Cape Peninsula
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SMART CONTRACTS TO MITIGATE LATE PAYMENT IN THE CONSTRUCTION INDUSTRY IN CAPE TOWN

by

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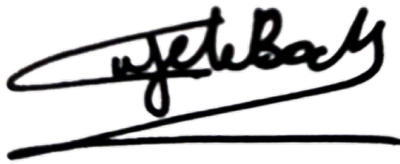**Supervisor: Dr. Samuel Tabot Enow**

District Six Cape Town
December 2022

DECLARATION

I, Angelo Bock declare that the contents of this dissertation/thesis is my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Signed: **Date: 10 December 2022**

ABSTRACT

The goal of this study was to investigate why smart contracts are not widely used despite their relevance. As documented in the literature, this system built on the blockchain technology has a profound impact on mitigating late payments. The study was inspired by the ongoing problem of late payment, which is a major source of concern for contractors in Cape Town's building industry. A semi-structured questionnaire was used to acquire the relevant data from a sample of twelve participants. The findings of the study indicates that most of the contractors cannot easily switch to smart contracts because they are solely dependent on what their clients provide. In other words, their clients prefer paper-based contracts and therefore the contractors cannot insist on using smart contracts. Also, some of the participants indicated that some of their employees are advanced in age and prefer working with traditional paper contracts, as they are not familiar with the new technology.

The findings of this study provide important insights into why smart contracts are not commonly adopted, which might be used to drive future government efforts to enhance operational efficiencies in this sector, as well as for the contractors themselves.

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DEDICATION

In memory of my late father, **Mr. Frederick John Bock**, may his memory forever be a comfort and a blessing. He was the best father a child could ever have.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1
INTRODUCTION AND BACKGROUND

1.1. Introduction

There has been a common consensus among industry experts that smart contracts and blockchain technology have a profound impact on day-to-day operations in the construction sector (Matthew, Kelechi & Sarhan, 2018). This is due to its automated nature of validating performance faster than conventional contracts (Shermin, 2017). Automating these contracts also connotes that all the relevant stakeholders can agree on the content of the contract, which will be automatically executed, ensuring performance (De Caria, 2019). These smart contracts are revolutionising the construction industry by increasing the speed and the efficacy with which transactions occur between stakeholders.

Smart contracts provide an ongoing process with minimal disruptions, particularly with regard to cash flow management (Manzano & Agugliaro, 2019). Smart contracts were introduced as a tool to mitigate the challenges posed by late payments that had devastating effects on contractors globally (Bagheri & Hassan, 2015). These contracts can be executed swiftly and in a deterministic way, which acts as a reliable solution for late or inconsistent payment (Christidis & Devetsikiotis, 2016). The reliability of these contracts is a result of their accessibility to all the stakeholders involved. Secondly, all the parties involved can easily verify the contracts when the need arises, which gives rise to a quick consensus about the outcome of the contract (Lin & Liao, 2017).

Smart contracts are also immutable with standard terms and conditions, which increases the level of transparency. These contracts are particularly important in the present dispensation because of their multi signature functions (Governatori, Idelberger, Milosevic, Riveret, Sartor & Xu, 2018). This function allows the various parties involved in a contract to make periodic payments at different stages in a project, without excessive bureaucratic administrative systems (Mengelkamp, Notheisen, Beer, Dauer & Weinhardt, 2018). The framework of contracts is designed such that the participants must both agree before a trade is executed, which increases the level of transparency (Kshetri, 2018). Without using human resources, smart contracts automatically manage the account balances in a contract and, in some cases, transfer tokens among stakeholders (Levy, 2017).

Due to the notion that smart contracts are usually authenticated before being initiated, these self-executing contracts are becoming the standard for most firms and form part of most institutions' foundation in modern society and economies (Chien, Jan & Tseng, 2002). Another significant benefit of smart contracts is their decentralisation and distributive consensus components (Udokwu, Kormiltsyn, Thangalimodzi & Norta, 2018). This implies that, there is no single authority or place where the information is processed. It is also not dependent on one single note with varying processing powers. According to Hunn (2019), the rules stipulated on the contract are executed automatically with computer codes. This therefore qualifies smart contracts to be the face of new technology, where stored information on a digital database is available to all the stakeholders involved. The information on the contract can be supplemented locally with functions as a peer-to-peer network. However, the construction sector in South Africa is still experiencing a plethora of challenges regarding late payments (Ansah, 2011). Specifically, late payments have led to disputes among stakeholders in industry and more severely sometimes even bankruptcy for contractors because of cash flow setbacks (Ansah, 2011). To date, there is still growing uncertainty regarding the awareness, feasibility, and implementation of smart contracts in South Africa; particularly in the Western Cape, to mitigate the issue of late payment. Therefore, this study seeks to fill this gap by exploring the use of smart contracts in the construction industry in South Africa.

1.2. Problem Statement

The construction sector accounts for a significant portion of the Gross Domestic Product (GDP) and Gross National Product (GNP) in South Africa (Dlamini, 2012). Despite their relevance, prior research has shown that there is a problem of late and irregular payment in the south African construction industry (Miller & Wongsaroj, 2017). Many factors have been identified as causes of late payment, ranging from client's inefficient cash flow management policies to contractual inefficiencies and disputes (Ramachandra, Rotimi & Hyde, 2015; Ansah, 2011; Merwe, Buys & Vosloo, 2011). With regard to these late payments, smart contracts are seen as a possible solution to mitigate this difficulty, where they act as an insurance and reduce cash flow uncertainty and irregular payments. Smart contracts can scale down the cost associated with implementing orthodox contracts, while providing transparency and trust to all the stakeholders involved. Therefore, this study seeks to improve on the use of technology in the day-to-day operations in the construction sector; particularly, the implementation of smart contracts in the South African construction sector.

1.3. Objectives

The aim of the study is to determine why smart contracts are not currently used in the South African construction industry, despite their relevance.

1.3.1 The research objectives

The research objectives are as follows:

- To investigate the level of awareness of smart contracts in the construction industry.
- To determine if there are structures in place to assist the implementation of smart contracts.
- To determine whether the construction industry has adequate skilled workers to implement smart contracts.

1.3.2 The main research question

The main research question to be addressed would be:

- Why are smart contracts not used in the South African construction industry, despite their relevance?

The sub-questions to the main research question are:

- What is the level of awareness of smart contracts in the construction industry?
- What are the available structures to assist with smart contract implementation?
- What are the necessary skills in the construction sector to utilise smart contracts?

1.4. Rationale of the Study

The use of smart contracts around the world has gained momentum (Mathew *et al.*, 2018). However, the South Africans construction industry is still using conventional contracts, which encourage late payment (Miller & Wongsaroj, 2017). Moreover, there have been very few interventions which are deemed effective to curb late payment as the focus is not on introducing smart contracts. This is crucial in addressing late payments, as failure to mitigate this systematic risk is equivalent to attending to the symptoms, as opposed to the root cause (Cargill, 2011). As a reaction to the exacerbation of late payment, the researcher has increasing interest in promoting smart contracts as a course of action.

In the context of smart contract literature, a significant number of studies have shown that smart contracts have the potential to reduce late payments (Ansah, 2011; Akinsiku & Ajayi, 2016). Many researchers argued that smart contracts should be the standard whereby many businesses should run their operations (Scott & Triantis, 2005). Most importantly, the development and the implementation of these contracts should be seen as essential and not as punishment (Hart & Moore, 1999). Accordingly, this study has significant relevance as it aims to explore the feasibility of implementing smart contracts in South Africa and the renewed interest in this niche research area. Without this knowledge, it will be difficult to develop interventions that will unveil specific issues regarding late payment. Accordingly, it is necessary to investigate the potential use of smart contracts, as there is a lack of information to date. By exploring the feasibility of using smart contracts in South Africa, construction workers can successfully adopt this technology, and by doing so, mitigate the issue of late payments.

1.5. Paradigm

This study will view the research problem through the lens of the interpretivist paradigm. A paradigm is a particular worldview, characterised by assumptions regarding the nature of social reality (ontology) and the nature of knowledge (epistemology) (Patton, 2002, cited in Kawulich, 2012). These paradigmatic features influence how researchers perceive and investigate the research problem. The main pursuit of interpretivism is to understand the subjective world of human experience (Kivunja & Kuyini, 2017). As this study aims explore the feasibility of implementing smart contracts, an interpretivist paradigm is appropriate, as the features of the paradigm form part of participants' subjective experiences. By understanding their experiences and their opinions on smart contracts, this study will be able to answer the question of why smart contracts are not being sufficiently used in the South African construction industry.

1.6. Data Collection Method

Structured interviews will be used to collect the relevant data, to meet the research objectives. According to Powell and Single (1996), structured interviews use a guided and interactional discussion. In so doing, structured interviews produce abundant details concerning the reasoning behind the actions, beliefs, perceptions, and attitudes of the respondents. Moreover, structured interviews are especially beneficial when exploring individual's knowledge and experiences (Kitzinger, 1995). Consequently, this method is extremely useful to the current study, as it is aligned with the purpose of the study which is explorative in nature. This method

also has the tendency of producing the type of information required to sufficiently answer the research question which is 'Why are smart contracts not used in the South African construction industry despite their relevance'?

1.7. Data Analysis

The data collected from interviews will be analysed using thematic analysis which is an apt form of data-analysis frequently used in qualitative research (Braun & Clarke, 2012; Javadi & Zarea, 2016). Thematic analysis involves methodical identification, organising and offering of insight into patterns of meaning known as themes, across a data set (Braun & Clarke, 2012: 57). In so doing, this approach will enable the researcher to gain an in-depth understanding of the feasibility of implementing smart contracts in South Africa. Accordingly, by focusing on meaning across data sets, thematic analysis will enable the researcher to make sense of shared meaning and experiences, with regard to the possible difficulties of implementing smart contracts in the construction sector (Braun & Clarke, 2012: 57). Additionally, thematic analysis is effective in analysing the viewpoints of different participants, pinpointing similarities and differences, and producing unexpected understanding (Nowell, Norris, White & Moules, 2017). Finally, due to the advantage of this method in generating rich and insightful understanding of complex phenomena, it is especially suited for this study which aims to explore the feasibility of implementing smart contracts in South Africa.

1.8. Research Approach

A qualitative approach was deemed appropriate for this study as it best suits the epistemological stance adopted for the research. This methodology resonates with interpretivists as their worldview is one in which reality is complex. The social construct of qualitative methods provides a good understanding of the relationship between people and their surroundings, as well as the role people play in constructing their reality (Thanh & Thanh, 2015). With regard to the current research problem which is the inability to use smart contracts in the construction industry, it cannot be separated from the social context that gives rise to this problem. Also, using a quantitative method to explore the use of smart contracts will present new complexities of the context by not gaining insights and in-depth knowledge that surround the contractor's views and challenges of implementing these contracts.

1.8.1. Research design

A case study research design will be used in this study. This design is appropriate for the study as it is qualitative research, and thus is closely linked to the interpretative paradigm (Starman, 2013). Case study designs are preferred when the focus of a study is to answer "why" and "how" questions (Yin, 2003, cited in Baxter & Jack, 2008), which will be the focus of the current study. Case study designs provide a rich close collaboration with the participants, allowing them to share their experiences. Accordingly, these experiences are considered to be a comprehensive qualitative account that aids in exploring the data in real-life contexts (Zainal, 2007). In so doing, case study designs are useful in explaining the difficulties of real-life scenarios that wouldn't be captured through quantitative statistical analysis, as in the case of implementing smart contracts.

1.8.2. Demarcation/delimitation of the study

This study will be based on the construction industry within the Western Cape, specifically Cape Town. The Construction Industry Development Board (CIDB) has a register of contractors which can be filtered by status, region, designation, and class with contractor information being available. Samples of registered contractors listed on the CIDB will be selected.

Chapter outlines are:

Chapter 1: Introduction: This section has presented an introduction and background to the study. It contains the research problem, the aim of the study and the rationale and justification for it.

Chapter 2: The Literature Review: This chapter will provide definitions of concepts, the theories supporting the research and a review of the relevant literature.

Chapter 3: Methodology: This chapter will focus on the methodology to be used in obtaining the data needed for the study.

Chapter 4: Analysis and Discussion of the Data: This chapter will focus on presenting the analysis of the results obtained from the collected data.

Chapter 5: Conclusion and Summary: The focus in this chapter will be on the summary of results, conclusion, limitations and recommendations for future research.

CHAPTER 2
LITERATURE REVIEW

2.1. Introduction

The aim of this chapter is to critically evaluate the current debate on the topic, to establish the significance of the study. To achieve this aim, this chapter used selective but substantial prior studies to present what is known and find the gaps to position this study. To this end, section 2.2 shall present the theoretical concept, section 2.3 shall present and an overview of the South African construction industry, section 2.4 shall highlight the concept of smart contracts while section 2.5 shall explain the mechanism of smart contracts. Section 2.6 shall present the benefits and challenges of using smart contracts. Section 2.7 shall present a description of the blockchain technology , section 2.8 shall present a review of prior literature and section 2.9 shall present the conclusion of the chapter.

2.2. Theoretical Concept

The use of smart contracts is a type of planned behaviour that can mitigate late payment in the construction industry. However, contractors have not yet adopted this technology and hence behaviour has proven to be slow to change. Efforts to promote a behavioural change are more successful when one considers which factors cause the desired behaviour (Steg & Vlek, 2009: 311). Moreover, behavioural interventions are more effective if targeted at significant antecedents of the relevant behaviour, as well as at eliminating obstacles for change (Steg & Vlek, 2009: 311). Correspondingly, it is necessary that this study understands exactly which factors promote or inhibit the use of smart contracts. Factors influencing behavioural change have been examined from different theoretical viewpoints, with the most popular being the Theory of Planned Behaviour (TPB) (Steg & Vlek, 2009; Nguyen, Lobo & Greenland, 2015). This theory is grounded in the proposition that people's behaviour is related to their emotions and thoughts concerning a phenomenon (Oreg & Katz-Gerro, 2006: 2). In addition to understanding the change in behaviour in moving towards smart contracts, this theory aims to explain the level of awareness. Accordingly, this theory is relevant to the problem under study and is important for understanding contractors' behaviour.

2.2.1. The theory of planned behaviour

The theory of planned behaviour was proposed by Ajzen (1991) and improves on the theory of reason action by adding a perceived behavioural control factor. The theory of planned behaviour proposes that behavioural patterns are a function of three factors, namely, attitudes, subjective norms, and perceived behavioural controls (Ajzen, 1991) as shown in the figures below.

Figure 2.1. Theory of planned behaviour
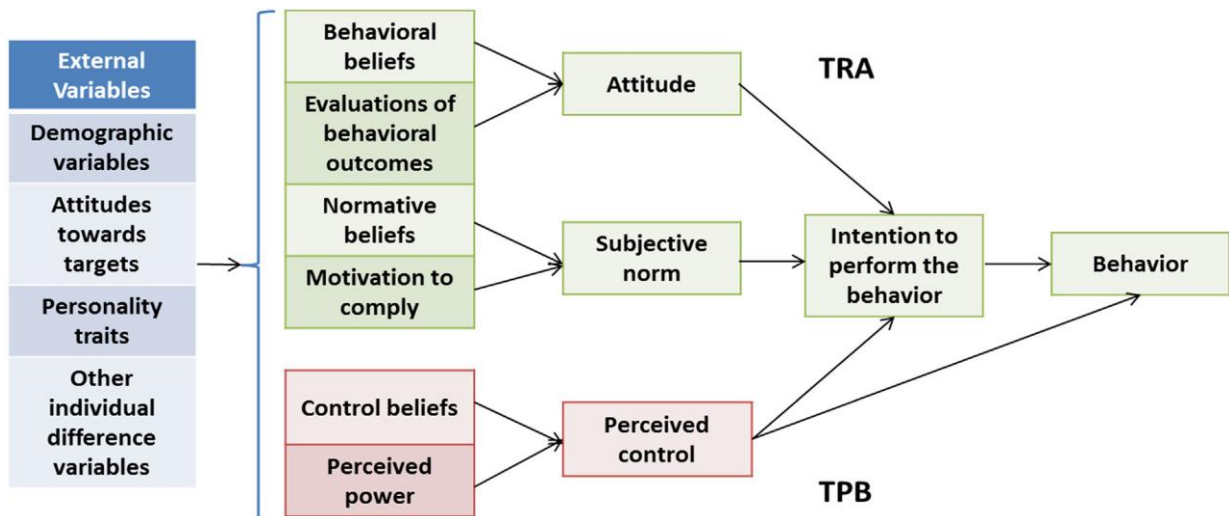
Source: DeNicola, Aburizaize, Siddique, Khwaja and Carpenter (2016:9).

According to TPB, people are motivated by their own self-interests as they assess the costs and rewards of various sorts of behaviour such as spending money, time or gaining social approval (Lindenberg & Steg, 2007: 124). Furthermore, the desire to execute a behaviour is the most important antecedent of visible conduct and intentions which are influenced by attitudes toward the activity, social standards, and perceived behavioural control (PBC) (Lindenberg & Steg, 2007: 124). Attitudes represent the overall assessment of completing the behaviour and are based on ideas about the behaviours expected costs and rewards (Lindenberg & Steg, 2007: 124). Furthermore, social norms are the interpreted social pressure to engage in a behaviour, which is based on perceptions about others' expectations, resulting in social costs and benefits (Lindenberg & Steg, 2007: 124). Lastly, the perceived ability to conduct the relevant activity as indicated by perceptions about the presence of circumstances that either facilitate or inhibit behaviour is recorded by PBC (Lindenberg & Steg, 2007: 124).

Applying TPB, contractors will use smart contracts if they think doing so will have positive consequences for themselves, as this influences their intention to use the technology. Additionally, they will use smart contracts if they think that doing so is possible, which also directly impacts their intention. Thus, a reason for the gap in the contractor's behaviour would be the perceived costs outweighing the benefits, or the fact that contractor perceives the habitual use of smart contracts as an unattainable task.

Even though this theory has been extensively used, they have specific constraints (Nguyen, Lobo & Greenland, 2015: 4). TPB fails to account for moral considerations (Nguyen, Lobo & Greenland, 2015: 4). However, approaching the use of smart contracts due to either self-interest or moral responsibility is not necessary (Steg & Vlek, 2009; Nguyen, Lobo & Greenland, 2015). This study will be guided by the TPB by drawing on specific aspects of weighing of costs and benefits of using smart contracts. De Groot and Steg (2008) stated that individuals with powerful egoistic values are likely to evaluate the personal costs and benefits. If the costs outweigh the benefits, they will not engage in the relevant behaviour and vice versa; whereas individuals with powerful altruistic values ground their decision on whether to engage in a particular behaviour based on the costs and benefits of others (De Groot & Steg, 2008: 62). Lastly, individuals with powerful bio spheric values are influenced by the costs and benefits to the environment (De Groot & Steg, 2008: 62). Contractors should use smart contracts as the social costs of using traditional contracts are too high (egoistic). This is because, traditional paper-based contracts either facilitate late payments (altruistic) or accept delays because it takes time to execute payments (bio spheric) (De Groot & Steg, 2007: 1820). However, people's behaviour is not always aligned with their altruistic and/or bio spheric values (De Groot & Steg, 2008:62). The research problem is a prime example of this, where contractors in the construction sector in South Africa are increasingly still using traditional contracts.

2.3. An Overview of the South African Construction Industry

The South African construction industry is a major contributor of employment and is interconnected with a percentile of the other industries (Windapo & Cattell, 2013:65). The term "construction" is an ecosystem of service providers including but not limited to material services as well as heavy duty machinery (Waris, Liew, Khamidi & Idrus, 2014:96). When the performance in this sector is in decline, a value chain of other industries is also affected. In the past, although the total value added to the economy has increased slightly, the market capital

of the construction industry in South Africa has experienced a decline coupled with the government budget to capital expenditure dwindling in the sector (Woods, 2021). According to Windapo and Cattell (2013:66), some of the challenges experienced in this sector are:

- Slow pace of awarding tenders.
- Unending extension of validity on submitted tenders.
- Cancellation of tenders.
- Shedding of jobs through the industry value chain.
- No development of suppliers to support infrastructure delivery.
- Delay in enacting the public procurement Act.
- Late payment, resulting in poor performance.

Relevant to this study, is the fact that the issue of late payment is a global problem and remains an ongoing issue. In some parts in the world, the average accounts receivable in the construction sector have increased dramatically; especially in less developed countries (Jung, You, Chi, Yu & Hwang, 2018:13). In some cases, the accounts receivable has increased from 62 days to 70 days, which has negatively impacted the cost of construction, as well as investments in new projects (Jung *et al.*, 2018:13). In a typical payment process in which the consultant or contractor applies for payment, the client has to pay the instalments at various stages. In other words, the final payment of a project should be completed within days unless a notification is issued prior to the final payment date and well in advance. It is also worth noting that the payment process in most construction agreements is complex, which makes it easier for a contractor not to receive payments on time. This lengthy and complex agreement includes a pay-when-paid principle which makes it even easier for contracts to be breached. As a matter of practice, given the segregated nature in this sector; coupled with a number of constructing tiers, payments are often delayed without justification. It is also common for pay-when-paid payments to be withheld midway through a project, because of manual contracts in place where all the parties involved have to sign before the funds are released. Hence, the concept of smart contracts is relevant.

2.4. Smart Contracts

As defined by Szabo (1994), smart contracts are computerized transaction protocols that carry out the terms of a contract. These contracts are designed to satisfy certain contractual conditions such as payment terms, liens, confidentiality, and enforcement, to minimize both

malicious and accidental exceptions or omissions, as well as to reduce the need for intermediaries (Szabo, 1994). By so doing, other costs such as losses from fraud arbitration and enforcement costs will be avoided.

According to Temte (2019), smart contracts are fully executable contracts without human intervention, which aligned with Bjorklund and Vincze's (2019) definition stating that smart contracts are written as codes to alleviate the shortcoming of traditional contracts and increase the automation of transactions. According to Khan, Loukil, Ghedira-Guegan, Benkhelifa & Bani-Hani, 2021:1), smart contracts are computer programs that are used to facilitate, execute, and enforce negotiation or performance of an agreement, using block chain technology. The entire smart contract process is automated and is perceived to be the best substitute for legal contracts (Borselli, 2020:102). This is because, whenever a condition is met in the contract, it triggers a web block which is recorded in the computer in the computer language, as a set of instructions (Borselli, 2020:103). These instructions are sent as notifications to the different participants. This type of contract runs automatically where it is replicated on a distributive storage platform and is becoming a central capability of block chain platforms where rules can be embedded using codes (Khan et al., 2021:2).

In using smart contracts, all the participants involved must create a program and define and enforce a logic by making self-execution. The development process of these contracts involves creating a language that will be supportive for the block chain network. The most common language used for smart contracts represents solidity networks (Sunday, 2021). Solidity has a similar syntax to JavaScript where they are both designed with Ethereum virtual machine (Parizi, Amritraj & Dehghantanha, 2018:2). Smart contracts operating on solidity contains declarations such as block code that are executed when called. It also contains functions modifiers and variables such as values which are permanently stored in the contract storage (Hill, Chopra, Valencourt & Prusty, 2018). Furthermore, smart contracts on solidity have four sorts of visibilities (Simons, 2017).

These are:

- Public visibility which can be called internally.
- Private visibility which is only available to current contract participants.
- Internal visibility which can only be accessed internally.

- External visibility which can be called from other contracts and transactions.

There are also two types of functions required in a smart contract, namely, constructor functions and fallback functions (Atzei, Bartoletti & Cimoli, 2017:178). Constructor functions also known as triggers, are functions which are called only once (Atzei, Bartoletti & Cimoli, 2017:168). This type of function is used to create objects using an internal template. On the other hand, a fallback function is used to send messages to participants in the form of Ethereum. From the above specifications and functions of smart contracts, it is evident that they are completely different from traditional contracts. The difference between these two types of contracts is highlighted below.

Table 2.1. Differences between smart contracts and traditional contracts

	Smart contracts	**Traditional contracts**
Execution time	Minutes	Days/weeks/months
Remittance	Automatic	Manual
Cost	Less expensive	Expensive
Transparency	Available	Not Available
Physical presence	Not needed	Needed
Third party involvement	Not needed	Needed

Source: Author

A contract in its simplest form is an agreement between at least two parties with laid down responsibilities of the parties for the execution of a specific activity (Finsen, 2005). Contracts exist because they legally bind the parties involved to the responsibilities undertaken. Despite the existing contracts in the construction industry, there is still a persistent problem of delayed or non-payment to contractors, which gives rise to disputes. Such disputes will usually bring about costly legal proceedings, where third parties will have to come in and this inevitably leads to financial loses for construction contractors. Smart contracts are being advocated due to the mistrust that exists among clients and contractors as well as the financial losses incurred by contractors.

2.5. Mechanism of Smart Contracts

In a smart contract, the agreements between the participants are written directly into a program code on an if-when statement. When the necessary conditions of the if-when statements are met, the program automatically executes the terms of the contract on a then perspective (Lamb, 2018). The execution of the contract starts with a transaction where one of the participants instructs the contract to perform a particular task. This transaction is received by the Ethereum node which then passes it over to the contract, inside a virtual machine. This simulated virtual machine in the contract takes the transaction as an input on a blockchain and runs it as a software program within which all the participants in the contract can see the updates. The codes in the contract are distributed among all the participants, as there is no centralised authority that holds all the documents and controls the process. The blockchain allows different actors to agree to or make changes to the contract, through their access passes. The basic features of a smart contract are highlighted in the figure below.

Figure 2.2. Basic features of blockchain
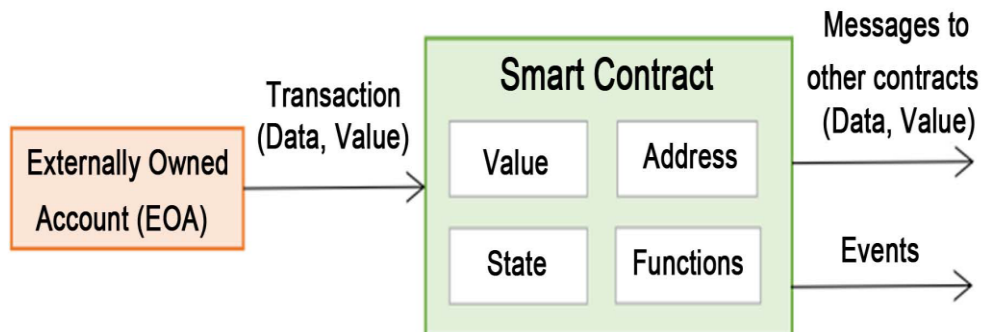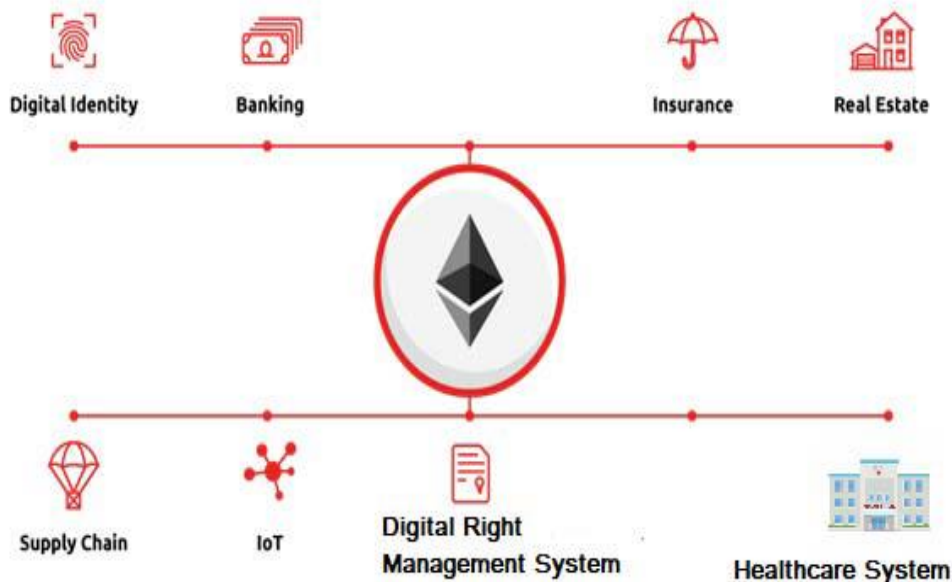
Source: Mohanta, Panda and Jena (2018:3)

2.6. Benefits and Challenges of Using Smart Contracts

Limited collaboration and the serious issue of mistrust among participants in the construction industry has been cited in literature as a major cause for concern (Alreshidi, Mourshed & Rezgui 2018). Smart contracts help to mitigate this issue as the recording and sharing of all transactions on a shared ledger improves trust and promotes transparency among those directly involved with projects. The use of smart contracts also reduces the problem of late payment and secure payments that comes with it (Carderia, 2015).

Smart contracts are not reliant on human intermediation as they are guided by nodes in the blockchain network. This makes room for self-executable contracts which are more efficient; unlike traditional paper contracts, which heavily rely on human verification. Therefore, smart contracts are widely used to automate payments once a completed task has been achieved. Then it commands payment (Koutsogiannis & Bernsten, 2017). The occurrences of disputes among participants which is a common problem faced in traditional contracts can be greatly minimised; thus, leading to a reduction in the frequency of disputes occurring (Szabo, 1994).

In summary, smarts contracts provide the following benefits:

- Autonomy.
- Trust.
- Safety.
- Speed.
- Accuracy.
- Self-governance and self-reliance.

However, despite the above benefits, there are also some challenges associated with the implementation of smart contracts. The readiness to adopt smart contracts has been identified as a major setback. This is especially so because of the resistance to change, coupled with slowness of adopting new technologies in the construction industry (Koutsogiannis & Bernsten, 2017). This situation is further compounded by the resistance to change coupled with the need for more collaboration between all the participants, as well as the data exchange needed for the system to run efficiently (Barima, 2017). This setback will be mitigated if all the change happens gradually, and all stakeholders are part of it.

There may not be suitably skilled personnel to manage the blockchain and smart contract technology, leading to higher costs at the adoption stage (Koutsogiannis & Bernsten, 2017). Hiring and training more people may outweigh the initial costs accrued during the adoption stage which may not be feasible for some businesses. There are also some concerns regarding the length of time needed to finalise smart contracts, due to the complexity involved in drafting and implementing construction contracts (Gronbaek, 2016). However, the challenges highlighted cannot be compared to the advantages associated with implementing these contracts. To effectively implement these contracts, a good understanding of the blockchain technology is required.

2.7. Blockchain Technology

Blockchain technology has been defined as a network on which assets (tangible or intangible) are shared and stored on a distributed ledger (Nakamoto, 2008). With this technology, information can be shared with everyone completely and chronologically, as it contains all historical transactions. Three generations of blockchain have been developed so far to serve different purposes, namely, blockchain 1.0 for digital currency, 2.0 for digital finance and 3.0 for digital society (Shojaei, 2019).

Smart contracts form part of the blockchain 2.0 generation, as it operates in a general manner and covers transactions related to assets. There are also three main types of blockchain configurations developed to provide different solutions, based on the needs of the users, being private, public and consortium. The public blockchain is built with permission-less principles and can be accessed by anyone on the network and the data can also be read or written by any participant (Morabito, 2017; Andoni et al., 2019). The private system permits only certain participants to access and share data on it, while the consortium configuration allows separate blockchain networks to exchange information.

Blockchain technology is free and cheaper than other shared database systems such as Cloud (Shojaei, 2019). The original purpose of blockchain technology was to power bitcoin. However, blockchain technology can do much more. Despite the monotype meaning of the word, there is an array of a whole suite of distributed ledger technology involved. These distributed ledgers are programmed to record and tract anything of value from financial transactions to medical records. Due to the specific innovative features, blockchain stands to revolutionise the way business participants interact with one another.

These features are highlighted below:

- Blockchain organises data into bunches called blocks which are linked chronologically to form a pattern (Little, 2021). This pattern is referred to as a pattern of blocks in metaphor and any modifications made to the information stored in a single block cannot be rewritten; instead, the changes are put on a new block. This is made possible because blockchain is based on the accounting general ledger which is a good method of tracking data changes over time (Weking, Mandalenakis, Hein, Hermes, Böhm & Krcmar, 2019:287). Unlike the age-old ledger method which was originally a data-based file stored on a single system, blockchain was created with the intention of being dispersed and decentralized across a huge network of computers (Casino, Dasaklis & Patsakis, 2019:56). The potential to tamper with data is reduced due to the decentralisation of information.
- Blockchain creates trust in data. A series of steps must occur before a block is created. To begin, the cryptographic problem that forms the block must be solved (Zhang, Xue & Liu, 2019:16). As evidence of work done, the puzzle that has been decoded is shared with other computers in the network. The evidence is then verified by the network, and

if it is valid, a new block is added to the chain. Combining these complex functions and verifying them with many other computers ensures that every block of the chain can be trusted (Casino, Dasaklis & Patsakis, 2019:56). Since the network does the trust building, participants can interact directly on a real time basis.

- Blockchain offers a trusted peer-to-peer interaction, thus revolutionising the way participants get involve in a contract (Casino, Dasaklis & Patsakis, 2019:56). The access, verification and transaction with another party is facilitated through this network. This is because blockchain is a collection of technologies rather than a single system that may be used in a variety of ways. This network of technologies can be public and open accessed by everyone while others are not open to everyone. There is also hybrid blockchain, which combines public and private blockchain.

The diagram below depicts the blockchain process.

Figure 2.3. Sequence of blocks in a blockchain
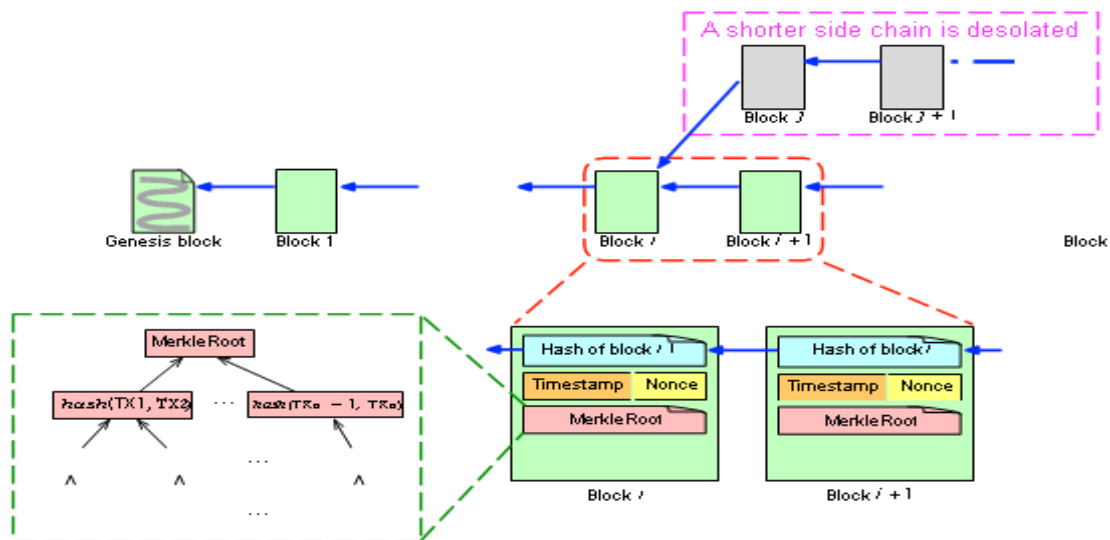
Source: Zheng et al. (2019:475)

2.8. Review of Prior Literature

The understanding of smart contracts and the factors that prevent them from being used in various industries has been thoroughly documented across the world. One such study was carried out by Seijas, Thompson and McAdams (2016) which also revealed a lack of technical know-how and the inability of the parties involved in the contract, to understand the contract

codes. This has caused some businesses to rely on the skills of third parties or revert to the traditional paper-based agreements. Seijas et al., (2016) also indicated that communication through the blockchain network was a difficulty that most businesses faced. Mason and Escott (2018) investigated the possibility of implementing smart contracts to the construction industry in the United Kingdom; since it was successfully being used in other sectors in the country. Mason and Escott (2018) distributed questionnaires to 117 participants, to gain an understanding of the willingness and potential barriers to implementing the technology. The findings revealed that although there was some knowledge of smart contracts and some form of awareness on the potential benefits, compared to traditional contracts; the fear of the unknown and overpowering doubt that full automation was possible was a source of major concern. There were also divided opinions regarding the role technology would play in fostering or hindering human interaction, which is considered key in the construction industry. In a South African study, Osunsanmi, Aigbavboa and Oke (2018) investigated the readiness of professionals in the construction industry towards embracing digitalisation. Questionnaires were used as the primary data collection tool and the findings revealed that digitalisation awareness levels among construction professionals were quite low. Their study also revealed that, both contracting and consulting firms in the construction industry seemed not quite ready to digitalise their transactions, although its ability to improve performance was agreed upon. Bjorklund and Vincze (2019) measured how much is known in the construction industry in Sweden. Bjorklund and Vincze (2019) explored the concept of blockchain and smart contracts on the factors that inhibited how they could be implemented and how they could increase efficiency within financing and supply chain management. Using semi-structured interviews and questionnaires on six Swedish construction companies, the findings revealed that most construction workers had limited knowledge of blockchain and smart contract technologies.

The level of digital immaturity and the continuous use of paper-based contracts make it difficult to switch to smart contracts. In the same year, the discussion paper of Zheng et al., (2019) also indicated that smart contracts are usually written in programmable languages such as Java, which could not be easily understood by the contractual parties. Faraji (2019) looked at a smart contract based conceptual model for optimizing risk distribution in the construction industry. The aim of the study was to explore the features of smart contracts and their potential application for contract risk management. A questionnaire and expert opinions were used to collect the data, where the main finding proposed a blockchain based model for the

administration of contracts which would focus on the balancing of risk distribution. In another study in Nigeria, Adeyera and Olanipekun (2020) investigated the potential barriers of using smart contracts in the Nigerian construction industry. The authors also used interviews with employees from seven ICT compliant construction companies. Using content analysis, the findings revealed that the knowledge and usage of smart contracts in the Nigerian construction industry was notably low. This is in line with the findings of Bjorklund and Vincze (2019), who also discovered that an unfavourable attitude towards change remains one of the biggest barriers to the adoption of smart contracts and other new technologies. Hu *et al.*, (2020) revealed that businesses lacked the necessary oriented skills to implement smart contracts. This lack of skills caused design complexity and reduced widespread use. Gurgun and Koc (2021) studied the administrative risks challenging the adoption of smart contracts in construction projects. They used a focused group discussion methodology to discuss mitigation strategies and found that the top five risks challenging the adoption of smart contracts in construction projects were; a lack of driving force, regulation changes, work not accounted for during planning, a lack of a dispute regulation mechanism and shortcomings of current legal arrangements. It was also suggested that a semi-automated contract arrangement is considered more practical than fully automated contracts. Nanayakar, Perera, Weerasuriya and Bandara (2021) researched blockchain and smart contracts to try and find a solution for payment issues in construction supply chains. The construction industry has a vibrant supply chain with multiple suppliers and as a result, it has suffered from issues associated with financial problems. However, the blockchain and smart contract technology has been gaining significant recognition as a possible solution to such problems. The study identifies the aptness of blockchain and smart contract technology for resolving payment issues in the construction industry. A structured questionnaire was used to collect data and the findings showed that blockchain and smart contract powered solutions can significantly mitigate payment and related financial issues. A summary of the above literature is presented in the table below.

Table 2.2. Review of prior literature

Study (Author) (Year of Study)	Methodology	Country	Findings
Seijas, et al. (2016)			A lack of technical know-to-use and the inability of the parties involved in the contract to understand the contract codes.
Mason and Escott (2018)	Questionnaire survey	UK	Knowledge of smart contracts and some form of awareness on the potential benefits, compared to traditional contracts. The fear of the unknown and overpowering doubt that full automation was possible was a source of major concern.
Osunsanmi, Aigbavboa and Oke (2018)	Questionnaire survey	South Africa	Digitalisation awareness levels among construction professionals are quite low. Both the contracting and consulting firms in the construction industry seemed not quite ready to digitalise their transactions, although their ability to improve performance was agreed upon.
Bjorklund and Vincze (2019)	Semi-structure interviews and questionnaires	Sweden	Most construction workers had limited knowledge of blockchain and smart contract technologies. The level of digital immaturity and the continuous use of paper-based contracts make it difficult to switch to smart contracts.

Study (Author) (Year of Study)	Methodology	Country	Findings
Zheng et al. (2019)	Discussion paper	N/A	Smart contracts are usually written in programmable languages such as Java, which could not be easily understood by the contractual parties
Faraji (2019)	Questionnaire and expert opinions	N/A	A blockchain based model for administration of contracts will focus on the balancing of risk distribution.
Adeyera and Olanipekun (2020)	Questionnaire	Nigeria	The knowledge and usage of smart contracts in the Nigerian construction industry was notably low.
Hu et al. (2020)	System dynamics and cost setup	N/A	lacked the necessary oriented skills in implementation smart contracts. This lack of skills causes design complexity and reduces the widespread use.

Gurgun and Koc (2021)	Focus groups	N/A	A lack of a driving force, regulation change, work not accounted for during planning, lack of dispute regulation mechanism and short comings of current legal arrangements.
Nanayakar, et al. (2021)	Questionnaires	N/A	Blockchain and smart contract powered solutions can significantly mitigate the payment and related financial issue.

Source: Author

Despite the relevance of the above studies, the following gaps still exist:

- The findings of all the studies conducted in Asia and Nigeria may not be applicable to South Africa.
- The South African study was not conducted in the Western Cape region.
- The South African study did not investigate the level of awareness, the necessary structures in place and skills needed to use smart contracts. Hence this study seeks to fill in the research gap. From the above gaps, the following research questions are still unanswered

Why are smart contracts not used in the South African construction industry, despite their relevance?

The sub-questions to the main research question would be:

- What is the level of awareness of smart contracts in the construction industry?
- What are the available structures to assist with smart contract implementation?
- What are the adequate skills in the construction sector to utilise smart contracts?

2.9. Summary of the Chapter

The aim of this chapter was to present a discussion on the body of knowledge on the construction industry and smart contracts, to identify a gap in the literature and take a unique angle, hence the need for this study. The next chapter highlights the research methodology that was used to achieve the research objectives.

CHAPTER 3
RESEARCH METHODOLOGY

3.1. Introduction

Chapter One which precedes the literature review presented a system of methods and guidelines on data collection and methodological philosophies which were employed to meet the research objectives. This chapter explains the methodological approach, described the data collection methods and analysed, evaluated and justified the methodological choices. Section 3.2 highlights the paradigm. Section 3.3 shall present the research approach, while section 3.4 shall present the research design. In section 3.5, the population, sampling and sample size shall be presented. Section 3.6 shall present the data collection instrument, while section 3.7 shall present the data analysis method. In section 3.8 trust worthiness and rigour shall be presented while section 3.9 shall present the ethical consideration, respectively.

3.2. Paradigm

A paradigm is a set of assumptions about the nature of social reality (ontology) and the knowledge (epistemology) that characterize a particular worldview (Patton, 2002, cited in Kawulich, 2012: 1). These paradigmatic characteristics have an impact on how researchers view their research problem and how they study it (Kawulich, 2012: 2). Interpretivism's major goal is to comprehend the subjective realm of human experience (Kivunja & Kuyini, 2017: 33). These experiences are used by researchers to provide meaningful interpretations of the subject under investigation (Thanh & Thanh, 2015: 24). Interpretivism is based on a relativist ontology, which holds that reality differs from person to person, but that all these realities are equally valid (Haverkamp & Young, 2007; Dammak, 2015). This is because it is believed that various people have distinct perspectives on the world and that accepting these various perspectives allows the researcher to gain a better grasp of the phenomenon (Willis, 2007, cited in Thanh & Thanh, 2015). Another important notion is that reality is socially produced whereas Interpretivists propose that people actively build their own reality (Bogdan & Biklen, 1998, cited in Kivunja & Kuyini, 2017: 33). More specifically, people participate in their surroundings and make sense of them, using their historical and social perspectives as a foundation (Crotty, 1998, cited in Creswell, 2009). Consequently, the importance of comprehending the perspectives of the phenomenon under study, as well as their interpretations of the world in which they live is important and needs to be emphasised. (Bogdan & Biklen, 1998, cited in

Kivunja & Kuyini, 2017: 33). Given these two assumptions, it can be concluded that reality is mind-dependent rather than being something that exists outside of the mind (Kawulich, 2012: 10). As this study aims to understand why smart contracts are not widely used in the construction sector in Cape Town, an interpretivist paradigm is appropriate. Regarding a relativist ontology, different contractors will have different reasons for not using smart contracts all of which are equally valid. By acknowledging these different realities, this research will gain a better understanding of the intricacies that underpin the widespread use of smart contracts, which are currently functioning as a barrier to adoption.

According to Interpretivist epistemological principles, knowledge is subjective, socially produced, and mind dependent (Kawulich, 2012: 10). Interpretivists reject the idea of conducting an objective study on human behaviour, correspondingly valuing subjectivity (Willis, 2007, cited in Thanh & Thanh, 2015). Furthermore, knowledge from interpretivist research is constructed and originates from people's interactions as it cannot be observed directly and must instead be interpreted (Haverkamp & Young, 2007: 268). For qualitative researchers, this means interpreting the data as revealed by their interactions with participants and making sense of the data via their own ideas provides an intuitive understanding of the phenomena (Kivunja & Kuyini, 2017: 33). Relating to this study, researching the use of smart contracts, and using objective reasoning would not result in a comprehensive understanding of the problem as this reasoning exists in the minds of the contractors, which is subjective and based on their personal feelings and opinions. Consequently, it is essential that this study values subjective beliefs and claims, as these concepts are indispensable to investigating the problem. The researcher must interpret and develop the significance of these ideas and claims by actively engaging with participants, to uncover them.

3.3. Research Approach

This study will make use of a qualitative approach to investigate the problem because a qualitative approach is strongly associated with the Interpretivist worldview (Creswell, 2009; Thanh & Thanh, 2015; Gichuru, 2017). It is a way of analysing and interpreting the meaning that people attach to a certain circumstance, and the data is typically obtained in the natural surroundings of the participants to decide what is the best fit (Creswell, 2009: 4). Since qualitative research recognizes that the research problem occurs in a social context, the most appropriate technique to make sense of social problems is not using numbers and precise

statistical tests or experiments (Gichuru, 2017: 2). A qualitative methodology enables Interpretivist to produce fruitful reports that are required to thoroughly comprehend the relevant context, because it collects data through a procedure with great attentiveness and understanding (Thanh & Thanh, 2015: 25-26). Furthermore, Interpretivists appreciate this methodology because they believe that reality is a complicated social construct. Therefore qualitative methods enable researchers to grasp the link between individuals and their surroundings; as well as the role people play in forming their reality. (Thanh & Thanh, 2015: 25-26). In terms of the present research problem of late payment in the construction industry, it is impossible to isolate it from its social context. Since smart contracts have been sluggish to adopt or are not extensively used, quantitative approaches cannot be used to understand them. It is vital that the researcher gains insights and in-depth knowledge surrounding the contractors in the construction sector, regarding the challenges or barriers they face so that the issue of late payment can be mitigated. The researcher will be able to uncover the depth of the problem as well as how their values and opinions influence their experiences with smart contracts, by employing a qualitative methodology.

3.4. Research Design

The research design adopted in this study was a case study design which is an investigation about a present-day phenomenon bound by its real-world context (Nieuwenhuis, 2016:51). According to Miles and Huberman (1994), cited in Nieuwenhuis (2016), a case is a phenomenon that is bounded in context by a concept. When applied in this study, the phenomenon is the use of smart contracts and its relevance to mitigating late payments. This design is suited for the study since it is a qualitative research method that is closely associated with the interpretative paradigm (Starman, 2013: 30). Additionally, case study research accommodates the investigation and comprehension of complex problems such as the use of smart contracts in the construction industry; and possible interventions to mitigate late payments (Zainal, 2007: 1). Furthermore, when the goal of the study is to address "why" and "how" questions, case studies are the best option (Yin, 2003, cited in Baxter & Jack, 2008). A case study design was beneficial to this study as its use enabled the researcher to surpass the quantitative statistical results and grasp the behavioural conditions, through the eyes of the participants (Zainal, 2007: 1). This was facilitated by the fact that the design involves close collaboration between the researcher and the participants, by allowing the participants to share their experiences (Nieuwenhuis, 2016). Furthermore, case studies produce extensive

qualitative narratives that aid in exploring data in real-world contexts and describing the problems caused by real-world circumstances that would not be represented by experimental or by survey research (Zainal, 2007: 4).

3.5. Population, Sampling and Sample Size

The population of this study was made up of contractors in the construction industry in South Africa. In addition to operating countrywide, it is crucial to set population boundaries so that the study remains focused. First, the study will be restricted to contractors operating in Cape Town and will thus be conducted in this geographic location. Second, the participants who will partake in the study will be both male and female contractors. This specific group of participants is selected as this cohort of contractors are more likely to cooperate and share their experiences.

Within the boundaries of the population, participants will be selected by using purposive sampling which is the deliberate selection of a participant meeting some form of pre-existing characteristics (Etikan, Musa & Alkassim, 2016). Purposive sampling determines what needs to be known and selects participants who are able and willing to offer the information needed by virtue of knowledge or experience regarding the phenomenon of interest (Etikan *et al.*, 2016). This sampling method is generally used in qualitative research, making it suitable for this study (Niewenhuis, 2016). Purposive sampling will be used to select participants who are experiencing difficulties with cash flow because of contract delays, as they will be able to provide the necessary and in-depth information to understand why contractors are not using smart contracts. In addition, the participants will be selected from within the Construction Industry Development Board (CIDB) which has a register of contractors and can be filtered by status, region, designation, and class. In qualitative research, there are no defined guidelines for the size of the sample, and there is no restriction on how many participants should make up a purposive sample; all that matters is that the needed information has been acquired (Tongco, 2007; Nieuwenhuis, 2016). Generally, the sample size should not be too big, as this will make it difficult to extract the "thick, rich" data needed for qualitative research (Nieuwenhuis, 2016: 84). Yet the sample should also not be too small, as this will make it difficult to achieve saturation (Nieuwenhuis, 2016). However, Seidler (1974, cited in Tongco, 2007) studied various sample sizes of participants chosen purposively and found that at least five participants were needed for the data to be reliable. This study used interviews as the data collection

method discussed in the next section. Consequently, the sample size of this study was twenty contractors, which were purposively selected from the CIDB data base.

3.6. Data Collection Instruments

This study made use of semi structured interviews as the data collection instrument. These semi structured interviews usually solicit in-depth responses of the problem and usually prompt a desire to share thoughts, resulting in broadening the range of responses which may trigger forgotten details of experiences (Nieuwenhuis, 2016). Semi-structured interviews are basically a conversation with the participant to solicit rich information which is very convenient and are widely used because of their flexibility where the researcher can easily change the wording or questions to ensure that detailed information is retrieved from the participants. However, such information can also be prompted. Question guides can easily be created where the research questions are broken-up into more indirect questions in order to tease out information that answers the main research questions and sub questions. To ensure reliability of the questions, the researcher conducted a pilot test by soliciting expert and independent opinions on potential bias, ambiguity and to see whether the questions are simplified enough to allow the participants to easily understand them. Furthermore, the credibility, transferability, dependability, and confirmability of this study was implemented by means of the following steps:

- The researcher will undertake a prolonged engagement with participants during the data collection process.
- The researcher will reinforce the transferability of this study by providing a rich, detailed description of the context.
- Finally, the researcher will ensure that the research process is logical, traceable, and clearly documented, by means of an audit trail.

The researcher followed a semi-structured interview guide with additional probing, to ensure that open-ended questions are asked such as:

- Is your organisation aware of alternative contract types apart from traditional paper-based contracts?
- Why are smart contracts not being used for settling payments in your business?
- Who is responsible for enforcing computerized contracts at your organisation?

The interviews sessions were recorded in an unobtrusive manner using audio equipment. Once the session was complete, the researcher transcribed the recording at a later stage.

3.7. Data Analysis Method

The transcription of the data from the interview was analysed using thematic analysis (TA), a popular form of data-analysis in qualitative research (Braun & Clarke, 2012; Javadi & Zarea, 2016). This strategy systematically identifies, organizes, and provides insight into patterns of meaning, referred to as themes, across a data set (Braun & Clarke, 2012: 57). The researcher was able to notice and make sense of shared meaning and experiences by focusing on meaning across the data collection using TA. (Braun & Clarke, 2012: 57). Additionally, TA is useful for analysing diverse people' points of view, identifying parallels and differences, and generating unexpected understanding (Nowell et al., 2017: 2). Lastly, another advantage of this method is that it can generate rich and insightful understanding of complex phenomena (Braun & Clarke, 2012). Consequently, it was the most appropriate data analysis method which is used in this study to achieve the aim which was understanding why smart contracts are not widely used in the construction industry in Cape Town.

As a meticulous TA can create trustworthy findings (Nowell et al., 2017: 2), the researcher followed the Braun and Clarke's six-phase approach to TA. In the first phase, the researcher familiarised himself with the data, by reading and rereading the transcript of the interviews, as well as listening to the audio recording (Braun & Clarke, 2012: 60). As part of this phase, the researcher made notes while reading and listening to the data (Braun & Clarke, 2012: 60). In the second phase, the researcher began the systematic analysis of the data using coding which required another read through the data. All the important aspects were coded every time the researcher identified something that was potentially relevant to the research questions (Braun & Clarke, 2012: 62). The researcher took an inductive approach to data coding where the codes and the themes were derived from the content of the data, rather than from bringing different concepts and ideas to the data such as in a deductive approach (Braun & Clarke, 2012: 58). However, the researcher recognises that it is unrealistic to be entirely inductive and it is was not possible to entirely avoid bringing various concepts and ideas to the data; especially as this study requires drawing on aspects from the literature (Braun & Clarke, 2012: 58). In phase 3, the data applicable to each code was assembled (Braun & Clarke, 2012: 63). The researcher began by constructing themes from the raw data by including something significant about the

data into the context of the research question in each theme (Braun & Clarke, 2012: 63). This phase necessitated analysing the coded data to establish areas of similarity between codes, as well as examining the link between the themes and reflecting on how these themes would contribute to compiling a comprehensive narrative from the data (Braun & Clarke, 2012: 63-65).

The researcher then concluded this phase by creating a thematic table and assembling all the data extracts under each applicable theme; to begin phase 4 (Braun & Clarke, 2012: 65). Phase 4 involved reviewing the themes in the context of the coded data and totalling the data sets which required a final reread of all the data, to determine whether the themes encapsulated the most significant and pertinent details of the data (Braun & Clarke, 2012: 66). Additionally, this phase did not require the researcher to create supplementary themes or abandon existing themes (Braun & Clark, 2012: 66). In phase 5, the researcher defined and named themes which involved intensive work making up TA which is the "crucial shaping up of analysis into its fine-grained detail," as stated by Braun and Clark (2012). The researcher then selected extracts to present and analyse the data to tell the narrative of the data by exploring what is interesting about each extract relating to the research questions (Braun & Clarke, 2012: 67). Finally, in stage 6, the researcher produced the report with the purpose of delivering a captivating narrative about the data, based on his analysis as well as making an argument that adequately answers the research questions (Braun & Clarke, 2012: 69). In this phase, the researcher presented the themes in a manner that logically and meaningfully links them to each other (Braun & Clark, 2012: 69).

3.8. Trustworthiness and Rigour

Rigour is defined as the standard of being thorough and accurate in a study (Cypress, 2017: 254). Systematic study design, data collection, and analysis methodologies are essential for both qualitative and quantitative researchers, to ensure rigour (Pope & Mays, 1995: 110). However, qualitative researchers should strive for two additional objectives, in order to develop an account of the methods and the data that will allow another researcher to analyse the same data using the same methods and reach similar conclusions, as well as to produce a credible and coherent explanation of the phenomenon under investigation (Pope & Mays, 1995: 110). As a result, to improve the study's rigour, the researcher included a sufficient description of the procedures in the final report, particularly regarding data analysis. In qualitative research,

trustworthiness refers to the quality, authenticity, and veracity of findings, as well as the level of confidence readers have in the findings (Cypress, 2017: 254). Guba and Lincoln (1985), cited in Nowell, Norris, White & Moules (2017) revised this concept by introducing the criteria of credibility, transferability, dependability, and confirmability. For each of these terms, there are steps that the researcher engaged with to enhance the trustworthiness of the study. According to Lincoln and Guba (1985, cited in Cypress, 2017), the criteria aid researchers in directing research activities and determining whether or not the various stages of the research process fulfil the requisite rigour standards. First, the congruence of the participants' views with the researcher's representation of them is referred to as credibility (Tobin & Bengley, 2004, cited in Nowell et al., 2017).

As a strategy for achieving credibility, the researcher undertook a prolonged engagement with the participants during the interview sessions. This enabled the researcher to examine perspectives and allowed the participants to feel comfortable (Krefting, 1995: 217). Second while transferability refers to the amount where findings may be applied to people in other contexts, it differs from other components of research in that readers determine how relevant the findings are to their own circumstances (Connelly, 2016).

The researcher enhanced the study's transferability by providing a rich, complete explanation of the context, location, and participant studies, allowing readers who want to transfer the findings to do so (Connelly, 2016; Nowell et al., 2017). Third, dependability which relates to the consistency of the data was achieved by ensuring that the research process was logical, traceable, and clearly documented by means of an audit trail (Nowell et al., 2017). Audit trails supply readers with a rationale for all the researcher's decisions and choices regarding theoretical and methodological matters (Koch, 1994, cited in Nowell et al., 2017). The researcher believes that the aim of this study and its findings are auditable with the same data and that applying the findings to different circumstances could reach comparable but not contrasting conclusions (Koch, 1994, cited in Nowell et al., 2017). Last, confirmability refers to the neutrality of the data; where the findings are purely the outcome of the participants and the conditions of the research, rather than other biases and motivations (Krefting, 1990: 216-217).

3.9. Ethical Considerations

As this study involves human participation in the data-collection process, it is important to protect the participants through the application of appropriate ethical principles (Orb, Eisenhauer & Wynaden, 2001). Yet is of paramount importance for the participants to give voluntary consent before they can partake in the research. To uphold the ethics principles of the research, the nature of the study had to first, be explained to all the participants. Second, the researcher informed all the respondents about their voluntary participation and recorded their consent in writing via a consent form. Permission was requested from all the participants before audio-recording the interviews. The participants' right to privacy was enacted by ensuring that the information they provided remained confidential and anonymous (Wiles et al., 2006). To safeguard confidentiality of participants, the findings of the study will be presented in a manner such that readers cannot link the responses to the participant's identity and will thus refrain from disclosing identifiable information (Wiles et al., 2006; Wiles *et al.*, 2008). To ensure anonymity, the data analysis chapter will make use of terms such as "participant 1" instead of including names when directly quoting the participants responses. To ensure that the participants are not negatively affected because of the research process, the questionnaire was thoroughly screened to eliminate sensitive questions that could cause psychological or emotional distress (Vanclay, Baines & Taylor, 2013). Finally, the data collected from the interviews was not misused to suit the researcher's views.

3.10. Summary and Conclusion

The aim of this chapter was to highlight the methodological blueprints used in achieving the aim of this study. The research paradigm and other relevant information applied was presented in this chapter. The next chapter will focus on presenting the results and analysis of the data for this study.

CHAPTER 4

DATA RESULTS AND ANALYSIS

4.1. Introduction

The purpose of this chapter is to present, describe, interpret, and link the findings of qualitative data collected. This chapter presents the themes identified in the data as well as extracts from the interview transcripts, to support any claims. To this end, section 4.2 shall present restatement of the research problem while section 4.3 shall present the research questions, respectively. Section 4.4 shall present the survey response rate while section 4.5 shall present the findings of the type of contracts being used. Section 4.6 shall present the level of smart contract awareness. Section 4.7 shall present the findings on the reasons for not using smart contracts. Section 4.8 shall present the benefits of using smart contracts while section 4.9 shall conclude the chapter.

4.2. Restatement of the Research Problem

Prior research has shown that there exists a problem of late with irregular payment in the south African construction industry (Miller & Wongsaroj, 2017). Many factors have been identified as causes of late payment, ranging from client's inefficient cash flow management policies to contractual inefficiencies and disputes (Ramachandra, Rotimi & Hyde, 2015; Ansah, 2011; Merwe, Buys and Vosloo, 2011). Regarding these late payments, smart contracts are seen as a possible solution to mitigate this difficulty, where such contracts act as an insurance and reduce cash flow uncertainty and irregular payments.

4.3. Research Question and Sub-questions

Why are smart contracts not used in the South African construction industry despite their relevance? The sub-questions to the main research question are:

- Are stakeholders in the construction industry aware of smart contracts?
- Are there available structures to assist with the smart contract implementation?
- Are there adequate skills in the construction sector to utilise smart contracts?

4.4. Survey Response Rate

Response rate refers to how many people participated in a survey where a low response rate may not generalise the result to the entire population. The response rate acts as a guide to the representativeness of the sample. According to Baruch (1999:432), the minimum response rate should be 56 percent. The table below highlights the response rate for this study.

Table 4.1. Interview Response Rate

	Number	Percentage
Contractors invited	20	100%
Number of participants who declined the invitation	8	40%
Number of participants who accepted and participated	12	60%
Discarded	0	0%
Response rate	12	60%

Source: Author

From Table 4.1 above, the minimum response rate was achieved and hence inferences can be made from the data.

4.4.1. Business profile of selected businesses

This section of the questionnaire required the participants to provide details on the number of years they have been operating and their position in the business. The aim was to determine whether they were new to the industry and hence were not aware of smart contracts, as well as whether they were in a position of authority and thus able to effect changes. The table below presents the findings.

Table 4.2. Profile of Respondents

	Number of Respondents	Percentage
Position in the business:		
• Other	3	25%
• Manager	4	33%
• Director	3	25%
• Foreman	2	17%
Number of years in the business:		
• Less than 2 years	1	8.33%

• 2 – 5 years	3	25%
• 6 – 10 years	1	8.33%
• More than 10 years	7	58.33%

Source: Author

From the table above, it is evident that most of the businesses had been operating in the industry for two years or more (91.67 percent approximately). This meant that their decision makers could be expected to be familiar with smart contracts. Most of the participants were in a position of authority where 9 out of 12 (75 percent) were either managers, directors, or foremen. Therefore, the sample was a good sample to investigate why smart contracts were not used in the construction industry.

4.5. The Type of Contracts Used

The first question in section B required the participants to indicate the type of contracts that they were currently using. Their responses were recorded are recorded below.

Participant 1 – 'Using paper-based contracts'.

Participant 2 – 'Currently using traditional contracts'.

Participant 3 – 'Using paper-based contracts moving over to digital. It is a bit of both traditional and digital'.

Participant 4 – 'We are using traditional paper-based contracts'.

Participant 5 – 'Paper based contracts are being used'.

Participant 6 – 'Paper based contracts are being used'.

Participant 7 – 'Not using smart contracts'.

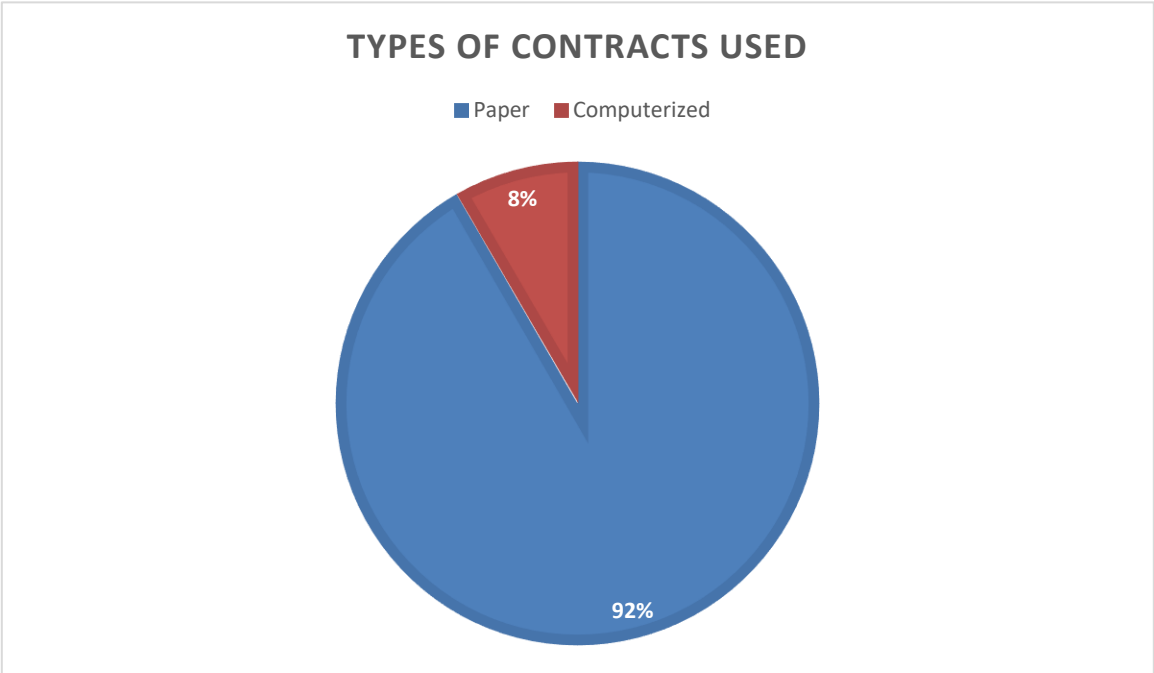Participant 8 – 'Paper based contracts are being used'.

Participant 9 – 'Using traditional paper-based contracts'.

Participant 10 – 'Computerised contracts'.

Participant 11 – 'Traditional paper-based contracts'.

Participant 12 – 'Yes, both computerised and traditional paper base contracts'.

Table 4.3. Types of Contracts Used

TYPES OF CONTRACTS USED

■ Paper   ■ Computerized

8%

92%

Source: Author

The above findings support the research problem statement which says that smart contracts are not widely used, resulting in payment delays. From the above responses, over 90 percent of the participants said they were still using traditional paper-based contracts despite operating in that industry for over 10 years. The process of drafting and enforcing these traditional contracts usually takes time which might cause delays in payments. A face-to-face meeting including a third party can further delay the process of agreeing on terms and conditions. The findings above showed that the benefits of using automated contracts are not maximised in the industry. Traditional contracts require a signature from all the participants involved and increase the chances of forging signatures or contract modification, which increases the risk of using this type of contract. Therefore, contractors in this industry are not maximising the use of smart contracts. A follow up question was also asked to investigate and to ascertain whether they were aware of other or better alternatives.

4.6. Smart Contract Awareness

The second section of the questionnaire aimed at investigating whether the contractors in the construction sector were aware of the use and benefits of smart contracts. They were required to indicate whether they were aware of digital contracts. The responses below were provided by the participants.

Participant 1 – 'Yes we are aware'.

Participant 2 – 'The company is aware of alternative contract types'.

Participant 3 – 'The company is using smart contracts'.

Participant 4 – 'Yes'.

Participant 5 – 'Yes'.

Participant 6 – 'The company is aware of alternatives'.

Participant 7 – 'We do not use smart contracts'.

Participant 8 – 'I am not sure as we are using traditional paper-based contracts'.

Participant 9 – 'Yes'.

Participant 10 – 'The company is using smart contracts'.

Participant 11 – 'Yes, we are on the verge of moving over to digitally enhanced documentation compilation and implementation, but this depends greatly on our client's requirements'.

Participant 12 – 'Yes'.

Table 4.4. Smart Contract Awareness

SMART CONTRACT AWARENESS

■ Yes ■ No

17%

83%
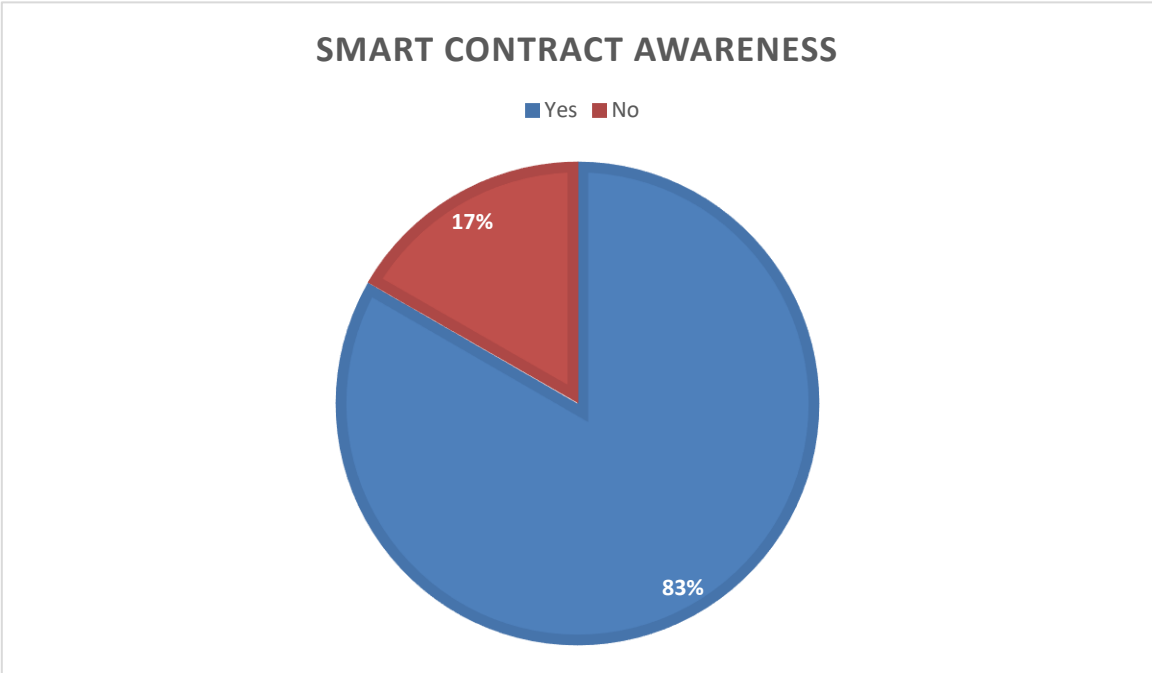
Source: Author

The above results indicate that the level of awareness of smart contracts is high among contractors. Almost all the participants indicated that they are aware of smart contracts, but it is still not clear why they are not widely used. This finding is in agreement with the findings of Mason and Escott (2018); Osunsanmi, Aigbavboa and Oke (2018), who also found high levels of smart contract awareness. However, the findings are in contrast with the results of Bjorklund and Vincze (2019); Adeyera and Olanipekun (2020) who instead found limited knowledge on smart contracts. This prompted the researcher to ask the next question on the use of these contracts.

4.7. Reasons for not Using Smart Contracts

The aim of this question was to investigate why smart contracts are not used, despite the benefits and awareness. The respondents were asked to indicate why they were using the contracts. A summary of their responses is highlighted below.

Participant 1 – 'We are aware of computerized contracts like JBCC and Procsa that get completed electronically. Contracts that we sign are initiated by clients and most of our clients

are using paper based. Our clients are mostly in the public sector. They are mostly on paper based contracts. What they give you is what you take'.

Participant 2 – 'The staff are not used to using computers and now they have to work with technology. The older staff struggle more as they are used to older working methods'.

Participant 3 – 'Company is using smart contracts'.

Participant 4 – 'We are signing contracts electronically. However, we are still using paper contracts as we are based on site'.

Participant 5 – 'I have not experienced a computerised contract as we have been signing contracts in person and electronically with clients. Certain documents are completed and signed electronically with clients and industry bodies'.

Participant 6 – 'Contracts are signed on paper, and it is dependent on the client. Clients are using traditional contracts. We are signing contracts electronically with clients and in person'.

Participant 7 – No response.

Participant 8 – 'I am aware that contracts are signed in person'.

Participant 9 – 'Cost of CAPEX investment in information systems required cost of IT systems, cyber security, employment and training costs'.

Participant 10 – 'Company is using smart contracts'.

Participant 11 – 'As mentioned above as per client's requirement's'.

Participant 12 – 'Company is using smart contracts.

The results above present some important insights as to why smart contracts are not used. Three participants indicated that the reason why they were using traditional based contracts was because of their clients. This means that the use of smart contracts is not solely based on the contractors but also on the clients. This may mean that insisting on doing business with smart contracts may result in loss of business. As per the literature, Seijas et al., (2016) also found a similar result where the clients involved do not understand the smart contracts; and hence the contractors must revert to the traditional paper-based agreements. Interestingly, two respondents indicated that they were not used to smart contract technology so they preferred paper-based contracts.

This points to a lack of the required skills to use the technology. This finding supports the findings of Seijas et al., (2016); Zheng et al., (2019); Bjorklund and Vincze (2019); Hu *et al.*, (2020) who also found a lack of the required skills to implement smart contracts. However, it differs from the findings of Gurgun and Koc (2021) who indicated that the main challenges for not using smart contracts included lack of a driving force, regulation change, work not accounted for during planning, lack of dispute regulation mechanism and shortcomings of current legal arrangements. One participant indicated that the cost of implementing smart contracts is high as an information technology officer would have to be appointed hence, they preferred to use traditional paper contracts. One participant mentioned that they had older staff who preferred working with traditional contracts and did not want to change. This agrees with the theory of planned behaviour, which states that people are generally reluctant to change. In answering the above questions, the aim and the objective of this study was achieved.

4.8. Is there any Benefit Using Smart Contracts

The aim of this question was to investigate whether the contractors using smart contracts are experiencing any benefit from using this technology. To this end, the contractors were asked to state the benefits. Their responses are recorded below:

Participant 3 – 'Faster, easier, convenient and up to date record keeping'.

Participant 10 – 'Can be stored digitally on server for easy access. Can be stored safely (password protected) on server. The signing process is quicker as the document can be emailed between parties. No transport/courier costs linked to digital contracts. Signees can be verified via online meeting'.

Participant 12 – 'The turnaround time is quicker'.

These findings are not surprising and agree with those of Carderia (2015); Koutsogiannis and Bernsten (2017) as well as Szabo (1994).

4.9. Summary and Conclusion

The aim of this chapter was to present the findings of the data collected during the interviews. The findings are like the findings in the literature, where the pattern of responses is similar. The next chapter comprises a summary and a conclusion of the study.

CHAPTER 5

CONCLUSION AND SUMMARY

5.1. Introduction

The goal of this chapter is to summarize the important findings and offer conclusions about how smart contracts can be used. This chapter also summarizes the contributions, evaluates their limits, and makes recommendations for further research. The problem statement, the major research question, and sub-questions, as outlined in Chapter 1 are re-stated in section 5.2. The literature review on smart contracts and the mechanism covered in Chapter 2 is summarized in section 5.3. The research strategy and technique employed in this study are summarised in section 5.4. This is followed by a summary and conclusion of the analysis, as well as a discussion of the study's findings in section 4.5 of Chapter 4. The contribution, significance, and recommendation of this study are presented in section 5.6, followed by the study's limitations and suggestions for further research in section 5.7.

5.2. Summary of Chapter 1

5.2.1. Problem statement

The construction sector accounts for a significant portion of the Gross Domestic Product (GDP) and Gross National Product (GNP) in South Africa (Djaimin, 2012). Despite their relevance, prior research has shown that there is a problem of late with irregular payment in the south African construction industry (Miller & Wongsaroj, 2017). Many factors have been identified as causes of late payment, ranging from client's inefficient cash flow management policies to contractual inefficiencies and disputes (Ramachandra, Rotimi & Hyde, 2015; Ansah, 2011; Merwe, Buys & Vosloo, 2011).

5.2.2. Purpose statement

The aim of the study is to determine why smart contracts are not currently used in the South African construction industry, despite their relevance.

5.2.3. Main research question and sub questions

Why are smart contracts not used in the South African construction industry despite their relevance?

The sub-questions to the main research question would be:

- What is the level of awareness of smart contracts in the construction industry?
- What are the available structures to assist with smart contract implementation?
- What are the adequate skills in the construction sector to utilise smart contracts?

5.3. Summary of Chapter 2

Chapter 2 began the theoretical concept where the TPB was used as a foundation to construct the research questions and sub questions. The chapter then proceeded with an examination of the literature on smart contracts where the mechanism, benefit and cost were highlighted. It then reviewed and explained the mechanism of blockchain technology, as well as how this technology is used to ensure efficiency in smart contracts. The chapter then reviewed prior literature on what has been conducted in the area of smart contracts. Chapter 2 revealed gaps in the prior literature and unsolved questions, which were subsequently investigated in this study, by evaluating the literature.

5.4. Summary of Chapter 3

The research approach utilized to collect data needed to answer the study's research questions was outlined in Chapter 3. The chapter began with a discussion of the research paradigm and the research approach used in the study. The research design, as well the population, sampling technique, and sample size employed in this study, were all explained in the following section. The reliability and validity of the semi-structured questionnaire were also reviewed in the next section, which covered the data gathering process, the data collection instrument, and trustworthiness and rigour. In the conclusion and summary, the ethical considerations applied in this study were explained.

5.5. Summary of Chapter 4

The outcomes of the interview sessions that were conducted to address the study question and sub-questions were presented and discussed in Chapter 4. The chapter opened with a restatement of the study topic and sub-questions, followed by a discussion of the response rate, as well as the background information of the respondents and non-response bias. The chapter then proceeded with the results and analysis of the types of contracts that are currently

being used by the participants. In addition, the chapter presented results on whether the participants were aware of smart contracts. The chapter then presented the results and analysis on why smart contracts were not being used. These focused on the factors that act as a hindrance to implementation. Finally, the findings of those contractors who are using smart contacts were also presented om the conclusion and summary of the chapter.

5.5.1. What is the level of awareness of smart contracts in the construction industry?

The results of the level of awareness of smart contracts indicated that almost all the participants interview showed that they were aware of smart contracts. Some of the participants acknowledged that they were using traditional contracts and were contemplating moving to smart contracts. Although the above results suggest that contractors are aware of smart contracts, it is still a concern considering the issue of late payment. This might imply that either the contractors are ignorant of the perceived benefits or that they are simply not interested in switching to smart contracts. Given the widespread availability of low-cost computers, it is surprising that these contractors are still using traditional paper-based contracts. This may be due to computer illiteracy.

5.5.2. What are the available structures to assist with smart contract implementation?

With regard to structures in place to implement these contracts, the results indicated that these contractors are not ready to implement smart contracts and some of them said that their staff were comfortable working with traditional paper-based contracts and they are not willing to change.

5.5.3. What are the adequate skills in the construction sector to utilise smart contracts?

As far as the required skills needed to implement smart contracts is concerned, the results showed that these contractors do not really know about the skills that are needed to use this technology. This is because some of them indicated that they could sign their contracts online and that the cost of using smart contracts is high. Although most of them said that they were not using smart contracts because of their clients' requirements, there is still not much indication that efforts are being made to convince these clients to consider the use of the blockchain technology. As indicated by the TPB, these contractors will only adopt a particular behaviour if they see the need to do so. These findings are not surprising and are in line with previous research findings, which showed that a lack of technological know-how, a fear of the

unknown and a resistance to change in the construction industry are restricting factors or impediments. This could indicate that there are other obstacles that prevent building contractors from implementing smart contracts, which were not included in the current study.

5.6. Contributions, Significance and Recommendations of the Study

5.6.1. Contributions of the study

The most significant contribution of this study is that it will provide a deep and comprehensive understanding of the factors that are currently inhibiting the habitual use of smart contracts. The study provides the contractors with viable interventions to successfully change their behaviour, in the context of technology by highlighting these aspects and gaining insights into the problem. This is especially important because neither government institutions nor contractors have to date intervened in this change in behaviour. As a result, this research will make a significant contribution to the construction industry.

5.6.2. Significance of the findings of the study

Given that the government has taken on the role of promoting this sector by developing support and steps to create a climate in which these contractors can thrive, the findings of this study are crucial to support the government in this endeavour. The findings provide light on why smart contracts are not being adopted in Cape Town's building industry. They could be used to guide the government's future efforts to design interventions to reduce late payments. As a result, the construction workers will then be able to work more efficiently.

5.6.3. Recommendations of the study

Various recommendations are made based on the findings of this study:

- The South African government should make smart contracts mandatory because contractors are unable to implement this approach on their own. Before enacting this rule, workshops focusing on the importance of smart contracts should be held for both contractors and their clients.
- The government should also offer smart contract technology support seminars to help people learn the skills they will need to put smart contracts in place.
- Contractors should invest in computerized technologies to make their operations work more smoothly.

5.7. Limitations of the Study

This research had two significant flaws. Despite its many benefits, interviews require participants to self-report their behaviour, attitudes, opinions, and expertise. As a result, this data-collection approach is subjected to socially desirable responses (SDR), which refers to participants' predisposition to provide a positive image of themselves, either through self-deception, seeking to conform to socially acceptable ideals, or avoiding judgment (Van de Mortel, 2008: 41). SDR is more likely to occur in responses to socially sensitive issues (Van de Mortel, 2008: 41), such as those relating to the usage of smart contracts and a lack of abilities that are socially undesirable and irresponsible. This may have an adverse effect on the truthfulness of their responses. However, as a moderator, the researcher addressed the SDR by creating an open and liberal space, in which the participants expressed their true attitudes and behaviours. Due to the current pandemic, the sample size was small, and the interview sessions held were limited. This raises concerns with regard to data saturation, as data saturation can only be known after at least two cases are investigated. Yet what the study lacks in quantity, the researcher has made up for with quality, where more hours of recordings will provide more depth and richness of the data. Thus, the lack of raw data was compensated for by a high level of in-depth descriptions and interpretations of the data. According to O'Reilly and Parker (2012) adequacy of sample size is evaluated by the depth of data, rather than its frequency.

5.8. Suggestions for Further Research

The study's limitations point to areas that could be investigated further in the future. The following are some of the gaps that could be filled with more study, based on the research findings and conclusion.

- Only construction contractors were interviewed, and the sample size was limited. More open-ended interviews could be used in a future study to get a better grasp of the situation.
- Most of the questions utilized in this study to evaluate the application of smart contracts was limited, owing to time restrictions. Further research should involve other stakeholders to have a relevant analysis. More open-ended interviews could be used in future studies, to get a better grasp of the situation.

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APPENDIX A : ETHICAL CLEARANCE

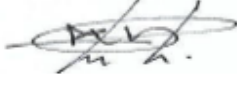**Cape Peninsula University of Technology**

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Office of the Chairperson Research Ethics Committee	**FACULTY: BUSINESS AND MANAGEMENT SCIENCES**

The Faculty's Research Ethics Committee (FREC) on **4 May 2021**, ethics APPROVAL was granted to **Angelo Marcelle Bock (203121007)** for a research activity for **MTech: Business Administration** at Cape Peninsula University of Technology.

Title of dissertation / thesis / project:	The use of smart contracts to mitigate late payment in the construction industry: The case of Cape Town construction workers Lead Supervisor (s): Mr S Enow

Decision: APPROVED

Signed: Chairperson: Research Ethics Committee	17 May 2021
	Date

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the CPUT Policy on Research Ethics.

2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study requires that the researcher stops the study and immediately informs the chairperson of the relevant Faculty Ethics Committee.

3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.

4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing accompanied by a progress report.

5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines, and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, notably compliance with the Bill of Rights as provided for in the Constitution of the Republic of South Africa, 1996 (the Constitution) and where applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003 and/or other legislations that is relevant.

6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.

7. No field work activities may continue after two (2) years for Masters and Doctorate research project from the date of issue of the Ethics Certificate. Submission of a completed research ethics progress report (REC 6) will constitute an application for renewal of Ethics Research Committee approval.

Clearance Certificate No | 2021_FBMSREC 031

APPENDIX B: SURVEY QUESTIONS

Section 1: Purpose

The purpose of this survey is to determine why smart contracts are not currently used in the south African construction industry despite their relevance. The outcome of the research will assist in the implementation of smart contracts in the construction sector in Cape Town and optimistically the rest of South Africa.

Please note that by accepting to participate in this study your consent has been sought and obtained. All the information provided for this research will be treated with complete confidentiality and will not be used for anything else except for this research. You reserve the right to withdraw at any stage during the survey should you choose to do so.

Thank you in advance for partaking in this survey.

Please do not hesitate to contact me Mr. Angelo Bock on 0734134996 email 203121007@mycput.ac.za should you wish to have the full report of the study.

Selection criteria

You were selected as a possible participant in this study because you are:

(a)   A registered contractor on the Construction Industry Development Board database
(b)   You are based in Cape Town the Western Cape

Section 2: Organisational Information

2.1. What sector of the construction industry do you work under?
2.2. For how long has your business been operating?
2.3. What is your position in the business?

Section 3: Computerised contract awareness

3.1. Does your company use computerized contracts or traditional paper based contracts?

3.1.1. If computerized contracts
3.1.1.1 Please briefly describe the specific computerized contract being used.
(Proceed to question 3.3 and onwards)

3.1.2. If traditional paper based
3.1.2.1. Is your organisation aware of alternative contract types apart from traditional paper based contracts?

If Yes
3.1.2.2. Why are the alternatives not being used? (End of interview for this participant)

3.3. Name some benefits of computerized contracts

Section 4: Structures to assist computerised contracts

4

4.1. Who is responsible for enforcing computerized contracts at your organisation?
4.2. What technology does your organisation use in executing computerized contracts? How often is the technology updated?
4.3. Which procedures does your organisation follow when executing computerised contracts?

Section 5: Skills

5.1. Which training did the staff at your organisation receive regarding computerized contracts before it was implemented?
5.2. Are the workers at your organisation comfortable with the use of technology?

APPENDIX C: Proof Reading and Editing Certificate

Busy Bee EDITING

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Email: info@busybeeediting.co.za / brendavanrensburg2@gmail.com
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Proofreading and Editing Certificate

TO WHOM IT MAY CONCERN

Busy Bee Editing has completed the proofreading, editing, layout, syntax, spelling, grammar and reference check to the best of their ability on a 16,960-word Master's Thesis titled: SMART CONTRACTS TO MITIGATE LATE PAYMENT IN THE CONSTRUCTION INDUSTRY IN CAPE TOWN for ANGELO MARCELLE BOCK, Student No.: 203121007, submitted in fulfillment of the requirements for the degree Master of Technology: Business Administration in the Faculty of Business and Management Sciences at the Cape Peninsula University of Technology.

Hugo Chandler

_____
For Busy Bee Editing: Hugo Chandler

Brenda van Rensburg

_____
For Busy Bee Editing: Brenda van Rensburg

Date: 18 December 2021