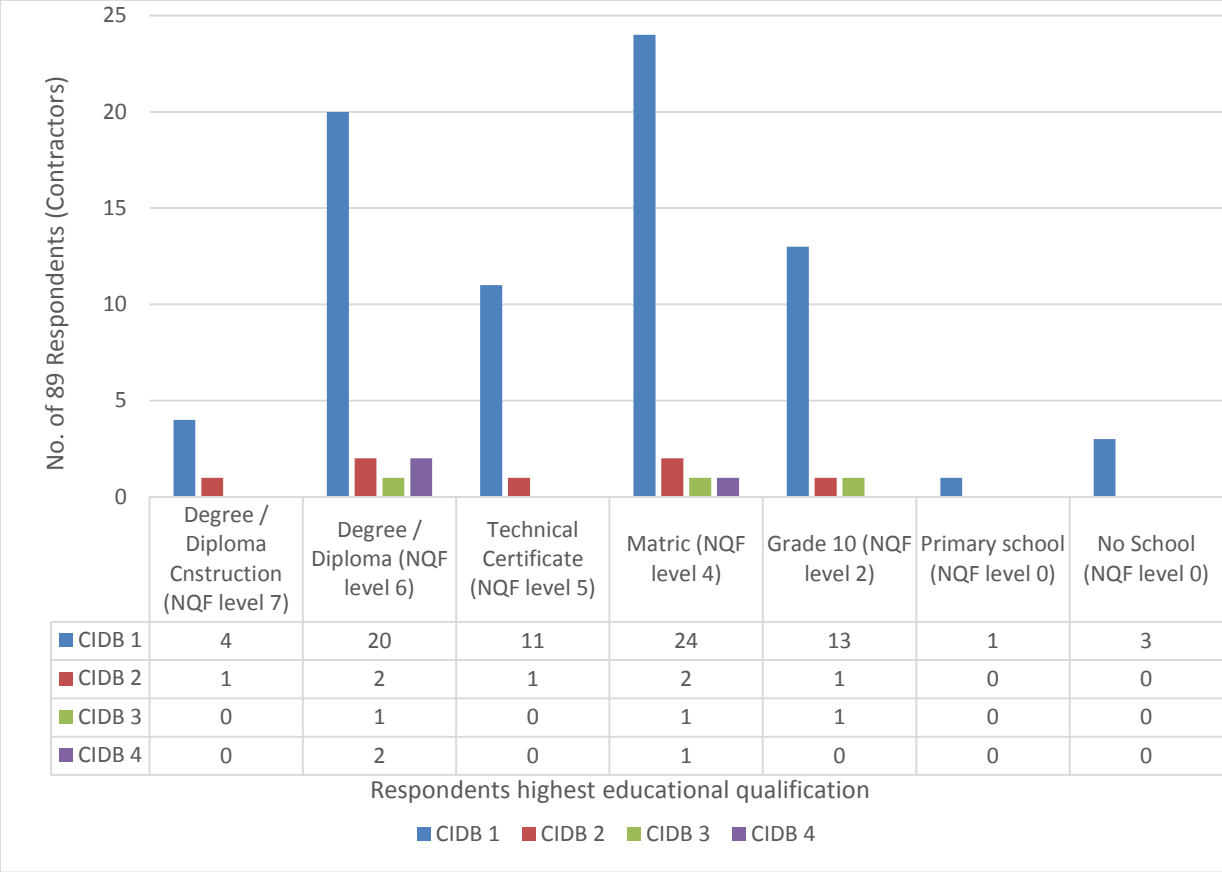


Figure 26: Respondent's highest educational qualification (Own graph compiled from CSD Database; respondents' highest educational qualification)

The graph in Figure 26 above indicates the highest educational qualification of the 89 respondents. The data reflects that CIDB grade 1 respondents the majority in the research, 27% have a matric certificate; 22% possess a degree from university not in construction, 5% have a degree or diploma in construction-related qualification, 12% hold a technical certificate whilst 19% hold lower levels of education. Educational qualifications for CIDB grade 2 respondents indicate that 2% have matriculated another 2% have non-construction related degrees from university; 1% hold construction qualification degrees, 1% technical certificate and lastly 1% have education below grade 10. Educational qualifications for CIDB grade 3 and 4 respondents

reflect 3% have degrees from university not in construction whilst other respondents have matriculated and possessing lower educational levels.

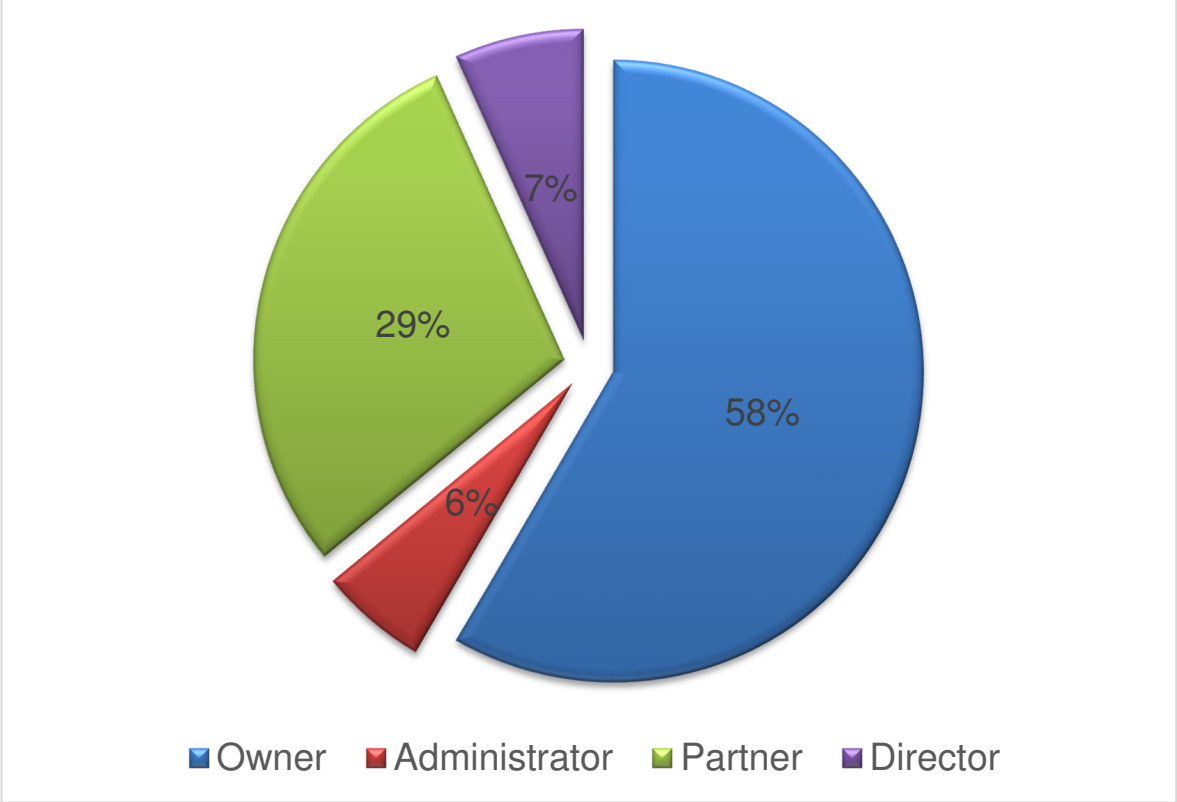


Figure 27: Respondents role/position in company (Own diagram compiled from CSD Database; respondent's role in company)

The diagrams in Figure 27 above indicate the different roles or the positions held in the construction company by the 89 respondent. The largest portion of respondent's role or position in the company is the Owner manager with well over 58% share of the total respondents; partners and co-owners is the second greatest portion with 29% of the respondents reporting that they are co-owners of the firms they are managing. The data confirm the findings that in SA emerging construction companies are unilaterally owner-managed small business having limited financial capabilities and the firms are mostly managed by owners who lack formal education and training; lacking formal business premises and equipment (Thwala & Phaladi, 2009; Thwala & Mvubu 2008; Waziri et al., 2014). Only 7% of the total respondents reported that they are directors of the construction companies; whilst 6% of respondents indicated that they form part of the administration in the construction companies that employ them.

Table 11: Respondent's Company Profile

Contractors classified by Gauteng municipality		Company Age (Years)	CIDB grade	Permanent/ Temporary Employees		2018 Annual Turnover	Typical Project size (3years)	Clients	Source of projects	Project Geographic area
				P	T					
Ekurhuleni Respondents	E – 1	3	CIDB1	0	3	R25 000	R75 000	Private	Referral	Ekurhuleni
	E – 2	10	CIDB2	1	5	R0,75	R2,5 m	Public/Private	Tender/referral	Gauteng
	E – 3	7	CIDB1	2	10	R0,1 m	R1,5 m	Private	Referral-Market	Gauteng
	E – 4	8	CIDB1	3	8	R0,5 m	R2 m	Subcontractor	Tender/referral	Gauteng
	E – 5	2	CIDB1	0	5	R30 000	R90 000	Private	Referral	Ekurhuleni
	E – 6	5	CIDB1	0	0	NIL	R0,5 m	Public/Private	Tender/referral	Gauteng
	E – 7	8	CIDB1	0	3	R0,1 m	R1,5 m	Public	Tendering	Gauteng
	E – 8	13	CIDB3	4	18	R1,25 m	R4 m	Public/Private	Tender/referral	Gauteng
	E – 9	7	CIDB1	0	11	R90 000	R0,5 m	Public/Private	Tender/referral	Gauteng
	E – 10	4	CIDB1	0	0	NIL	R0,5 m	Subcontractor	Tender/referral	Gauteng
	E – 11	8	CIDB1	0	3	R0,25 m	R1,5 m	Public/Private	Tender/referral	Gauteng
	E – 12	4	CIDB1	3	20	R0,5 m	R2,7 m	Public	Vukphile-CDP	Gauteng
	E – 13	6	CIDB1	0	4	R35 000	R0,1 m	Private	Referral	Johannesburg
Johannesburg Respondents	J – 1	4	CIDB1	1	6	R50 000	R0,15 m	Private	Referral-Market	Johannesburg
	J – 2	4	CIDB1	2	8	R0,1 m	R0,9 m	Subcontractor	Tender/referral	Gauteng
	J – 3	11	CIDB2	3	13	R1 m	R2,75 m	Public/Private	Tender/referral	Gauteng
	J – 4	6	CIDB1	1	8	R0,15 m	R1,5 m	Public/Private	Tender/referral	Gauteng
	J – 5	5	CIDB1	0	5	R75 000	R0,15 m	Private	Referral-Market	Johannesburg
	J – 6	8	CIDB1	0	0	NIL	R1 mil	Public/Private	Tender/referral	Gauteng
	J – 7	2	CIDB1	0	5	R30 000	R90 000	Private	Referral-Market	Johannesburg
	J – 8	4	CIDB1	3	10	R0,1 m	R1,5 m	Public	Vukphile-CDP	Gauteng
	J – 9	8	CIDB1	1	10	R0,25 m	R2 m	Public/Private	Tender/referral	Gauteng
	J – 10	5	CIDB1	1	12	R0,15 m	R1 m	Public/Private	Tender/referral	Gauteng
	J – 11	5	CIDB1	0	6	R0,25 m	R0,8 m	Public/Private	Tender/referral	Gauteng
	J – 12	7	CIDB1	0	0	NIL	R0,5 m	Public	Tendering	Gauteng
	J – 13	12	CIDB2	4	15	R1,15 m	R3,5 m	Public/Private	Tender/referral	Gauteng
	J – 14	3	CIDB1	2	8	R0,25 m	R1,5 m	Subcontractor	Tender/referral	Gauteng
	J – 15	16	CIDB4	3	25	R1,15 m	R4,25 m	Public/Private	Tender/referral	Gauteng
	J – 16	6	CIDB1	0	0	NIL	R0,5 m	Public/Private	Tender/referral	Gauteng
	J – 17	7	CIDB1	2	9	R0,3 m	R1,75 m	Public/Private	Tender/referral	Gauteng
	J – 18	4	CIDB1	0	4	R25 000	R80 000	Private	Referral-Market	Johannesburg
	J – 19	8	CIDB1	1	12	R0,5 m	R1,5 m	Public/Private	Tender/referral	Gauteng
	J – 20	5	CIDB1	0	0	NIL	R0,5 m	Public/Private	Tender/referral	Gauteng
	J – 21	3	CIDB1	0	6	R60 000	R0,25 m	Private	Referral-Market	Johannesburg
	J – 22	7	CIDB1	2	13	R0,75 m	R1,5 m	Subcontractor	Tender/referral	Gauteng
	J – 23	7	CIDB2	3	15	R0,85 m	R2 m	Public/Private	Tender/referral	Gauteng
	J – 24	4	CIDB1	0	8	R50 000	R0,15 m	Private	Referral-Market	Johannesburg
	J – 25	11	CIDB1	3	11	R1,01 m	R2,5 m	Public/Private	Tender/referral	Gauteng
	J – 26	5	CIDB1	0	0	NIL	R0,5 m	Public/Private	Tender/referral	Gauteng
	J – 27	8	CIDB1	2	7	R0,65 m	R1,25 m	Public/Private	Tender/referral	Gauteng
	J – 28	5	CIDB1	0	0	NIL	R0,5 m	Public/Private	Tender/referral	Gauteng
	J – 29	8	CIDB1	2	15	R1,05 m	R0,5 m	Subcontractor	Tender/referral	Gauteng
	J – 30	15	CIDB4	5	20	R2 m	R4,5 m	Public/Private	Tender/referral	Gauteng
	J – 31	4	CIDB1	0	0	NIL	R0,5 m	Public	Tendering	Gauteng
	J – 32	3	CIDB1	0	3	R35 000	R0,1 m	Private	Referral-Market	Johannesburg
	J – 33	5	CIDB1	0	10	R0,35 m	R0,75 m	Subcontractor	Tender/referral	Gauteng
	J – 34	8	CIDB1	1	11	R1 m	R2,5 m	Public/Private	Tender/referral	Gauteng
	J – 35	6	CIDB1	0	9	R0,5 m	R1,75 m	Public/Private	Tender/referral	Gauteng
	J – 36	5	CIDB1	0	0	NIL	R0,5 m	Public/Private	Tender/referral	Gauteng
	J – 37	3	CIDB1	2	10	R0,5 m	R1,85 m	Public	Tender/referral	Gauteng
	J – 38	6	CIDB1	0	0	NIL	R1 m	Public	Tendering	Gauteng

Contractors classified by Gauteng municipality		Company Age (Years)	CIDB grade	Permanent/ Temporary Employees		2018 Annual Turnover	Typical Project size (3years)	Clients	Source of projects	Project Geographic area
				P	T					
Johannesburg	J – 39	5	CIDB1	0	4	R50 000	R0,1 m	Private	Referral-Market	Johannesburg
	J – 40	4	CIDB1	1	11	R0,3 m	R1,75 m	Subcontractor	Tender/referral	Gauteng
	J – 41	11	CIDB3	2	14	R1,2 m	R3,25 m	Public/Private	Tender/referral	Gauteng
	J – 42	5	CIDB1	0	0	NIL	R0,5 m	Public/Private	Tender/referral	Gauteng
	J – 43	3	CIDB1	1	9	R0,85 m	R1,5 m	Public	Vukphile-CDP	Gauteng
	J – 44	6	CIDB1	0	7	R0,25 m	R1,25 m	Public/Private	Tender/referral	Gauteng
	J – 45	5	CIDB1	0	6	R60 000	R0,25 m	Private	Referral-Market	Johannesburg
Tshwane Respondents	T – 1	5	CIDB1	0	0	NIL	R1 m	Public/Private	Tender/referral	Gauteng
	T – 2	12	CIDB2	1	13	R0,9 m	R2,25 m	Public/Private	Tender/referral	Gauteng
	T – 3	7	CIDB1	1	10	R1 m	R1,5 m	Public	Tendering	Gauteng
	T – 4	3	CIDB1	0	0	NIL	R0,5 m	Public/Private	Tender/referral	Gauteng
	T – 5	5	CIDB1	0	0	NIL	R0,5 m	Public	Tendering	Gauteng
	T – 6	3	CIDB1	0	5	R40 000	R0,15 m	Private	Referral-Market	Tshwane
	T – 7	6	CIDB1	0	12	R0,6 m	R1,5 m	Public	Tendering	Gauteng
	T – 8	14	CIDB4	5	20	R1,8 m	R4,25 m	Public/Private	Tender/referral	Gauteng
	T – 9	4	CIDB1	0	0	NIL	R0,5 m	Subcontractor	Tender/referral	Gauteng
	T - 10	4	CIDB1	0	2	R65 000	R0,1 m	Private	Referral-Market	Tshwane
	T - 11	7	CIDB1	2	11	R0,25 m	R1,75 m	Public	Tendering	Gauteng
	T - 12	3	CIDB1	0	5	R0,1 m	R0,9 m	Public	Tender/referral	Gauteng
	T - 13	8	CIDB1	0	4	R0,3 m	R1,5 m	Subcontractor	Tender/referral	Gauteng
	T - 14	6	CIDB1	1	9	R0,65 m	R1,9 m	Public/Private	Tender/referral	Gauteng
	T - 15	8	CIDB1	1	9	R0,5 m	R1 m	Public/Private	Tender/referral	Gauteng
	T - 16	5	CIDB1	0	0	NIL	R0,5 m	Public/Private	Tender/referral	Gauteng
	T - 17	4	CIDB1	0	6	R65 000	R0,12 m	Private	Referral-Market	Tshwane
	T - 18	5	CIDB1	0	0	NIL	R0,5 m	Public	Tendering	Gauteng
	T - 19	13	CIDB3	5	18	R1,4 m	R3,5 m	Public/Private	Tender/referral	Gauteng
	T - 20	8	CIDB1	0	15	R0,9 m	R1,25 m	Public	Tendering	Gauteng
	T - 21	4	CIDB1	2	5	R0,85 m	R1,5 m	Subcontractor	Tender/referral	Gauteng
	T - 22	3	CIDB1	0	0	NIL	R1 m	Public/Private	Tender/referral	Gauteng
	T - 23	7	CIDB1	1	8	R0,5 m	R2,5 m	Public	Tendering	Gauteng
	T - 24	2	CIDB1	0	3	R35 000	R0,1 m	Private	Referral-Market	Tshwane
West Rand	W – 1	3	CIDB1	0	5	R20 000	R80 000	Private	Referral-Market	West Rand
	W – 2	6	CIDB1	0	0	NIL	R1 m	Public/Private	Tender/referral	Gauteng
	W – 3	11	CIDB2	1	10	R1 m	R2,5 m	Public/Private Subcontractor	Tender/referral	Gauteng
Sedibeng	S – 1	4	CIDB1	0	0	NIL	R0,5 m	Public/Private	Tender/referral	Gauteng
	S – 2	7	CIDB1	0	10	R0,5 m	R1,5 m	Subcontractor	Tender/referral	Gauteng
	S – 3	9	CIDB2	1	11	R1.2 m	R3 m	Public/Private	Tender/referral	Gauteng
	S – 4	4	CIDB1	0	5	R55 000	R0,25 m	Private	Referral-Market	Sedibeng

Source: Own table compiled from CSD Database, Respondent's Company profile

Table 11 above captures the characteristics of the construction company for CIDB grade 1-4 GB in Gauteng Province; the characteristics relates firstly to the data which is stratified according to the CIDB grading of the companies and secondly clustered and stratified according to project geographic area captured from the respondents. The nature of projects done by the respondents indicates details relating to typical clients whether these would be classified as public or private projects; the type of work executed and the typical size of projects

executed in past three years. Details concerning when the company was created the number of years in existence as a construction contractor; the number of permanent or temporary employees hired by the company. Furthermore, company previous financial year annual turnover and how the procurement of projects is outsourced. The data collected in table 11 above informs the research to make statistical inference on whether company profile and characteristics impact the adoption trend towards apps for business.

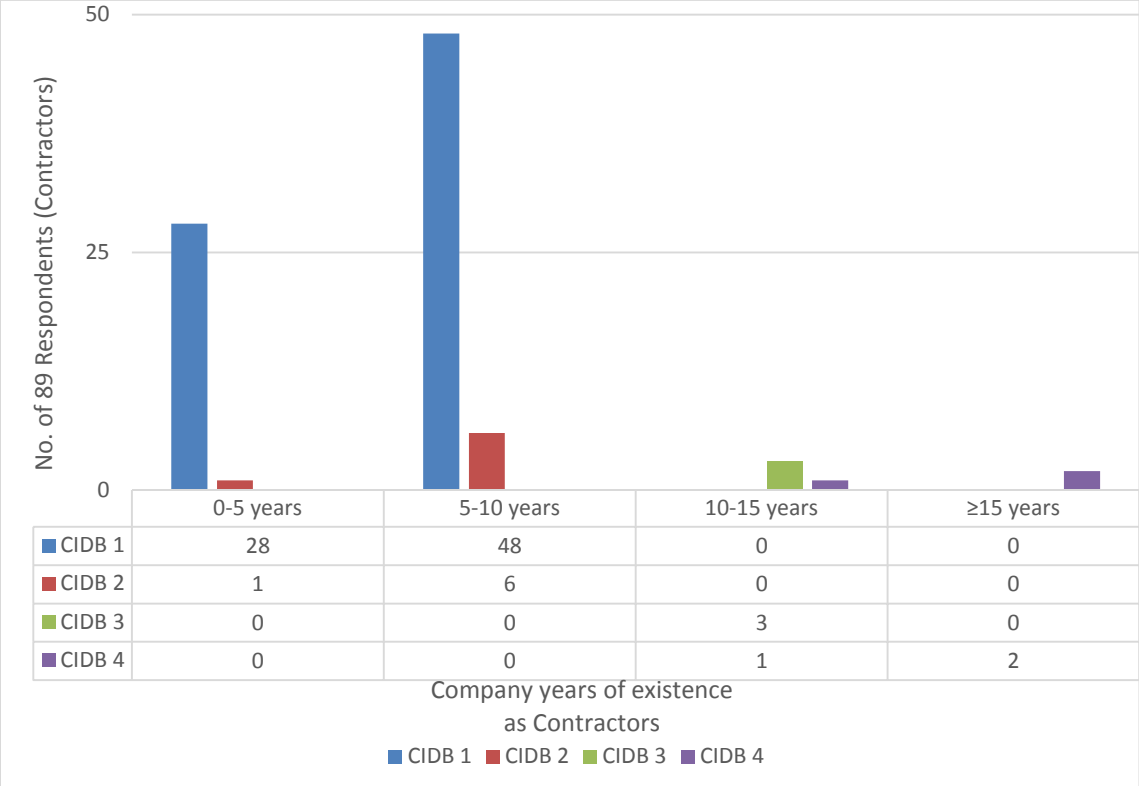


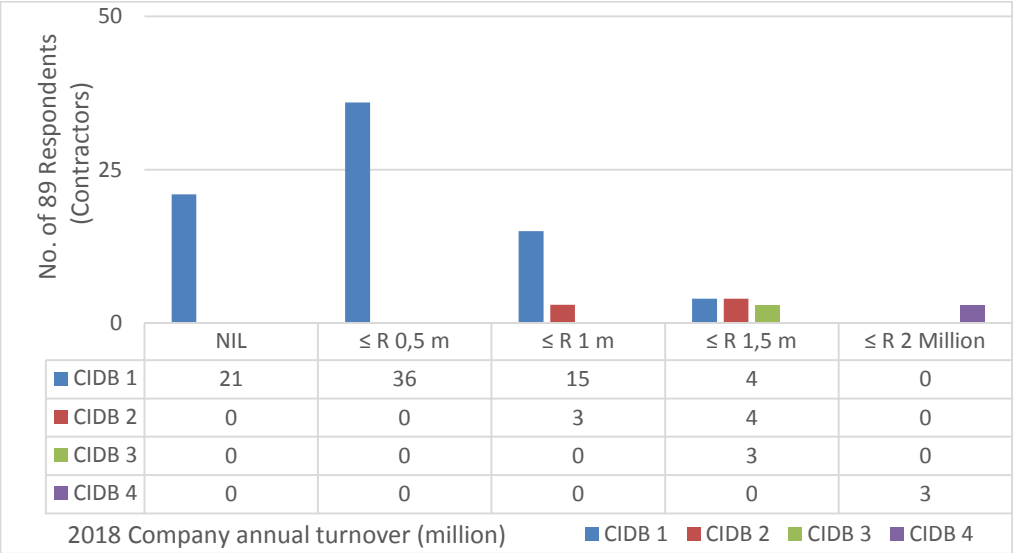
Figure 28: Company years of existence as contractor (Own graph compiled from CSD Database, respondent's company years of existence)

The graph in Figure 28 above indicates the respondent's company years of existence in the construction industry. The data captured in Table 11 and Figure 28 above demonstrate that 54% of the respondents (CIDB grade 1) have had their construction firms established or in existence between 5-10 years. There are 31% of respondents (CIDB grade 1) who have been in existence for less than 5 years; none of the respondents with CIDB grade 1 have been operating their construction firms for more than 10 years and above.

The majority of respondents 7% who are CIDB grade 2 contractors report that they have had their construction firms operational between the years 5-10; with only 1% falling below 5 years of business operation and none above 10 years of firm establishment.

CIDB grade 3 and 4 contractors appear to have more construction-related experience; with 3% of the total respondents who are CIDB grade 3 indicating that their firms have been in operation between 10 and 15 years. CIDB Grade 4 respondents indicate that they have been running their construction business for a period over 15 years with only 2% of respondents reporting on the vast experience they possess in the construction industry.

Figure 28 below illustrates the respondent's company 2018 annual turnover as also shown in Table 11 above. Data collected from the respondents indicate that the CIDB grade 1 contractors, who are the majority in the research report; 40% report making financial returns of less than R0.5 million for the 2018 financial year. 17% of the same CIDB grade 1 group indicate that they have earned more than R1 million for the same financial year. Only a marginal portion 4% of CIDB grade 1 respondents reported earning R1.5 million and less for 2018 fiscal year, and none have reported receiving R1.5 million and above in earnings. A staggering number of respondents 24% reported making nil earnings in 2018 financial year as they were relying on government projects and were not awarded any tenders, some of the respondents have been registered with CIDB and CSD however, have been inactive within the 2018 fiscal year.



	NIL	≤ R 0,5 m	≤ R 1 m	≤ R 1,5 m	≤ R 2 Million
CIDB 1	21	36	15	4	0
CIDB 2	0	0	3	4	0
CIDB 3	0	0	0	3	0
CIDB 4	0	0	0	0	3

Figure 29: Company annual turnover (Own graph compiled from CSD Database, respondent's company 2018 annual turnover)

The graph on Figure 29 above further illustrates that respondents who are CIDB grade 2 contractors, 5% of whom report that the company's annual turnover was below R1.5 million whilst 3% received earnings less than R1 million. None of the CIDB grade 2 respondents

reported making nil on company annual turnover nor did they report making an excess of R1.5 million and less than R2 million. All the CIDB grade 3 respondents (3% of total respondents in research) reported that their companies made an annual turnover of R1.5 million; whilst all the CIDB grade 4 contractors (3% of total respondents) indicate making profits of less than R2 million. None of CIDB grade 3 and 4 reported making nil on their company's annual turnover for the 2018 financial year.

4. 5 Preferred ICT Devices

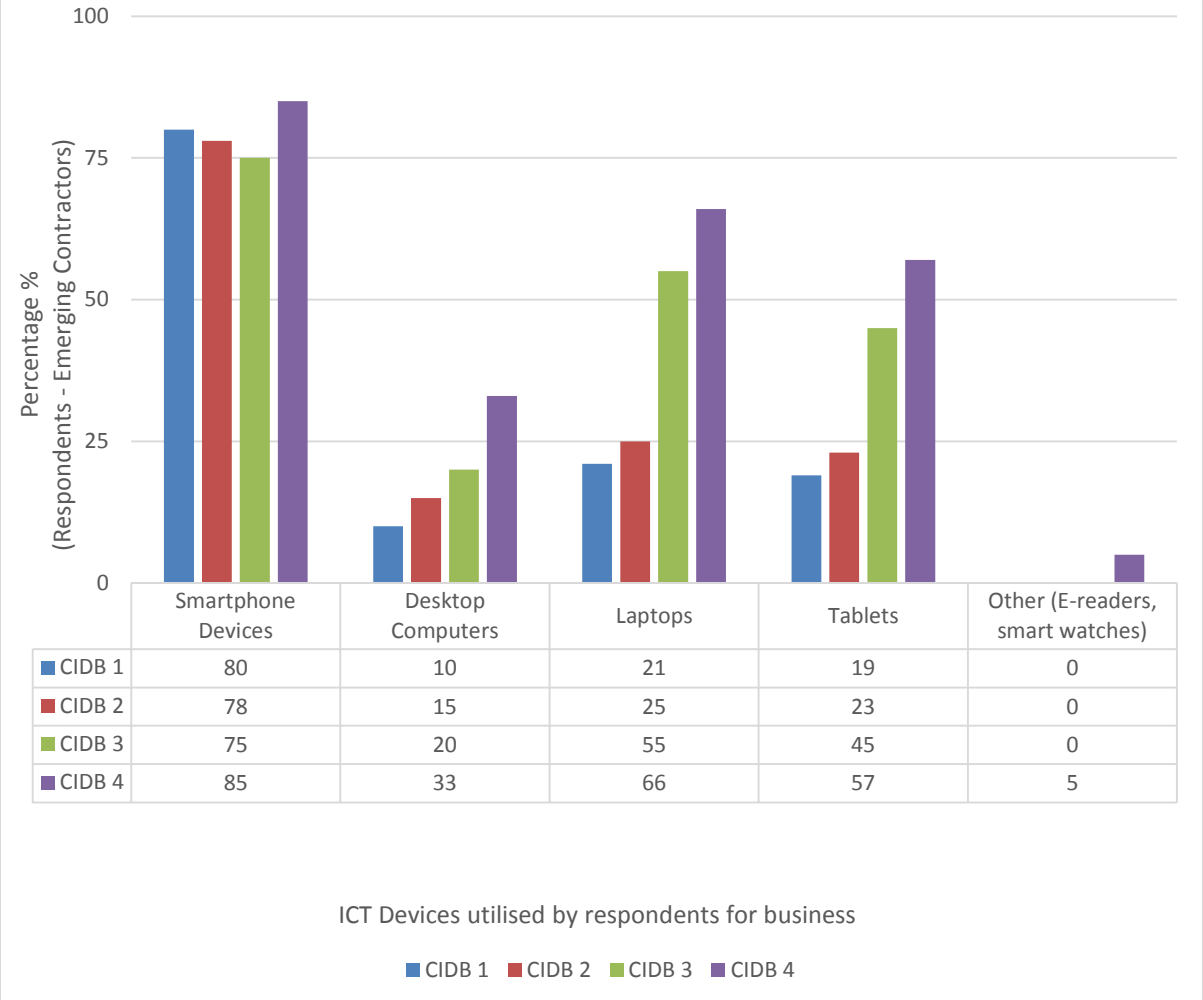
The preceding section discusses characteristics details gathered from the respondents relating to the profile of the emerging contractor, the demographics and background information of the respondents. The respondent's construction firm characteristics were also reported and generalized to the target population and statistical inference made to ascertain how the company profile impacts the apps adoption trend for business operations.

This section discusses qualitative data gathered through telephone interviews from the 89 respondents; the data is presented in graphs and analyzed to achieve the aim of the research. The research report aims to explore the use of apps uses by small emerging contractors in SA to improve their business performance. The main objective of the research report is firstly, to identify the various popular apps available for business usage. Secondly, assess the extent of use and how widespread particular apps are utilized and for what purpose. Lastly, assess the adoption trend of apps for business operations amongst emerging contractors and understand the adoption trend.

Qualitative data captured through the telephone interviews reflect that there are repetitive prevalent common themes. The themes analyzed by summarizing, coding, clustering and categorizing data into groups. The qualitative data and analysis is presented first to discuss the two propositions in the research. Secondly, the qualitative analysis presents data relating to the research objectives; lastly, the qualitative analysis presents data relating to the research questions. Telephone interviews have been directly quoted verbatim to report on respondents' first-hand experience on the use of apps for business operations. The order of findings is aligned with the research objectives.

Telephone interviews were conducted with the respondents who participated in the research. A percentage has been calculated from the total number of respondents (89) according to CIDB grade 1-4 to determine a percentage per grade the number of respondents who owned and

utilized a particular ICT device. The respondents reported the utilization of ICT devices as illustrated in Figure 30 below.



	Smartphone Devices	Desktop Computers	Laptops	Tablets	Other (E-readers, smart watches)
CIDB 1	80	10	21	19	0
CIDB 2	78	15	25	23	0
CIDB 3	75	20	55	45	0
CIDB 4	85	33	66	57	5

Figure 30: ICT devices utilized by the respondents (Own graph compiled from CSD Database, ICT devices utilised by 89 respondent)

The respondents were posed with research questions to substantiate the two research propositions.

- The first research proposition is that *"small emerging contractors with limited financial resources are not adopting ICT technologies to support business"*.
- The second research proposition is that *"small emerging contractors with limited formal education and lacking financial resources are adopting apps to manage the business in place of ICT technologies"*.

The following research questions were asked during the telephone interview to substantiate the proposition in the research; allowing the respondents to provide reasons for their choice of preferred ICT devices:

- What are the preferred ICT devices used by respondents for business (computer, laptop or smartphone)?
- What are the challenges and problems encountered using ICT devices for business?
- Why do respondents prefer using certain ICT devices for business?

The findings relating to the proposition reveal that the majority of respondents 75% and 80% ranging from CIDB grade 1-4 report owning an iOS and Android smartphone device, which they utilize for personal and business operations (Figure 29 above). This section discusses reports from the respondents which are transcribed verbatim and quoted; the use of language reflects the respondents' experiences on the usage of ICT devices. Extracts from the interview on the respondents' first-hand account reveal the decisions of the respondents to adopt certain ICT devices.

"Smartphones make their lives easier" (respondent, J-27); the respondent alluding to the flexibility of operating a smartphone.

Respondents report that *"smartphones are portable and can be carried around easily"* (respondent, J-5).

Other respondents mentioned that *"smartphones devices are cheaper and easily accessible"* (respondent, T-6).

Only less than 15% of the respondents reported not owning or using a smartphone device. These respondents rely on standard mobile phones which are used for communication, telephone calls, SMS messaging and files storage (pictures, text and audio recordings).

A greater number of respondents further reported that they utilize some of the other ICT technologies, indicating that a laptop is still predominantly utilized to support business operations. CIDB Grade 3-4 reported greater percentages of ownership and usage of laptops with between 55% and 66% of respondents indicating that they own a laptop. Laptops are portable and can be carried around between homes, the office and between attending meetings. Laptops are perceived to have more processing power and can handle the software needed to operate a business.

A respondent report: *"it is a basic necessary tool one must have when managing a company"* (respondent, J-41).

Amongst CIDB grade 1-2 laptops are still viewed as a costly and expensive nice to have the equipment; only low levels of respondents reported ownership of laptops between 21% and 25%. Low adoption levels could be attributed to 29% of CIDB grade 1-2 only possessing a matric certificate and 20% having lower levels of education. The low adoption is due to the lack of formal education and training; respondents do not know how to operate a laptop (computer literacy). A majority of CIDB 1-2 lack source of income and have limited financial capabilities with 40% making R0, 5 million and 24% making Nil on their 2018 annual turnover. The reports from the majority of CIDB 1-2 respondents reveal that they do not have the capital to invest in formal business premises and costly ICT technologies such as laptops, desktop computers, and printer/fax machines. They operate their businesses from home, relying on public transport, and use smartphones to communicate and as a portal to the internet.

Respondents reported on the challenges and problems they encountered using a laptop for business. The challenges and problems firstly include; high costs of laptops, hard drive failure, internet or network connectivity issues, vulnerability to theft and damage, slower processor and applications running slow, lastly, viruses and battery issues.

In terms of ICT device ownership amongst the respondents, tablet ownership came in third as a preferred device utilized for business operations. CIDB Grade 1 respondents' ownership of tablets indicates a meagre 19% utilization; affected by the affordability of the device. Followed by CIDB grade 2 respondents with ownership and utilization of tablets at a low 23%; financial capacity impacting on the adoption trend. The tablet may be less useful given the fact that approximately 78% of CIDB grade 2 respondents own a smartphone device which has the capacity of running applications and software. CIDB Grade 3-4 respondents well ahead of the other respondents came in second and first at 45% and 57% respectively in the utilisation of tablets as a preferred and additional ICT device to support business operations. This could be attributed to affordability, the flexibility and portability of the device. Although ownership of laptops for CIDB grade 3-4 respondents is reported at 55%; respondents indicated that tablets made life easier for them and that it can be carried around easily as compared to laptops. Tablets ownership reported at 66% for CIDB grade 3-4 respondents.

Desktop computers on the other hand are the least preferred ICT devices to be owned and utilized by the respondents. The CIDB grade 1 respondents' ownership of desktop computers

is reported at a low 10%; whilst CIDB grade 2 respondents noted ownership of 15%; CIDB grade 3 respondents with ownership of 20% and 33% for CIDB grade 4 respondents. The data indicates that the respondents are not adopting desktop computers to support business operations and rely on other devices which are as capable of performing the same functions as the desktop computer.

Respondents lamented on some of the challenges and problems referring to the *"high costs to purchase"* (respondent, J-42).

Another respondent indicates that *"a person cannot carry a computer around; it is connected to monitor, keyboard and mouse"* (respondent, S-1).

Other respondents decrying that *"computers need electricity to run compared to a smartphone device, a laptop or a tablet which can be charged and it can run during power shortages"* (respondent, W-2).

Approximately 20% of respondents who are employing higher numbers of permanent and temporary employees report that they are leasing office premises and are in ownership of ICT technologies which they utilized for business operations. Greater numbers of respondents 35% who have been operating for 5-10 years in the construction industry tend to adopt ICT technologies; connected to a central network server for file storage and running internet. The respondents whose companies have been in existence for less than 5 years are likely to utilise smartphone device for communication, email and for checking tendering opportunities online. The research findings reveal that the adoption trend is greatly affected by financial capacities; the number of years in practice and the number of employees in the firm.

A greater number of start-ups and struggling respondents (11%) reported utilizing an internet café (PostNet, Jetline, Print Zone etc.) to support business operations for printing documents and plotting drawings. Respondents also used internet cafes for checking emails and searching online websites for procurement of tenders and advertising for prospective clients. These struggling respondents do not own a motor vehicle and rely on public transport, they operate their business from home. The respondents are reporting not to own desktop computers and are in ownership of a standard mobile and/or smartphone devices. The respondents report that they visit provincial government departments, such as the Department of Infrastructure Development, the Department of Transport and Gauteng Provincial Treasury to view tender notice boards current tenders and work opportunities. Newspapers also provide a source of

tender information. Fewer respondents report using desktop computers or laptops for viewing the online website to search for tender opportunities. Google Chrome App and similar search engines are utilised to search and view online tendering opportunities; such as the eTender website. The smartphone device is readily available; although the majority of respondents lamented on data costs as a challenge to use a smartphone as a portal to the internet.

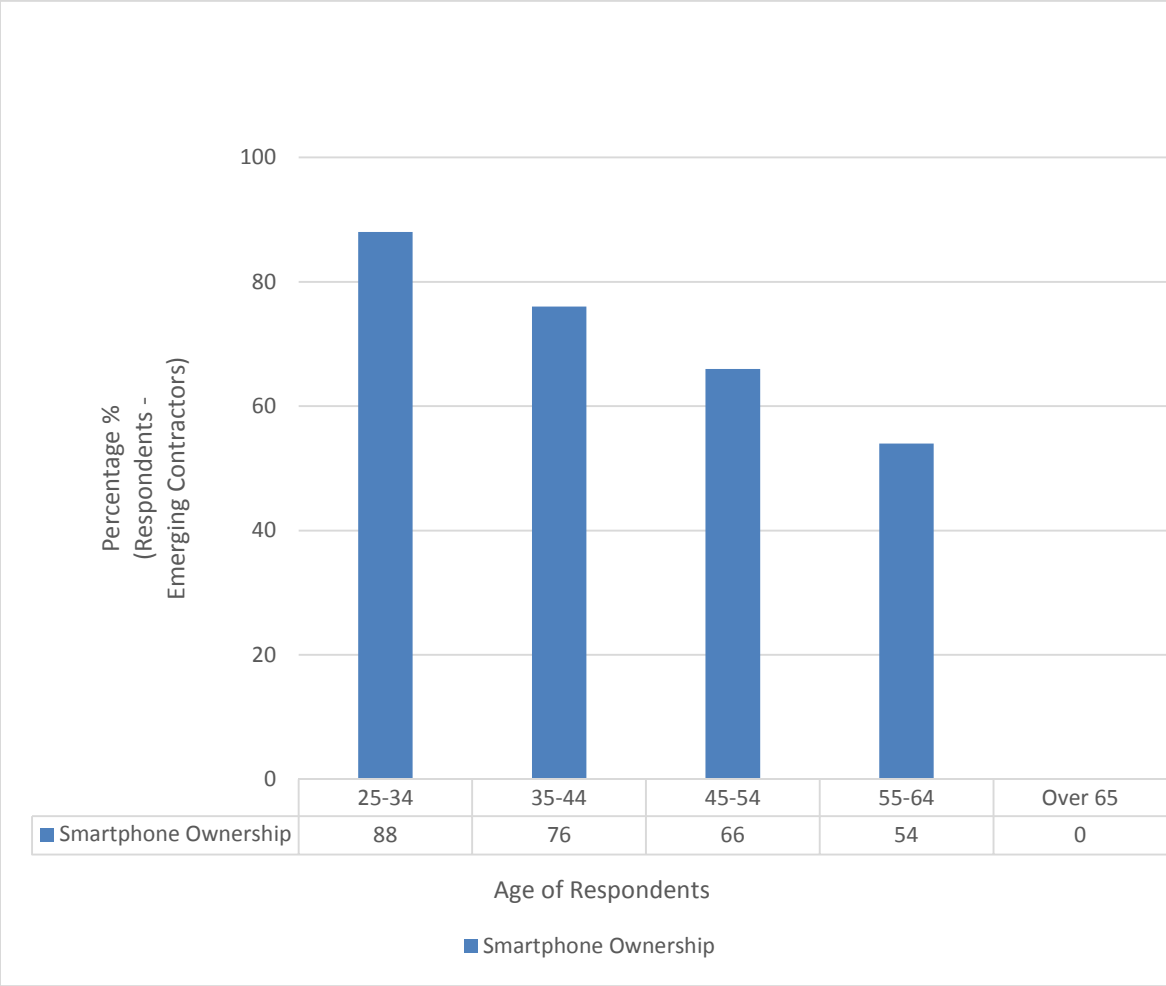


Figure 31: Respondent's smartphone ownership by age group (Own graph compiled from CSD Database, Smartphone device ownership by age group)

The figure 31 above shows the percentage of the respondents with ownership of a smartphone device according to age group varying with the highest penetration rate 88% reported amongst respondents between the age group 25-34 years; the penetration rate steadily decreasing with 76% for 34-44 years, 66% for 45-54 and 54% for 55-64 years. The data reveals that amongst the younger generation of respondents the trend to adopt smartphone devices is higher as compared to the senior citizen.

4. 6 Smartphones device and ICT devices Utilization trend.

In this section, the reports from the respondents are transcribed verbatim and quoted. The use of language reflects the respondents' experiences in the usage of ICT devices. Extracts from the interview are presented on the respondents' first-hand account.

Under the narrative theme for education and training a respondent report:

"We get a lot of our work through word of mouth, we visit sites to source work from the contractors. I do not have a computer or a laptop and I am using an old type of cellphone for making phone calls and SMS. They help me at the internet café to check emails and print documents, I need to learn how to use a computer" (respondents, E-6).

There were numerous reoccurring prevalent reports relating to the theme of education and training. A respondent disclosed that:

"I have not completed my high school, but I am a very skilled bricklayer and I get most of my work from people in the township. I do not know how to use a computer I need the training to operate one; I own a touch-screen phone which I use to make phone calls and for messaging" (respondent, T-22).

Reoccurring themes on portability of ICT device were clustered, coded and summarized with respondents' reports. A respondent who possesses a laptop noted that:

"My laptop is easier to carry around; the computer and printer are at our office and used for outlook email, internet, storing files and for programs. I have a smartphone device which I use most of the time, it is accessible I can check my emails and respond instantly" (respondent, J-30).

Respondent (J-30) comments are supported by another respondent reaffirming that:

"I have to carry my laptop around and it is inconvenient. I always have my smartphone with me, so my workers *can easily get hold of me and I advise them when I am off-site or out of the office"* (respondent, W-3).

The theme of financial capacity and cost is prevalent as the majority of the respondents allude to the impacts of the theme on the adoption trend. Numerous respondents with similar and core comments report that:

"Laptops and computers are too expensive; I do not own one. I operate my business from home, I don't have a car and use taxis for transport. I have a smartphone and get work via referrals, E-tenders online and notice boards at Treasury building in Johannesburg" (respondent, S-1).

A similar core comment relating to the theme on financial capacity and cost is noted by a respondent stating that:

"Smartphones devices are cheaper and easily accessible; I have two cellphones the one I use for work and the other I use for personal purposes" (respondent, T-19).

Repetitive comments are reported relating to the theme of the ease of use between the different ICT devices. A respondent stressed that:

"Smartphone devices make life easier for me; everything is done at a touch of hand; the device does not require any training to operate. I have tablet and laptop but prefer my smartphone device for messaging and for email" (respondent, J-27).

There are common prevalent reporting relating to the theme of problems and challenges encountered by the respondents with the use of different ICT devices. A respondent made a lighthearted comment about smartphone devices stating that:

"Data cost is too much, data must fall" (respondent, W-2).

Respondents further lamented on challenges and problems with commonly occurring reports noted; the majority of the challenges relate to theft, viruses and network reception.

"I must always check for viruses with a laptop and computer" (respondent, T-11).

"There is always a risk of theft for laptops and tablets" (respondent, E-9).

"Network reception is a big problem for modems in some areas outside the city" (respondent, J-39)

This section discussed reports from the respondents which are transcribed verbatim and quoted; extracts reflect first-hand experiences of the respondent on device utilization. Findings reveal prevalent reoccurring themes relating to education, ICT device portability, financial capacity, ease of use and common device problems playing a role in the adoption of various ICT technologies. The main findings in terms of the proposition to the research; the results from the telephone interviews reveal that the respondents preferred using a smartphone device.

Reports from the respondents support the proposition of the report in that financial capability is a great contributor to the adoption of the smartphone as a preferred device for business operations. Other factors that influence the adoption as alluded above include the educational background of the respondents. Smartphone devices are easily accessible, affordable and always in possession making it easier, convenient and the preferred ICT device of choice to be used by respondents as compared to other devices. There are obvious challenges with the use of ICT devices; smartphone device, however, has fewer problems and outweighs the use of desktop computers and laptops. The preceding sections discuss the research finding relating to the proposition of the research report. The subsequent section discusses apps adoption trend for business, identifying popular apps used and how apps are used to achieve the research objectives.

4. 7 Apps Utilisation for Business

The preceding section discussed qualitative data gathered from the respondents relating to the proposition of the research report. The preceding section discussed the preferred ICT device amongst the respondents; substantiating the proposition of the research report through examining factors contributing to the adoption of apps and other ICT technologies. The findings of the research report support the proposition in the report indicating that the respondents are influenced by the financial capacity to adopt smartphone devices for business operations.

The subsequent section analyzes the qualitative data collected through telephone interviews; presenting it through extracts quoted verbatim from the interviews reflecting the respondents' first-hand experience on apps usage for business. The order of research findings is aligned with the research objectives. The research questions asked during the telephone interviews are answered by respondents. Narrative themes on apps usage are examined, presenting extracts of quoted verbatim accounts from the respondents.

The primary research questions how small emerging contractors in SA are using apps to improve their business performance has been asked during the interview to assess the role of apps in enhancing performance. The interview narratives have been transcribed and presented; through clustering of common themes and presenting reports from respondents on how they use the apps to enhance the performance of their business. The respondents were specifically

asked to state construction apps which they use for business; examining the use of construction apps amongst respondents and substantiate literature findings on the use of construction apps.

Respondents were interviewed and asked the following research questions to identify popular utilized apps and establish how they utilize the apps. Reports from the respondents have been transcribed, clustered and grouped within narrative themes.

- Which of the apps are mostly used (frequency of use) by emerging contractors to manage their business?
- What do the emerging contractors mostly use the apps for in their businesses?
- How do you utilize apps to manage business operations?
- Where do you source apps for your business?
- Which construction apps do you use for business?
- What are the challenges of emerging contractors while adopting apps for business?
- What are the perceived benefits to the adoption of apps for business?

Respondents narrated various accounts under the prevalent reoccurring theme on communication. Respondents identified various apps that they use to communicate and also mentioned how they utilise the apps. The research findings reveal that the majority of respondents report that they use WhatsApp regularly both for personal and business usage. The WhatsApp application has been installed in respondents' smartphones devices and it is sourced from Google Play store.

a) Narrative theme – Communication

An account from a respondent on the prevalent reoccurring theme relating to communication alludes to how WhatsApp group is used for communication in their working environment.

"We are contracted under Vuk'phile Contractor Development Program (CDP) in Ekurhuleni, we set up a WhatsApp group with other contractors in the program, we share upcoming projects and tenders, we alert our workers on WhatsApp group when we get jobs and also address challenges with other contractors on the group" (respondent, J-43).

Other respondents had similar experiences with the use of WhatsApp to support their business. The respondents on the Vuk'phile program are fully embracing the adoption of WhatsApp to assist with communication. The majority of the respondents reaffirm that WhatsApp is mostly

used to support the business with communication and used largely for the procurement of prospective clients.

"WhatsApp group makes communication easier, I can chat with other Vuk'phile contractors at once" (respondent, J-37).

"I subcontract with CIDB grade 4 contractors and communicate using WhatsApp groups for job alerts" (respondent E-4).

Respondents also report on how they use the popular WhatsApp in their firm; alluding to the type of audience and specific apps that are used. Informal communication and chats are largely done using WhatsApp with workers and suppliers. On the other hand, formal communication with prospective clients, consultants and construction team is predominately done using email and telephone voice calls; this is purely done to maintain a trail of communication documentation.

"We use WhatsApp and Telegram App for internal communication; and use Gmail for external communicating with clients" (respondent, S-3).

Other respondents in ownership of the desktop computer, landline telephone and a smartphone device prefer communicating using telephone voice calls compared to WhatsApp. The use of other conventional ICT devices is still evident amongst some of the respondents who prefer using telephone voice calls to communicate with other contractors, workers and customers.

"Our firm uses phone calls to communicate with potential clients to set up appointments, its best practice not to use apps to make a phone call" (respondent, T-8).

Gmail is reported to be used by the majority of respondents for communication; sending and receiving emails between clients and the construction team and suppliers. Google Chrome is used by respondents as a portal to the internet; searching for availability of products, comparing prices and searching procurement opportunities.

"I use Gmail when responding to quotes for jobs" (respondent, J-45).

"Gmail account is linked to my smartphone device, I can respond quickly to emails and queries when I am away from the office computer" (respondent, E-9)

Respondents also reported how they utilize WhatsApp for business operations. Majority of the respondents are not well educated and have found easier ways to communicate using

WhatsApp. A respondent disclosed that he does not have matric and has difficulty communicating using typed messages. The respondent prefers to communicate using recorded voice messages and send to others via WhatsApp to convey the message.

"I use WhatsApp voice notes to communicate with other contractors to get work opportunities" (respondent, J-1).

"When checking for availability of the temporary workers I use WhatsApp to make voice calls, the data is better than using airtime to make a call, it is cheaper saves money" (respondent, S-4)

"Our manager regularly uses WhatsApp video calls to check with the foreman on how work is progressing on-site and also checks the availability of materials onsite" (respondent, J-30)

The WhatsApp video calls are used by respondents to inspect the progress on the construction works when they are offsite or in their offices. The respondents report that they inspect the works by having other workers who are based on the construction sites to position the camera of the smartphone in the direction of the works. In this way, the respondents not located at the site can manage and provide instantaneous instruction on how to deal with issues and also provides them with a review on the progress of works in real-time.

The respondents report that WhatsApp is also used for reporting to their managers on minor and major accidents which may take place during construction. The workers on the site record events that take place on construction sites; relating to strikes, community unrest, natural disasters which damages works and also record any defects to final completed works.

b) Narrative theme – Marketing and Procurement

The respondents have reported on various popular apps which they use for marketing and procurement. The research report discovers that the majority of respondents use social media apps and Google chrome for marketing and procurement of construction projects. Respondents report procuring public projects through the government E-tender portal on their smartphones, computers and internet cafe.

"I frequently check potential client's websites on my cell phone seeking job opportunities; I also send our company profile to some government departments" (respondent, S-2).

"When we complete a project for clients we post pictures of the final works and advertise to our local community using WhatsApp, Facebook, and Instagram showing photographs of completed projects using status update" (respondent, E-5).

Facebook and Messenger are not fully realized by the respondents; respondents only utilize the apps for marketing purposes. Respondents reported not having a Facebook business page; however, the majority has personal Facebook accounts.

"Our business uses Facebook to post adverts of pictures showing our completed projects and our business contact details to entice prospective clients. Our networks on Facebook share our posts by liking and commenting and the business can reach more potential clients" (respondent, E-4).

Some of the respondents report that they don't have a business website they use to market their services. The majority of the respondents also indicate that they don't have a LinkedIn business page to post information about the business and services offered.

"I manage and run a subcontracting company providing services of millwright artisans. I use the LinkedIn account for marketing my jobs and getting business opportunities. Mostly, LinkedIn has connected me with a network of other artisans who alert me on jobs or when they need my assistance. We send messages and share contacts details on LinkedIn" (respondent, J-33).

"Our firm is a small general building subcontractor and rely on renovations and alterations to residential buildings. The firm posts free advertising on Gumtree App to get customers who are looking to renovate their homes. The Gumtree App works and it has brought the company a lot of customers. The firm has not had much luck with CSD government tendering and referrals are not easy to come by" (respondent, T-12).

c) Narrative theme – Financial Management

There are various apps utilized by respondents for financial and business management. The respondents report using cell phone banking apps to manage business finances. The banking apps are used by respondents to view balances, transfer funds between accounts, make payment to suppliers and workers, and also to apply for finance to carry out construction work.

"Banking apps are safe and reliable I use the App in my business and it saves times. I can immediately make payments to suppliers using cell phone banking App and I don't have to queue for long hours in the bank wanting to make a transfer or payment" (respondent, J-22).

"The banking App easily allows the business to view bank statements tracking our expenditure and allows for payments to be made remotely on the smartphone. The banking App is also useful to check and verify deposits or payments into the business account" (respondent, E-12).

Other respondents report using the SMEasy app for the business accounting management system. The app simplifies the recording business transactions for the respondents as the majority have a little accounting background and rely on SMEasy app to assist with documenting transactions for the business. On the other hand, some of the respondents still access bank accounts by visiting their banks' branch to query bank statements and transactions.

"Our firm is fairly new in the construction industry and I don't manage financials on cell phone banking apps; I do not trust the apps. I go to the bank and use the ATM to check for balances and statements, withdraw money, make a deposit and transfer money; this way the process is safe" (respondent, S-1).

d) Narrative theme – Google services

The majority of the respondents gave accounts on how Google has positively influenced the processes within their businesses. Google services boost the performance of the business in several ways; respondents report that they use the App for research specifically for construction-related methods and techniques on how to execute the works on site. The Google app is used by the respondents for searching for materials from different suppliers and comparing the prices.

Google app is used predominately by the respondents to search for procurement opportunities from government departments; the app is used as a portal to the internet and provides a search list of items which provides information that benefits the businesses. Google Maps has been used mainly for way finding and directions to locate clients, customers, suppliers and other contractors. Some respondents report that they use Google maps for site assessments and using aerial images for presentations and discussion. Google business has been reported to be utilised by some respondents; the app is used to advertise the respondents' businesses and for locating their business address on Google Maps to get more customers.

"I am not aware of any popular apps but Google is the most important app for our company; we use Google for searching the internet for products and better deals on building materials. We also use YouTube app to search for videos on how to resolve construction-related issues onsite; especially with newer products which require information on how to install and assemble on-site" (respondent, J-23).

"Google Maps app is a major boost in site location; identifying nearby material suppliers and locating prospective clients' addresses. The app allows for savings on travel time and petrol when driving to sites and meeting clients. When driving to any destination Google Map app shows the shortest route with minimal traffic" (respondent, T-14).

e) Narrative theme – Photographs, Video and Audio

Under the theme documentation and recording to support business operations, respondents reported using the Camera app for taking photographs and videos of progress on construction works. Respondents report using Sound Recorder app during meetings, site briefings and construction-related short courses. Photographs make it easier for contractors to communicate with lay clients to convey a range of jobs completed, and how the job is done. Photographs are reported to be shared on WhatsApp and Facebook for prospective clients.

"On completion of a project I will take pictures of tiling or paving work and share the pictures on WhatsApp with clients; I will also check the pictures at home and only upload the best pictures onto WhatsApp profile for my status. My network on WhatsApp will then view my work and possibly appoint me on their next project" (respondent, W-1).

In terms of operations on a construction site respondent report that they use the WhatsApp to send and receive images, files and videos as a tool to support business operations.

"I use WhatsApp for chatting and sharing site images with management on the construction progress made on-site" (Respondent T-17).

"In our firm, the site foreman regularly takes pictures of the work and the problems we encounter onsite; the pictures are shared on WhatsApp group with the other workers and managers" (respondent, W-3).

"I use pictures to communicate remotely when sourcing materials and goods from suppliers. The pictures are used as a sample to convey to the suppliers the type and model of material I wish to purchase. Sharing the pictures on WhatsApp with clients and suppliers saves time by

reducing travel time and costs; sharing of pictures also ensures that the correct materials are delivered to the construction site" (respondent, J-8).

"When compiling an incident report our business uses the Camera app to take pictures and video recordings to illustrate the extent of the incident to the clients and project team, the pictures are shared instantaneously using Gmail and WhatsApp. The pictures and video recordings are used to communicate the progress of works and keep clients up-to-date with construction developments" (respondent, J-15).

"Workers use the Camera app to record a video of incidents as they happen on construction site and the videos are later used to identify risks to avoid future incidents; the videos are shared on WhatsApp and ShareIt" (respondent, E-8).

"I use the CamScanner app to scan construction drawings and any other construction related hard copy documents when I am on the construction site and do not have access to a scanner, copier or print machine. The CamScanner app allows for storage of scanned documents and drawings onto the smartphone and I will later share using WhatsApp and Gmail with other workers" (respondent, T-2).

"During progress meetings with the construction team, I use the Sound Recorder app to record the proceedings of a site meeting. When I am back in the office I will listen to the recordings and transcribe the minutes of the meeting. Recording the proceeding of the site meetings makes it easier for me and this support the business operations; I can engage in the meeting and do not need to be bogged down with transcribing the minutes as the meeting is taking place" (respondent, E-3).

f) Narrative theme – Construction Apps

Concerning the secondary research questions, respondents were specifically asked which construction apps they use for business? The research report findings on the use of construction apps to support business operations are not surprising. None of the respondents is aware or uses construction apps which are available on Google app store for download. The research report findings confirm with the findings of the literature review in that construction professionals in SA and Ghana do not use sector specific construction apps. Osunsanmi, Aigbavboa and Oke (2018) reveal that construction professionals are not aware of fourth industrial revolution construction concepts in SA. Ekow and Kofi (2016) findings reveal that construction

professionals in Ghana are not aware of construction apps and do not use construction apps instead they use other generic apps which can help them in the management of their businesses.

When respondents were asked about construction apps they are using in their business the respondents report that they are unaware of construction apps and only use general apps which are used by the majority of ordinary people in society. Respondents reported using construction programs on desktop computers and laptops in their business and they are not using construction apps.

"Our company does not use construction apps, the smartphone screen is too small to be able to clearly see and work properly. Programs need a lot of memory and storage space a smartphone device cannot handle our programs" (respondent, J-6).

"I have never used a construction App before; I don't know which ones are being used by other sub-contractors. How do you use construction apps on the cell phone?" (respondent, T-9)

g) Narrative theme – Benefits and Challenges

The research report does not measure the benefits associated with improvement to business operations gained from adopting apps. The respondents reported on some of the perceived benefits and improvements to performance in their business. There are core prevalent and repetitive common reporting from the respondents under the theme benefits.

"Using apps in our firm makes tasks and activities easier to accomplish; it is the quickest way compared to doing some tasks in person or in the office on the computer. I can do tasks immediately and remotely easily" (respondent, T-21).

"The apps are cheaper and easily accessible; it makes life easier for me to send and receive emails from anywhere and I can communicate with the team on WhatsApp" (respondent, E-7).

"Cell phone apps are user friendly and efficient; I can do more at the snap of my fingers. I can communicate with more people at once and receive responses without having to make phone calls and confirm details of the project" (respondent, J-39)

"I use WhatsApp all the time and engage with many people, chat, share information and images" (respondent, E-12).

"WhatsApp makes it easier to stay in contact all the time" (respondent, J-9)

"Our business uses Facebook, Instagram and Google business; the apps improve processes, and increase the level of accessibility for our customers" (respondent, J-29).

"Apps are flexible and can serve business special needs or save time and energy" (respondent, T-23).

The core challenges reported by the respondents are prevalently reoccurring; the challenges relate to the high cost of data in SA. Respondents lamented having to purchase data to keep up with the apps adoption trend. Cost of data makes it difficult for respondents to adopt as they are also struggling financially and do not have sufficient financial resources to keep up with downloading newer apps. Respondents report on the storage space required on the smartphone device for the apps; storage space is a barrier as respondents have to delete some of the apps to keep up to date with adoption trend of apps.

"Apps are useful but the cost of data is too much. To save on the data costs I visit the local fast-food restaurant or the fire station for free Wi-Fi near my home business so I can download and update apps" (respondent, J-42).

The preceding section provides quoted verbatim extracts from the respondent account on how they utilize apps for business. Narratives from the respondents reveal that generic apps used by ordinary people in society are used by the respondents in various ways to support their business operations. Apps are utilized for everyday business activities through simplifying and easily resolving business-related tasks. Respondents accomplish the tasks without the use of expensive ICT technologies.

The prevalent reoccurring themes reported by the majority of respondents relates to how the apps are used in their business environment. The Core themes related to communication, marketing and procurement, financial management, the use of Google services, the use of photographs, video and audio recordings, construction apps and lastly benefits and challenges. The research report finding reveals that respondents rely tremendously on WhatsApp for communication, sharing of pictures and files, marketing and procuring projects; Facebook, LinkedIn, Instagram and Gumtree used for marketing, procurement and networking. Google services predominantly used for Gmail and Google Maps for email, wayfinding and locating suppliers and clients. Banking apps are used by respondents for financial management; respondents also report using SMEasy, CamScanner and Sound Recorder apps to simplify their daily business tasks.

The subsequent section discusses various popular apps used by the respondents for business and relates to the research objective. The section presents graphs relating to popular apps; linking the preceding qualitative reporting from respondents. Assessment of the trend using graphs provides an understanding of how apps are utilized for business operations.

4. 8 Popular Apps

The preceding section discussed qualitative data gathered from the respondents relating to the research objectives. The preceding section assesses the apps adoption trend for business by presenting qualitative data gathered from the interview with the respondents to explore the use of apps uses by small emerging contractors in SA to improve their business performance.

The subsequent section analyzes the qualitative data collected through telephone interviews. Presenting the qualitative data collected in graphs relating to the identification of various popular apps available for usage. The order of the findings relates to the research objective in this report, research questions are answered by the respondents to achieve the aim of the research report.

Respondents were interviewed and asked to identify prevalent common and popular apps and for what purpose do they use the apps. The respondents report on the apps which they have downloaded and use on a day to day basis to support their businesses. A percentage has been determined from the total number (89) of respondents establishing how many interviewees installed and utilize the apps. The qualitative data in terms of popular utilized apps has been presented on the graph in Figure 32 below.

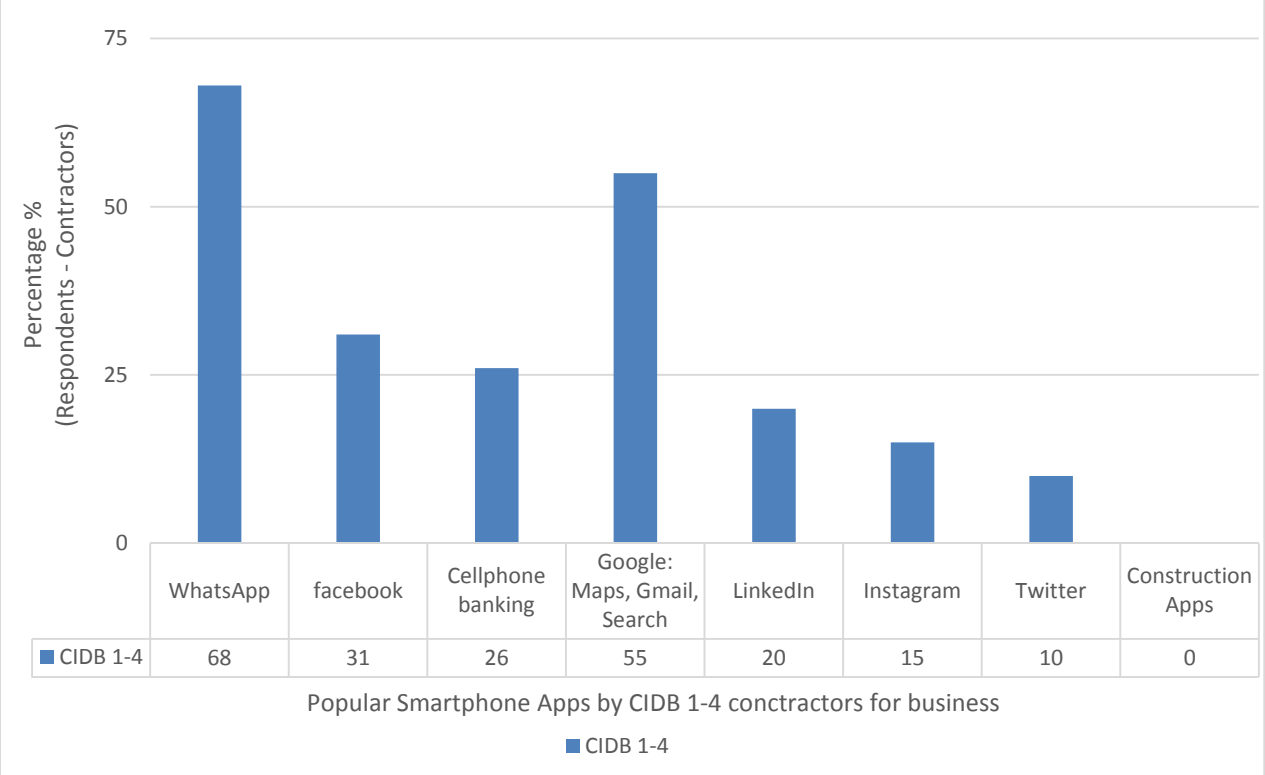


Figure 32: Popular smartphone apps utilized for business (Own graph compiled from CSD Database, popular smartphone apps utilised)

Respondents were asked to identify the apps they have downloaded, installed and use on their smartphone devices. The popular apps identified by the respondents are specifically utilized for business operations only. The qualitative data on Gaming apps and any other apps which do not support the business are excluded in this research report. Respondents (68%) who own a smartphone device report having downloaded and utilise WhatsApp in one form or the other for business operations. The research report has discovered that respondents' utilization of WhatsApp Voice over Internet Protocol (VoIP) and instant messaging data usage services outweigh the decreasing traditional voice calls and SMS usage. This is due to WhatsApp voice calls and instant messaging data being a cheaper substitute to traditional voice calls, SMS and airtime. The respondents report that WhatsApp allows them to communicate with partners, suppliers and clients in neighbouring countries. None of the respondents reported the use of construction apps which are available on Google Play store for download; they seem oblivious on the existence of construction apps for iOS and Android smartphones to assist them to manage the business. Company profile advertising on LinkedIn and Facebook through creating a business web page for company information is not fully realized and utilized by the respondent for marketing. However, respondents report having individual personal accounts or

profiles to form networks with other contractors and interested parties. (31%) of the respondents use Facebook and only (20%) of the respondents use LinkedIn. (10%) Of the Respondents report using Twitter and only (15%) of the respondents use Instagram for personal use and less for business purposes. Some respondents report using social media apps for uploading pictures of completed jobs to entice prospective customers. (26%) of the respondents report using cellphone banking apps to manage business finances; whilst some respondents use traditional means to access bank accounts via ATMs and branch visits.

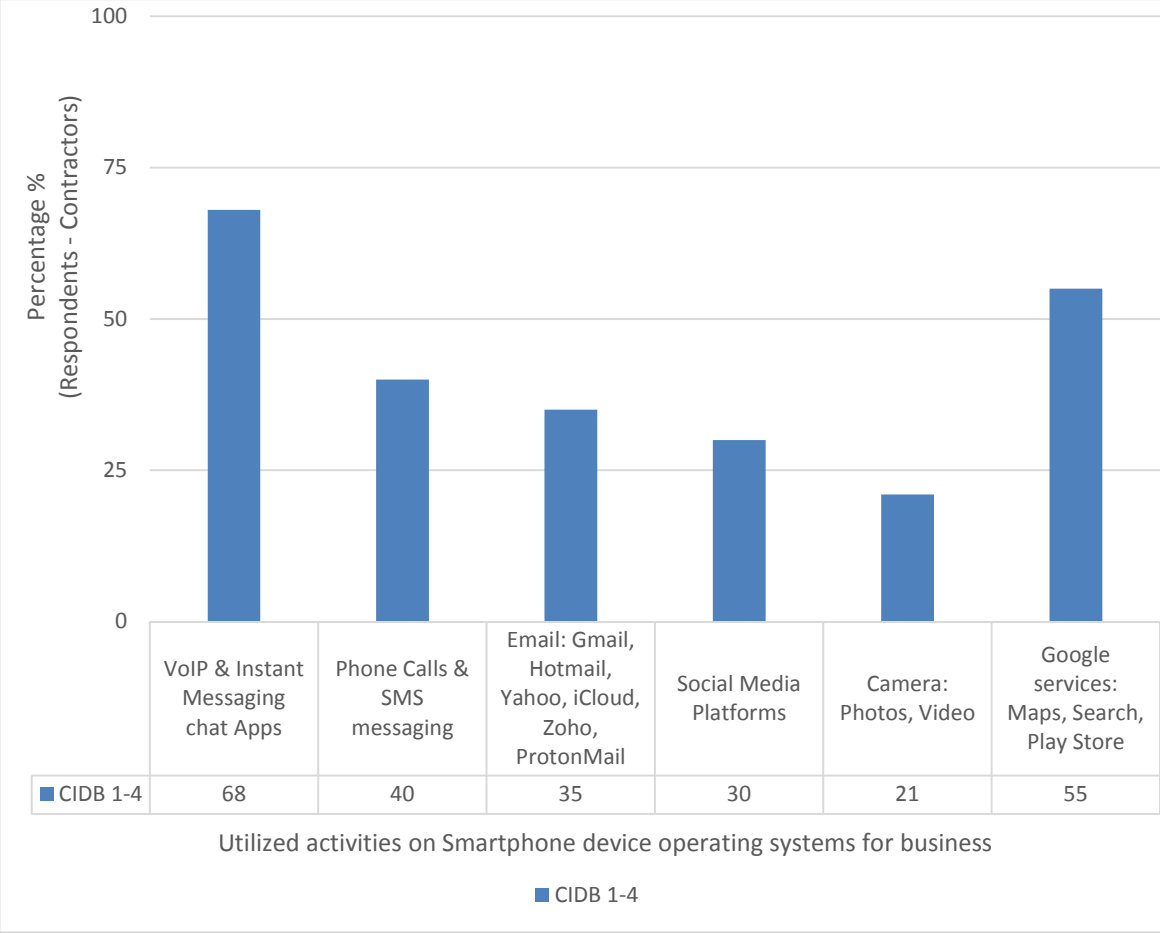


Figure 33: Utilized activities on iOS and Android operating system (Own graph compiled from CSD Database of the 89 respondent)

The graph in Figure 33 above illustrates that the prevalent and common utilized installed apps on smartphone devices is WhatsApp reported to be utilized by (68%) of the respondents. The use of Google services: Google Maps, Google Play store, Google Chrome as a gateway to the internet is reportedly utilized by (55%) of the respondents. Google services App as reported by the respondents is used for the following: searching job opportunities; searching Etender portals; searching government departments websites for prospective customers; searching commercial clients' websites for procurement opportunities; locating sites on Google Maps

searching for materials and suppliers; Gmail for sending and receiving emails; and cloud-based storage and sharing of large files.

The research finding reveals that (40%) of the respondents report utilizing traditional phone calls and text messaging which are overshadowed by WhatsApp instant messaging chat apps and VoIP. The WhatsApp adoption is purely impacted by the low cost of data usage services compared to the high cost of SMS text and phone calls airtime. Findings reveal that (35%) of the respondents use an email such as Gmail, Hotmail and Yahoo to communicate. The research findings reveal that (30%) of the respondents use social media platforms for networking, marketing and procurement. The research indicates that (21%) of the respondents are using a smartphone camera to capture photographs and video recording specifically for business operations. The majority use a smartphone camera for personal and not explicitly to support business operations. The adoption trend is affected by affordability as the respondents who are struggling financially use apps to enhance performance for their businesses. The age of respondents also impacts the adoption trend, the younger generation adopts social media and instant messaging chat apps (WhatsApp, Facebook) whilst the older respondents use traditional phone calls and SMS text messaging.

The preceding section reports on the findings and results of the data analysis; graphs and tables illustrate qualitative data captured from the respondents relating to the utilization of apps for business. The findings are structured to answer the research question and the findings also specifically answer the secondary research questions relating to the usage of apps for business operations. The qualitative data was analyzed using reports and first-hand accounts from the respondents and presented in graphs illustrating the percentage in apps adoption for business. The findings of this section reveal that WhatsApp, Facebook, Google services, banking apps and social media apps are popular amongst the respondents and are used predominately to support business operations.

In the subsequent section quantitative data is analyzed using a PMCC correlation coefficient to assess the strength of the statistical relationship between the variable in the research report. The variables assessed relate to the research objective linking the preceding qualitative reporting on App usage for business to determine whether the variables correlate.

4. 9 Apps Proposition testing

The preceding section discussed qualitative data gathered from the respondents relating to the objective of the research report. The preceding section discussed the apps utilized by the respondents specifically for business operations only. The preceding section identified and presents in graphs the popular apps downloaded and installed in the respondents' smartphone devices. The preceding section also assessed the extent of use of particular apps understanding the adoption trend towards apps utilization for business.

The subsequent section analyzes the quantitative data through PMCC correlation coefficient analysis. The correlation analysis is done between the variables: the number of apps used by the respondents; the educational qualifications according to NQF; the annual turnover of the companies for the year 2018; and the CIDB grading for the firm. The correlation analysis is presented in graphs and tables to ascertain whether there are any relationships between the variables and determine whether the variables impact the apps adoption trend. The section presents proposition testing through significance testing; testing the probability of a relationship between variables occurring by chance alone.

There are two propositions in this research report. The first research proposition is that *"small emerging contractors with limited financial resources are not adopting ICT technologies to support business"*. The preceding sections have discussed and partly answered the first research proposition using qualitative analysis and respondent's first hand reports on apps adoption. The research report has established that the majority of respondents (75%) report owning an iOS and Android smartphone device for personal and business usage. In comparison the smartphone device by far outweighs the other devices in terms of ownership and utilization to support the business.

The second research proposition is that *"small emerging contractors with limited formal education and lacking financial resources are adopting apps to manage the business in place of ICT technologies"*. Emerging contractors are impacted by a lack of financial capability and formal education; therefore, they tend to adopt alternative more affordable apps, which are not expensive and do not require training. The second research proposition will be answered below using quantitative data analysis and significance testing.

Table 12: Correlation Analysis Variables

Contractors classified by municipality	CIDB Grading	2018 Annual Turnover (R'000)	Educational Qualification (NQF Levels)	Number of Apps for business
E – 1	1	25	4	4
E – 2	2	75	2	0
E – 3	1	100	4	5
E – 4	1	500	6	4
E – 5	1	30	4	5
E – 6	1	0	2	0
E – 7	1	100	5	4
E – 8	3	1250	4	1
E – 9	1	90	4	5
E – 10	1	0	0	0
E – 11	1	250	5	4
E – 12	1	500	6	3
E – 13	1	35	4	5
J – 1	1	50	2	2
J – 2	1	100	5	4
J – 3	2	1000	6	2
J – 4	1	150	5	4
J – 5	1	75	4	4
J – 6	1	0	2	2
J – 7	1	30	2	2
J – 8	1	100	5	4
J – 9	1	250	6	3
J – 10	1	150	5	4
J – 11	1	250	5	3
J – 12	1	0	2	0
J – 13	2	1150	7	1
J – 14	1	250	5	3
J – 15	4	1150	4	1
J – 16	1	0	4	4
J – 17	1	300	6	4
J – 18	1	25	4	4
J – 19	1	500	6	4
J – 20	1	0	4	4
J – 21	1	60	2	2
J – 22	1	750	6	3
J – 23	2	850	4	4
J – 24	1	50	4	4
J – 25	1	1010	7	3
J – 26	1	0	4	3
J – 27	1	650	6	3
J – 28	1	0	4	3
J – 29	1	1050	7	3
J – 30	4	2000	6	1

J – 31	1	0	0	0
J – 32	1	35	4	4
J – 33	1	350	6	4
J – 34	1	1000	7	1
J – 35	1	500	6	3
J – 36	1	0	2	0
J – 37	1	500	6	3
J – 38	1	0	4	3
J – 39	1	50	4	4
J – 40	1	300	5	4
J – 41	3	1200	2	0
J – 42	1	0	2	1
J – 43	1	850	6	2
J – 44	1	250	6	4
J – 45	1	60	4	5
T – 1	1	0	4	3
T – 2	2	900	4	2
T – 3	1	1000	7	2
T – 4	1	0	4	3
T – 5	1	0	2	2
T – 6	1	40	4	5
T – 7	1	600	6	3
T – 8	4	1800	6	1
T – 9	1	0	0	0
T - 10	1	65	4	5
T - 11	1	250	5	3
T - 12	1	100	5	4
T - 13	1	300	6	5
T - 14	1	650	6	2
T - 15	1	500	6	3
T - 16	1	0	2	3
T - 17	1	65	4	5
T - 18	1	0	2	3
T - 19	3	1400	6	2
T - 20	1	900	6	3
T - 21	1	850	6	3
T - 22	1	0	0	0
T - 23	1	500	6	3
T - 24	1	35	4	5
W – 1	1	20	2	4
W – 2	1	0	4	3
W – 3	2	1000	5	2
S – 1	1	0	2	2
S – 2	1	500	6	3
S – 3	2	1200	6	1
S – 4	1	55	4	5

Source: Own table compiled from Respondent's Company profile

Table 12 above illustrates quantitative data collected from the respondents using telephone interviews. The respondents were asked to identify the number of apps they have downloaded, installed and use on their smartphone devices. The number of apps identified by the respondents are specifically utilized for business purposes only. Table 12 above also illustrates the educational qualifications of the respondents relating to the NQF levels obtained; the contractor classification relating to the CIDB grading; and the annual turnover of the firm for the year 2018. The PMCC correlation coefficient analysis was done on the numerical variables to quantify the statistical relationship between the number of apps used for business, the education qualifications, annual turnover, and CIDB grading. The results of the proposition testing are presented in graphs and table below to determine whether the relationships are statistically significant or not.

Table 13: Correlation Coefficient Matrix

		CIDB Grading	2018 Annual Turnover (R'000)	Educational Qualification (NQF Levels)	Number of apps for business
CIDB Grading	Pearson correlation Sig. (2-tailed) Number	**1**			
2018 Annual Turnover (R'000)	Pearson correlation Sig. (2-tailed) Number	**0.746** 0.001 89	**1**		
Educational Qualification (NQF Levels)	Pearson correlation Sig. (2-tailed) Number	**0.099** 0.357 89	**0.568** 0.001 89	**1**	
Number of apps for business	Pearson correlation Sig. (2-tailed) Number	**-0.412** 0.001 89	**-0.329** 0.002 89	**0.360** 0.001 89	**1**

Source: Own table correlation coefficient analysis, alpha = 0.05

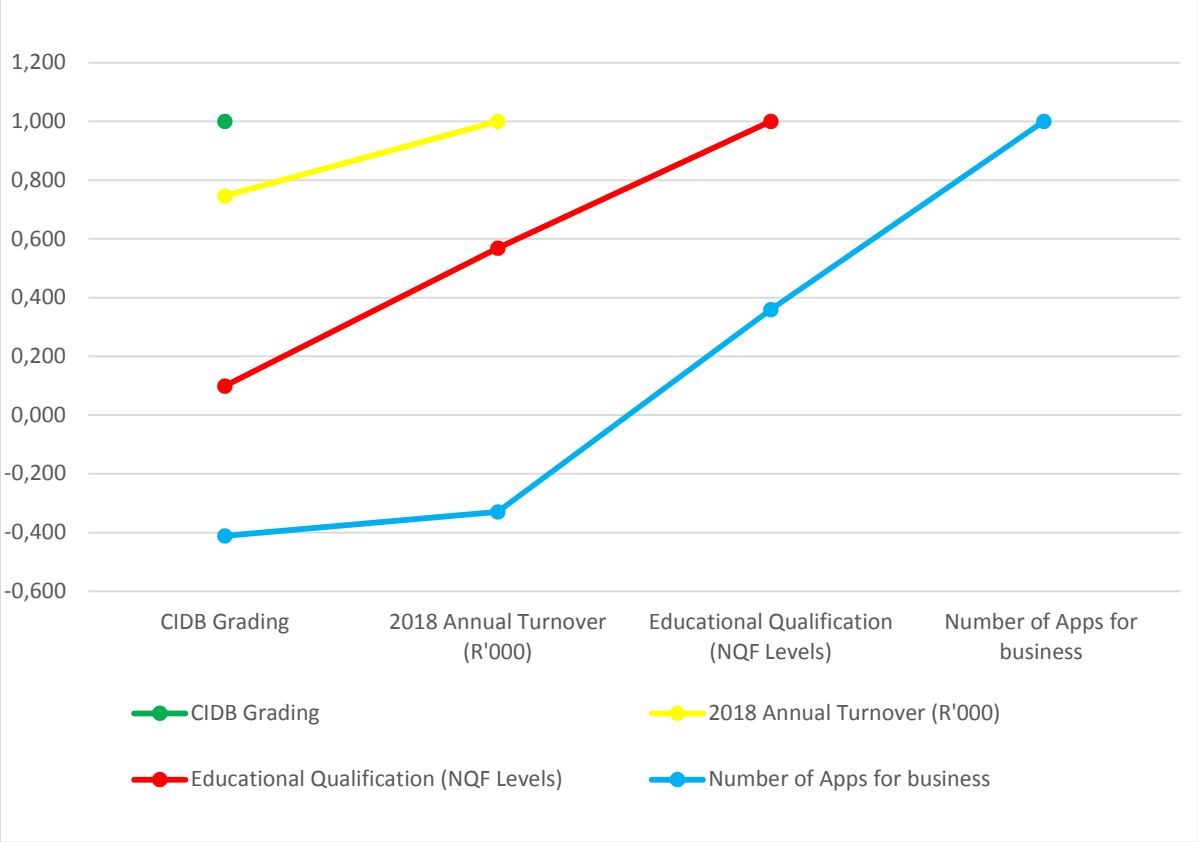


Figure 34: Apps Correlation Analysis (Own graph compiled from respondent)

Table 13 and figure 34 above illustrates the correlation coefficient for all pairs of variables. The correlation value between the number of apps utilized for business and the educational qualification is 0.360. This coefficient value means that there is a statistically significant moderate positive relationship between the number of apps used for business and the educational qualifications. The correlation value between the number of apps and the firm's annual turnover is -0.329; revealing that there is a statistical significant weak negative association between the variables. The correlation indicates that as the Annual turnover of the firm increase the number of apps used decreased; similarly, as the financial resources decrease the adoption of apps increases. The correlation value between the number of apps and the CIDB grading is -0.412; showing that there is a statistically significant moderate negative association between the variables and they are dependent. The negative correlation reveals that as the CIDB grading increases the number of apps decreases. The inverse correlation supports the proposition in the research report; relating to firms with higher CIDB grading and having better financial resources are not adopting apps for business. On the contrary, firms with lower CIDB grading are embracing the apps adoption trend as a means to an end since they do not have the financial capacity to invest in expensive ICT technologies.

The correlation value between the educational qualifications and the firm's annual turnover is 0.568; the value shows that there is a statistically significant moderate positive association between the two variables. The higher the educational qualifications obtained by the respondents the greater the annual turnover of the firms; and vice versa, the lower the qualifications the lower the firm's annual turnover. There is no correlation between the CIDB grading and the educational qualifications; the correlation value is 0.099 indicating that there is no statistically significant relationship and the variables are perfectly independent ($r = 0.099$, $p = 0.357$, *alpha* = 0.05, two-tailed*)*. The correlation value between the firm's annual turnover and CIDB grading is 0.746; indicating a statistical significant strong positive association between the variables. As the firm's turnover increases similarly the CIDB grading of the firm also increase the variables are dependent on each other.

a) Proposition testing - Apps are correlated to the annual turnover of firms

SUMMARY OUTPUT

Regression Statistics	
Multiple R	**0.329**
R Square	0.108
Adjusted R Square	0.098
Standard Error	1.401
Observations	89.000

ANOVA					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.000	20.781	20.781	10.582	**0.002**
Residual	87.000	170.859	1.964		
Total	88.000	191.640			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.263	0.190	17.157	0.000	2.885	3.641	2.885	3.641
2018 Annual Turnover (R'000)	**-0.001**	0.000	-3.253	0.002	-0.002	0.000	-0.002	0.000

Figure 35: Apps and annual turnover association

The correlation between the number of apps used and the firm's annual turnover is statistically significant as shown in figure 35 above (r = -0.329, p = 0.002, *alpha* = 0.05, two-tailed). There is a significant moderate negative relationship between the number of apps used by the respondents and the firm's annual turnover. The proposition is supported; the correlation value and moderate negative association reveal that as the firm's annual turnover increases the utilization of apps decreases. Similarly, as the firm's annual turnover decreases the utilization of apps increases. The moderate negative relationship indicates that the variables are dependent. The findings of the correlation analysis support the proposition in the research report in that as the firm's financial resources increase similarly the adoption of apps for business decreases and vice versa. Small emerging contractors are not adopting ICT technologies to support business since they do not have financial capabilities to invest in costly mainstream ICT technologies. Instead, emerging contractors are adopting apps to manage the business in place of ICT technologies. Emerging contractors are impacted by the lack of financial capability and they tend to adopt alternative more affordable apps to support the business operations.

b) Proposition testing - Apps are correlated to CIDB grading

SUMMARY OUTPUT

Regression Statistics	
Multiple R	**0.412**
R Square	0.169
Adjusted R Square	0.160
Standard Error	1.353
Observations	89.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.000	32.452	32.452	17.736	**0.001**
Residual	87.000	159.189	1.830		
Total	88.000	191.640			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	3.992	0.301	13.253	0.000	3.393	4.591	3.393	4.591
CIDB Grading	**-0.894**	0.212	-4.211	0.000	-1.317	-0.472	-1.317	-0.472

Figure 36: Apps and CIDB Grading association

The correlation between the number of apps used and the CIDB grading is statistically significant as shown in figure 36 (r = -0.412, p = 0.001, *alpha* = 0.05, two-tailed*)*. There is a significant moderate negative relationship between the number of apps used by the respondents and the CIDB grading of the firm. The proposition is supported; the correlation value and moderate negative association reveal that as the CIDB grading increases the utilization of apps decreases. When the firm's CIDB grading decreases the utilization of apps increases. The moderate negative relationship indicates that the variables are dependent. The findings of the correlation analysis support the proposition in the research report in that as the firm's CIDB grading increases on the inverse the adoption of apps for business decreases and vice versa. The correlation coefficient agrees with the research report proposition; firms with higher CIDB grading which can afford expensive ICT technologies are not using apps since the software and ICT technologies have the similar or even better capacity as the apps. Small firms with limited resources do not have many options; they are compelled by the lack of expensive ICT technologies and use apps that are readily available to them to enhance business performance.

c) Proposition testing - Apps are correlated to educational qualifications

SUMMARY OUTPUT

Regression Statistics	
Multiple R	**0.360**
R Square	0.129
Adjusted R Square	0.119
Standard Error	1.385
Observations	89.000

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1.000	24.783	24.783	12.922	**0.001**
Residual	87.000	166.858	1.918		
Total	88.000	191.640			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1.560	0.395	3.952	0.000	0.775	2.344	0.775	2.344
Educational Qualification	**0.303**	0.084	3.595	0.001	0.135	0.470	0.135	0.470

Figure 37: Apps and educational qualification association

The correlation between the number of apps used and the educational qualifications is statistically significant as shown in figure 37 ($r = 0.360$, $p = 0.001$, *alpha* = 0.05, two-tailed*)*. There is a statistically significant moderate positive relationship between the number of apps used by the respondents and the educational qualifications they possess. The proposition is supported; the correlation value and moderate positive association indicate that the higher the educational qualifications as per NQF level the greater the number of apps utilized by the respondents. The statistically significant moderate positive relationship indicates that the two variables are dependent; the lower the educational qualifications the fewer the apps are utilized by respondents. The higher the educational qualifications obtained by the respondents the greater the number of apps they use for business. The findings of the correlation analysis support findings of literature review; relating to the lack of training and education as a major problem in the implementation of apps in the construction industry.

If emerging contractors are impacted by lack of formal education; the correlation analysis between apps and education would seem to support this as it indicates that the respondents with minimal educational background tend not to adopt too many apps. Although, the results of the qualitative data analysis revealed that the majority of respondents with limited educational background tend to adopt ordinary apps such as WhatsApp and Facebook to support the business. The quantitative data analysis using correlation coefficient analysis reveals that the respondents possessing higher educational qualifications tend to adopt a lot more apps which they use to support business operations. Operating some of the complex apps requires prior learning and training; whilst other ordinary apps used by the general public for personal and business purposes such as WhatsApp and Facebook do not require training and education to operate them. Adoption of WhatsApp and Facebook is widely used in society and it is easier to adopt.

The preceding section reports on the findings and results of the PMCC correlation coefficient analysis. The quantitative data analysis was discussed relating to the correlation of variables in the utilization of apps for business. The findings of the quantitative data analysis support the research proposition. The correlation coefficient analysis was presented in graphs and tables indicating the statistically significant association between the variables. The findings support the research proposition and reveal that there is a statistically significant positive correlation between the usage of apps for business and educational qualifications. The findings support the proposition in the research report by revealing the statistically significant negative

correlation between the usage of apps for business, the CIDB grading, and the annual turnover of the firm.

In the subsequent section, a summary and conclusion of the entire chapter are discussed. Section succinctly summarizes the findings of the research report, discussing the qualitative data analysis and the quantitative data analyzed to answer the research questions. The section demonstrates how the research aim is achieved and discusses the findings relating to proposition testing.

4. 10 Summary of Key Findings

This section draws together the reporting from the preceding sections of Chapter 4 summarizing the findings and results of qualitative data analyzed through respondents' first-hand account on apps adoption for business. The section also succinctly summarizes the findings of the quantitative data analysis using the PMCC correlation coefficient analysis. The section is structured to discuss the relationships between the findings of the analyzed qualitative and quantitative data, the research question, the research objectives, the aim of the research, and the literature reviewed.

The majority of respondents are Black and Colored with no representation from other races, the findings support CIDB (2017) in that emerging contractor firms are predominantly owned, managed and controlled by previously disadvantaged persons. The gender is comprised of majority of males and fewer females. Gender of respondents does not impact the adoption trend as both males and females display similar characteristics in the adoption trend.

The respondents' age group differ with fewer young people because the construction industry requires experience for one to operate a firm. Age of respondents impacts the adoption trend as the younger generation are embracing the trend to utilise smartphone devices, the older citizens are slow adopters. This is purely based on the younger people being technologically savvy than the older generation, the majority of respondents under 35 years utilise apps, internet and social media compared to over 55 years. The young people are likely to utilise WhatsApp, Facebook, Facebook Messenger and Twitter compared to the older generation who are reluctant and slow adopters as they have established behavioural traits on standard mobile phones they currently own and are less digitally connect.

The highest education qualification attained by respondents varies significantly with matric

certificates (31%), degree or diploma (28%), grade 10 (16%), technical certificate (13%), degree or diploma in construction (28%), primary schooling (1%) and no schooling (3%). The roles and positions held in the company by respondents reflect majority are being unilaterally operated by owner-managers (58%), partners or co-owner (29%), directors (7%) and administration (6%).

The majority of respondent do not possess construction related qualifications having a limited educational background and the companies are mostly led by a single person. The educational qualifications confirm literature that in SA emerging construction companies are unilaterally owner-managed by unskilled and untrained leaders (Thwala & Phaladi, 2009; Thwala & Mvubu 2008; Waziri et al., 2014). Construction-related qualification is low amongst the respondents, this could be attributed to prior learning and ease of access into CIDB register. It is not a requirement for one to have construction skills to open a construction firm. The lack of training and education on construction qualification impacts the apps adoption trend as the majority of respondents do not understand the construction industry practices, policies, norms and standards. Thus, are construction technology illiterate lacking an understanding of sector-specific construction apps.

The findings of the research reaffirming the findings by Osunsanmi, Aigbavboa and Oke (2018) in that construction professionals are not aware of fourth industrial revolution construction concepts. Construction professional in SA have low awareness about modern technologies resulting from a lack of research investment in the construction industry. The research findings are further supported by Ekow and Kofi (2016) revealing that the majority of construction professionals are not aware of the existence or availability of construction apps. The research findings by Azhar, Jackson and Sattineni (2015) further support this research report and agree that the majority of apps used by construction professionals are not construction apps. The lack of training and education is a major problem in the implementation of apps in the construction industry (Ekow & Kofi, 2016). There is a statistically significant moderate positive relationship between the number of apps used by the respondents and the educational qualifications they possess; the higher the educational qualifications the greater the number of apps utilized by the respondents.

The research findings reveal that there is a correlation between firms with a higher annual turnover, and having a higher CIDB grading are likely to adopt ICT technologies for business; such as laptop, desktop computer, printer and scanner as opposed to apps. The qualitative data

analysis reveals that the respondents report owning smartphone devices for personal use rather than for business use. The respondents in firms with higher CIDB grading prefer to utilize standard phone voice calls, outlook, software, a central network server for data storage of large files and running of programs. This is purely because higher CIDB graded firms can afford the ICT technologies.

The firms with higher CIDB grading have also been in operation for a longer period and have established standard operational procedures on ICT technology adoption. It is a costly exercise for a higher graded firm to shift to another more modern technological system especially when the one they currently have works optimally. The shift in adoption for these firms requires employee training, licensing, restructuring and facility upgrade; thus, reluctant to adopt apps for business. The apps adoption for business is a new trend, the firms with the better financial resource are reluctant and slow adopters of apps for business operations. On the other hand, the correlation analysis reveals that the firms with lower annual turnover and lower CIDB grading are adopting the trend out of necessity to survive and to gain a competitive advantage. The correlation analysis shows that the lower graded firms have little educational background and do not understand the use of sector-specific apps for business and rely on generic apps to assist the business survive. The affordability and cost of common ICT technologies is a great factor to the apps adoption for business.

Qualitative data has been analyzed through reporting respondents' first-hand account on apps adoption and thematic narrative analysis; the quantitative data was analyzed using PMCC correlation coefficient; the findings of the data analysis support the proposition in the research report. The research aim has been achieved by establishing what is known and not yet known by critically reviewing the literature and through the qualitative and quantitative data analysis. The research findings show that the shift does occur amongst respondents from adopting traditional ICT technologies to apps for business operations.

The first research proposition is that *"small emerging contractors with limited financial resources are not adopting ICT technologies to support business"*. The first proposition has been supported by the research findings revealing that (80%) of the respondents report owning an iOS and Android smartphone device and the adoption trend has overtaken penetration of laptops, tablets, Desktop computers and other devices. The adoption trend is impacted by lack of formal education and training, number of years in existence as a company, number of employees in firm, affordability, accessibility, flexibility, portability and improved internet

speed of smartphone devices. The findings further add to the body of knowledge on what is known and not yet known concerning that smartphone device penetration has surpassed laptops/PC and tablets in SA (Deloitte, 2017).

The research findings support QWERTY digital statistics (2017) that SA prefers adopting smartphone devices for business and personal usage as opposed to adopting desktop computers, laptops, and tablets and other devices. The research report findings further agree with Deloitte (2017) research which revealed that smartphone device penetration has overtaken other devices in SA. The research findings, however, differ with Hung-Joubert and Van Huyssteen (2017) in that a desktop computer is mostly preferred device followed by a laptop and thirdly a smartphone device.

The second research proposition is that *"small emerging contractors with limited formal education and lacking financial resources are adopting apps to manage the business in place of ICT technologies"*. Emerging contractors are impacted by a lack of financial capability and formal education; therefore, they tend to adopt alternative more affordable apps, which are not expensive and do not require training. The second proposition has been supported; the qualitative data collected reveals the prevalent themes illustrating that apps are used by respondents for communication, marketing, procurement, and documentation, financial and business management.

The quantitative data analysis using correlation coefficient analysis reveals a statistically significant moderate positive relationship between the number of apps used by the respondents and the educational qualifications they possess. The higher the educational qualifications the greater the number of apps utilized by the respondents. The lack of training and education is a major problem in the implementation of apps amongst the respondents. The respondents with limited educational background tend not to adopt too many apps and rely on ordinary apps such as WhatsApp and Facebook; the more complex apps require prior learning and training to operate them.

The research report findings show that firms with higher turnover and higher CIDB grading tend to adopt ICT technologies to run software and programs. The adoption trend is purely based on the fact that these companies have better financial resources, and are likely to invest in premises for the firm and can afford ICT equipment to enhance business productivity. These firms are noted to employ administration, the receptionist with telephone landline and desktop computers. The support staff in the financially resourced firms are allocated a telephone

landline, a laptop or computer; and the firm also has a network server and a central printing station. Respondents in these firms are noted to owning smartphone devices, however, do not rely on apps to support business operation. In contrast, the firms that are unilaterally managed by owner-managers with little or no employees and which are struggling financially, utilize smartphone devices that are readily available as a means to an end to gain a competitive advantage. It was revealed that struggling respondents utilize an internet café to support business operations for printing, emails and searching the internet.

The research report aims to explore the apps utilized by contracting businesses in South Africa. The main objective of the research report is firstly, to identify the various popular apps available for business usage. Secondly, assess the extent of use and how widespread particular apps are utilized and for what purpose. Lastly, assess the adoption trend of apps for business operations amongst emerging contractors and understand the adoption trend. The aim has been achieved through analysis of narrative themes clustered around repetitive prevalent common themes; in which the respondents had given a first-hand account on how they adopt of smartphone device compared to other ICT technologies. The research report reveals that the adoption trend is influenced by the prevalent reoccurring themes as reported by the respondents. The interview narrative is thus clustered and structured along with the following themes:

- Education and training
- Portability
- Financial capacity and cost
- Ease of use
- Challenges and problems

The research aim has further been achieved by exploring popular apps utilized by respondents for business operations. The research report reveals that (68%) respondents report WhatsApp VoIP and instant messaging chat apps to be outweighing the decreasing traditional voice calls and SMS. The use of Google services for business: Google Maps, Google Chrome and Gmail as a gateway to internet is reportedly used for business.

The findings are supported by literature indicating WhatsApp and Facebook are the most utilized chat App in SA (QWERTY, 2017; Deloitte, 2017). The findings of the research report agree with Phokeer et al. (2016) that Facebook and WhatsApp are the most popular apps in

terms of usage. The popular apps in order of preference include Google Play Store, Chrome, Gmail, Twitter and Instagram.

It has been shown, surprisingly, that none of the respondents has installed construction apps into their smartphone devices; despite literature informing that there is an excess of 13 000 construction apps on Apple iPad (Azhar, Jackson & Sattineni, 2015). It would therefore be expected that emerging contractors are adopting construction apps to support business as they are easily accessible on Google play store and the apps are perceived to enhance performance. The research problem persists with fewer emerging contractors, in this instance, no respondent is adopting construction apps and some do not understand the apps adoption trend and therefore not adopting the trend. This is problematic as the trend to use construction apps for business operations is not widespread enough. Ekow and Kofi (2016) notes that construction professionals in SA are not aware of fourth industrial revolution construction concepts; a similar trend is evident in Ghana (Osunsanmi, Aigbavboa & Oke, 2018). The majority of apps used by construction professionals for business operations are not construction apps; instead, they use other generic apps which can help them in the management of their businesses (Azhar, Jackson & Sattineni, 2015). This means that the lack of education amongst emerging contractors in SA contributes to the misunderstanding and low adoption of sector-specific apps for business.

The research problem persists and it is a serious concern since the research report and literature has revealed that emerging contractors in SA do not understand the adoption of apps specifically intended or designed for business usage and are therefore not advancing their firms performance. The research report and literature has further revealed that emerging contractors are utilizing ordinary apps used by SA in general as a means to an end (Phokeer et al., 2016; Deloitte, 2017; QWERTY, 2017). The majority of respondents' response can be statically inferred and generalized to emerging contractors in SA; that they are not aware of fourth industrial revolution construction concepts and are not utilizing apps for business operations intended specifically for the management of construction industry firms. The research report supports the findings by Osunsanmi, Aigbavboa and Oke, (2018) and Amusan et al. (2018). There is a serious problem concerning the apps adoption trend and it continues to impede emerging contractors in SA construction industry.

The research report findings confirm what is known and not yet known relating to the construction industry decline in the adoption of fourth industrial revolution construction

concepts. The industry is a slow adopter, and it is reluctant and resist the adoption of ICT technologies when implemented compared to other industries (Sargent et al., 2012; Hosseini et al., 2012). Lack of construction apps adoption amongst the respondents could be attributed to only (28%) of respondents having attained construction-related educational qualifications. The respondents possess limited knowledge on construction industry practices and are therefore not knowledgeable on fourth industrial revolution construction concepts.

The research objectives have been achieved through assessing how popular smartphone apps are utilized; assessing the extent of use and the role of the apps through respondents' first-hand reporting and accounts on apps adoption for business. Respondents have shed the light by reporting the popular apps they use in their businesses. Qualitative data reporting how apps are utilized through interview narratives which were clustered and centred along the core themes revealing how apps are utilized. The core themes in the narratives are the following:

- Communication
- Marketing, Procurement and Social Media
- Financial & Business Management
- Photographs, Video and audio recording
- Construction apps
- Benefits and improvements to performance efficiency and productivity.

The primary and secondary research question relating to how small emerging contractors in SA use apps to improve business performance. Relating to preferred ICT devices, the apps mostly used and what it is used for, the challenges, barriers and benefits for business have been described in the preceding section. Respondents described the benefits of the adoption trend through the interviews. The research report findings reveal that the use of apps improves business operations. Respondents report that apps makes it easier to operate the business, saving time, cheaper, accessible, portable, user friendly and efficient. The apps allow for easier procurement management and marketing of business services online; provides for the platform to engage, communicate and share information with multiple people simultaneously. The apps improve business processes, increasing the level of accessibility for customers; however, the cost of data is a major disadvantage.

The preceding section summarized the findings of qualitative data analyzed. The section also summarized the findings of the quantitative data analyzed using the PMCC correlation

coefficient analysis. The section summarized the relationships between both the qualitative and quantitative data, the research question, the research objectives, the aim of the research, the research proposition and the literature reviewed.

The subsequent section is the conclusion and recommendations chapter, reporting on the practical implications of the research report, the relationships between the findings of the research, and the literature review. The limitations of the research report are discussed and recommendation for further research are made.

5. Conclusion and Recommendations

5. 1 Introduction

This chapter is a conclusion to the research structured into three parts; firstly, succinctly reporting on research question answered, the research objectives met, the research aim achieved and proposition supported. Secondly, concisely discusses the linkages between findings of the research and the literature review, reporting on practical implications of the research. Thirdly, the limitations of the research are discussed and lastly, the recommendation for further research.

The research report examined the trends in the utilization and adoption of smartphone apps for business purposes amongst emerging contractors with a CIDB contractor grading 1 to 4 in SA. The unique characteristics of emerging contractors in SA in terms of financial capabilities and lack of educational qualifications is a serious problem as it contributes to the misunderstanding and low adoption of sector-specific apps for business. The small emerging contractors do not understand the fourth industrial revolution construction concepts and are not utilizing apps for business operations intended specifically for the management of construction industry firms. The research report seeks to understand the decisions of small emerging contractors to adopt apps for their business; to make offerings and programs that are relevant to them.

The research question was thus to determine how small emerging contractors in SA are using apps to improve their business performance. The main objective of the research report was first, to identify the various popular apps available for business usage. Secondly, assess the extent of use and how widespread particular apps are utilized and for what purpose. Lastly, assess the adoption trend of apps for business operations amongst emerging contractors and understand the adoption trend.

Critical literature review revealed what is known and not yet known about the utilization of apps for business amongst emerging contractors in SA. The literature review began with shedding light on the context of emerging contractor in SA in terms of classification and categorization. The literature further informed on the preferred ICT devices for personal and business usage amongst ordinary SA. Research further highlighted the lack of awareness by SA construction professionals concerning the fourth industrial revolution construction concepts. Literature informed the research report on app-based computing devices for SMEs

and shown through research the nature of shift towards app-based devices globally and in SA.

The positivism research design approach was chosen in the report to assess the strength of the statistical relationship between the variables in the research proposition and generalize the research findings to a certain extent. The variables in the research proposition were the number of apps used by the respondents; the educational qualifications; the annual turnover; and the CIDB grading for the firms. A mixed-method approach both qualitative and quantitative was used in data collection and analysis to provide contextual background and a better understanding of how are small emerging contractors in SA using apps to improve their business performance.

Primary data collected through telephone interviews was analyzed in two sections; firstly, qualitative analysis to identify the various popular apps available for business usage, assess the extent of use and how widespread particular apps are utilized and for what purpose. The qualitative analysis assessed the adoption trend of apps for business operations amongst emerging contractors and understand the adoption trend. The second section, quantitative analysis using PMCC correlation coefficient analysis to ascertain whether there are any statistically significant associations between the research proposition variables and determine whether the variables impact the apps adoption trend.

5. 2 Research conducted vs aim and objectives

The research report aimed to explore the use of apps uses by small emerging contractors in SA to improve their business performance. The three primary research objectives linked to empirical questions on how apps are utilized for business were:

- Identify various popular apps available for business usage
- Assess the extent of use and how widespread particular apps are utilized and for what purpose
- Assess the adoption trend of apps for business operations amongst emerging contractors in SA and understand the adoption trend.

The objectives above can be evaluated in the data presented and analyzed in the preceding chapter 4. The first objective relating to identifying various popular apps available for business usage was discussed in section 4,5 and 4,8. The sections presented data relating to the first

objective, revealing the preferred ICT device, and identifying chat apps and social media apps as the most popularly used apps amongst the respondents for business.

The second objective on the assessment on the extent of use and how widespread particular apps are utilized and for what purpose was discussed in section 4,7. The narrative themes alluded to the respondents' first-hand experience on apps usage for business. The section reported on how respondents use the apps, the various types of apps they utilize and for what purpose the apps are used to assist in business operations.

The third objective on the assessment of the adoption trend of apps for business operations amongst emerging contractors in SA and understand the adoption trend. Section 4,7 discussed and presented qualitative data through narrative themes to understand the decisions of small emerging contractors to adopt apps for their businesses.

The third objective with the aim of understanding the adoption trend was partially met, the narratives captured from the telephone interviews have not provided a full understanding on the adoption trend in its entirety. This is due to the complexity of the factors influencing the decision of emerging contractors to adopt apps for business. However, the research report has endeavored to understand how small emerging contractors in SA are using apps to improve their business performance.

5. 3 Conclusion of the Study

The research report findings reveal that the most popular utilized ICT device for business operation is a smartphone device; supporting the proposition and agreeing with the literature review. The research further shows that the majority of apps utilized by emerging contractors are chat apps and social media apps and not construction apps. The aim of the research has been achieved by exploring the use of apps uses by small emerging contractors in SA to improve their business performance.

The aim of the research report was achieved by identifying popular apps used for business operations and how the apps are utilized by the respondents; describing the role of apps for business. The research report findings revealed that a lack of training and education, and affordability contributes to the adoption of apps. The research question was achieved through the qualitative data analysis using interview narratives and quantitative data analysis using PMCC correlation coefficient analysis. The research report did not measure the extent of perceived improvements to firms' performance. The research report shows that apps are

predominantly used for communication and procurement, thus, achieving the research objective by assessing the interview narratives on apps adoption trend. The research proposition was tested using significance testing; the number of apps used for business correlates to the educational background, the annual turnover and the CIDB grading for the firm.

The main findings in research are consistent with information provided in the literature review; the adoption trend utilizing smartphone device for business operations has surpassed the penetration of laptops, desktop computers and tablets (ICASA, 2019; Fluent, 2017; Deloitte, 2017; Qwerty, 2017; Ribiero, 2012; Mbuyisa & Leonard, 2015). Data-driven apps, VoIP and instant messaging chat apps utilisation is far greater than the decreasing traditional voice calls and SMS (QWERTY, 2017; Deloitte, 2017; Phokeer et al., 2016). Construction professionals are not entirely utilizing construction apps for business, they are reluctant and slow adopters of the trend (Osunsanmi, Aigbavboa & Oke, 2018; Amusan et al., 2018; Ekow & Kofi, 2016; Martinez-Rojas, Marin & Vila, 2016; Sargent et al., 2012; Hosseini et al., 2012).

Practical implications of the research findings center on the core of the research problem which persists. The serious concerns are evident in the research report and literature with emerging contractors in SA lacking education and financial resources in the construction industry. The understanding of the use of apps, both generic and sector-specific for business purposes is not well understood by small emerging contractors in SA and they are therefore not advancing their firms performance. The problem continues to handicap the small emerging contractors as the majority use ordinary apps which are used by others in society to support the business. It has been argued that some emerging contractors are not aware of fourth industrial revolution construction concepts and are not utilizing apps for business operations intended specifically for the management of construction industry firms. The unique characteristics of emerging contractors in SA in terms of financial capabilities and lack of educational qualifications is also a continuous problem as it contributes to misunderstanding and low adoption of apps for business.

There are five major findings observed in this research report presented in the list below

- The adoption trend utilizing iOS and Android smartphone device for business operations has surpassed the penetration of laptops and desktop computers.

- There is a statistically significant moderate positive relationship between the number of apps used for business and the educational qualifications. There is a statistical significant weak negative association between the number of apps used for business, the annual turnover, and the CIDB grading for the firms.
- WhatsApp VoIP and instant messaging chat apps utilisation are far greater than the decreasing traditional voice calls and SMS.
- Emerging contractors are not entirely utilizing construction apps for business, they are reluctant and slow adopters of the trend. Instead, generic apps utilized by ordinary SA are used as a means to an end.
- Social media apps WhatsApp, Facebook are the most popularly used apps amongst the respondents. Other apps utilised for business operations include Google Play Store, Chrome, Gmail, Twitter and Instagram.

According to this research, it is recommended that software App developers, the construction industry and government work in unison to develop apps and to formulate training programs targeted at emerging contractors aiding the increase in the apps adoption trend. More awareness needs to be conducted through statutory regulatory bodies such as CIDB educating emerging contractors on availability of apps informing them on related improvements to the firm's performance.

The research is limited to emerging contractors with CIDB grade 1-4, further research to be conducted to include the other CIDB grades 5-9 assessing the adoption trend for a myriad of construction companies to get a better understanding of the trend. The sampling location for the research is limited to respondents geographically located in Gauteng Province. Research to be conducted to include rural areas and other urban areas in SA to make an accurate statistical inference to the general population of emerging contractors in the country. The research has also been limited to general building (GB) classification of CIDB for convenience and since the sample became too large when including other classifications and is impractical to be completed within the research time frame. Further research with the inclusion of other CIDB classifications can paint a better picture of the apps adoption trend.

5. 4 Recommendations for Further Research

It is not known to what extent apps improve firms output and it is beyond the scope of this study. Research to be conducted to evaluate the extent of the perceived improvement to the

firms' performance utilizing apps for business.

Further research should be conducted to assess the barriers to construction apps adoption by emerging contractors; since none of the respondents in this research reported to be utilizing construction apps for business. Research on the development of a training program aimed at aiding construction professionals to adopt apps. Research on the influences of software apps developers in creating construction apps for professionals.

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APPENDIX A: SURVEY INSTRUMENT

Utilisation of Smartphone Apps for business by grade 1 - 4 emerging construction contractors

Personal Details

Surname/Last name

First name

Title/Prefix Mr ☐ Miss ☐ Ms ☐ Mrs ☐ other

Age | 25-30 | 30-35 | 35-40 | 40-45 | 45-50 | 50-55 | 55-60 | 60-65 | ≥65 |

Gender Female ☐ Male ☐

General Background

Population Group | Black | Coloured | Indian | White | Chinese |

Highest Educational Qualification

Role in Company and Years of experience

Company Details

Company years of existence As a contractor | 0-5 | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | ≥40 |

Company CIDB grade

Company No. Employees

Company 2018 Annual Turnover

Typical size of projects Executed in past 3 years

Typical clients & type of work?

How do you get work?

Geographic location of project

TELEPHONE INTERVIEW QUESTIONNAIRE

Utilisation of Smartphone Apps for business by grade 1 to 4 emerging construction contractors

Research questions

1. As a contractor do you use a computer and/or laptop to manage business operations?

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2. What are the challenges and problems you encounter using laptop for business?

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3. Do you have a smartphone device to manage business operations?

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4. Which smartphone apps do you utilise for your business?

---

5. How do you utilize smartphone apps to manage business operations?

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6. How do you utilize smartphone apps in you company for communication and sharing of information (recording site meeting, site images)?

---

7. How do you utilize smartphone apps to manage construction works onsite; GPS for location, planning schedule of activities and construction program?

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8. How do you utilize smartphone apps to manage financials, procurement, supply of goods and Human resource?

---

9. Where do you source smartphone apps for your business?

---

10. What are the benefits of smartphone apps for your business?

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11. How do smartphone apps improve performance in your company?

APPENDIX B

Participant Information Sheet

Utilisation of Smartphone Apps for business by grade 1 to 4 emerging construction contractors

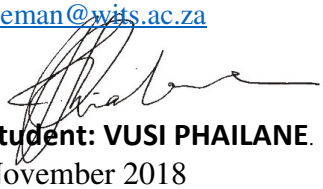
Dear Sir/Madam,

My name is Vusi Phailane registered for Master of Science in Building (Project Management in Construction) at Wits University in Johannesburg. As part of my studies I have to undertake a research project, and I am investigating Utilisation of Smartphone apps for business amongst emerging contractors with CIDB grading 1-4. The aim and objective of the research project is to assess adoption trend and utilisation of Smartphone apps and identify various apps available to influence business operation for emerging contractors.

As part of the project I would like to invite you to be a participant in telephone semi-structured in-depth interviews to establish how emerging contractors utilises iOS, Android or tablet Smartphone apps in enhancing business operations. The telephone interview will be transcribed with the participant's permission; data collected will be protected and abide by rights of privacy and copyright. The interview will take approximately 30 minutes, the questions asked are: how contractors utilise Smartphone apps and identify particular apps available for utilization amongst emerging contractors.

Participants to research project will not receive any redirect benefits from taking part in study, and there are no disadvantages or penalties for not participating. Participants may withdraw from the research at any time and refuse permission to be audio recorded or answer any questions. The semi-structure in depth telephone interview will be confidential and anonymous participant's identity will not be disclosed, and data collected through audio recording and transcript will be held securely privately and unrevealed. Pseudonyms to represent participant's identity in the research report; participants can stop the interview at any time and reschedule.

Queries about the research once conducted can be directed to myself on details provided. The study will be written as research report available online through Wits University library website. Research report to be accessed through email request indicated below. Ethical procedure of study queries to be directed to University Human Research Ethics Committee (non-medical), telephone + 27(0)11 717 1408, email Shaun.Schoeman@wits.ac.za



Signature:
Name of Student: VUSI PHAILANE.
Date: 23 November 2018
Email: 0210691p@students.wits.ac.za Tel: +27 82 411 1250
Supervisor: Professor David Root (david.root@wits.ac.za)

APPENDIX C

Consent Form

Utilisation of Smartphone Apps for business by grade 1 to 4 emerging construction contractors

Name of Student: Vusi Phailane
Supervisor: Professor David Root

I agree to participate in the research project, the aim and objective is to assess the widespread adoption trend and utilization of Smartphone Apps amongst emerging contractors

I agree that my participation will remain anonymous	YES	NO	(mark '**X**')
I agree that the researcher may use anonymous quotes in research report	YES	NO	
I agree that the telephone semi structured interviews may be taped and transcribed	YES	NO	
I agree that the information I provide may be used anonymously by other researchers following this study	YES	NO	

Signature: .....

Date: .....