BLOCKCHAIN READINESS FOR COUNTRIES TOWARDS 2030- THE BARRIERS AND BENEFITS OF ADOPTING BLOCKCHAIN TECHNOLOGY.

By

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List of acronyms and abbreviations

TCP/IP	Transmission Control Protocol/ Internet protocol
DLS	Decentralised Ledger System
P2P	Peer to Peer
DAO	Decentralised Autonomous Organisations
WEF	World economic forum
POW	Proof of Work
ICO	Initial Coin Offering
IPO	Initial Public Offering
DPOS	Dedicated Proof of Stake
ECDSA	Elliptic Curve Digital Signature Algorithms
TXID	Transaction ID
POS	Proof of Stake
POB	Proof of Burn
AWS	Amazon Web Service
ERP	Enterprise Resource Planning
CRM	Customer Relationship Management
GDPR	General Data Protection Regulation
MB	Megabyte
FATF	Financial Action Task Force
EU	European Union
FITS	Fraud, Intermediaries, Throughput, and Stable Data
PRG	Participatory Research Group
UTAUT	Unified Theory of Acceptance and Use of Technology
ICT	Information and Communications Technology
AI	Artificial Intelligence
IOT	Internet of things
Industry 4.0	Automation and data exchange technologies

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Citation

THE DEGREE OF MASTER IN BUSINESS ADMINSTRATION

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BLOCKCHAIN READINESS FOR COUNTRIES TOWARDS 2030- THE BARRIERS AND BENEFITS OF ADOPTING BLOCKCHAIN TECHNOLOGY

Abstract:

This study investigates the factors of blockchain that will promote sustainable business towards the year 2030. The study provides an outlook to areas where business might be vulnerable in the event of blockchain implementation. The findings of this study were identified by means of an online questionnaire that targeted specialists in the arena of blockchain and business management. By a thematic analysis, the outcome of the study guides, precautions, and prepares organisations for what may come in the future of blockchain.

1 CHAPTER 1- RESEARCH PROPOSAL AND DESIGN METHODOLOGY

1.1 Introduction

Historically innovations have made life more efficient and effective for humanity by solving social needs. The design of wheel solved the problem of walking faster, the telephone solved the problem to talk louder/communicate further, and electricity solved the problem of being able to see when luminosity was poor. Through time, especially within the last 150 years, the rate of innovations has increased exponentially. With so many innovations finding their way into the social sphere, it's difficult to anticipate when the next revolutionary concept will surface. Some researchers believe that blockchain is that revolutionary concept waiting to emerge, comparing it to the internet and the revolution that it brought about (White, 2017).

As the global blockchain infrastructure grows, the need to understand and apply the technology becomes significantly higher. Being a mega-trend in technological advancement, blockchain has the potential to revolutionise the internet and the way business is conducted. Although the global economy is directed towards technological advancement, the potential of blockchain and the dynamism that it can bring to the business environment is unfamiliar to many organisations. This may leave many businesses unprepared for changes that blockchain may bring to the marketplace in a decade from now.

Blockchain is a decentralised ledger system (DLS). Unlike traditional legers, blockchain is a ledger system that is decentralised, distributed, supports disintermediation, and can be censorship resistant, borderless and open. In its infancy, being only a decade since its inception, blockchain has already been theorized as the platform that would catalyse the next generation of the internet. While in certain social spheres blockchain is well known, the majority of business is unaware of the impact that it can have on current business models (Clohessy & Acton, 2019). Moreover Clohessy & Acton, (2019) argue that this is due to a lack of skills and knowledge in the subject area, and has thus resulted in minimal adoption and implementation of the technology. However, the findings in this study highlight further variables that have contributed towards the negation in adoption of the technology.

The objective of this study is to determine what factors of blockchain will promote sustainable business towards the year 2030. Additionally the researcher aims to investigate what future business opportunities and platforms blockchain may bring by the year 2030. The primary mechanism in which this is achieved is through an international survey/questionnaire involving a sample of blockchain experts.

Furthermore, the researcher applies an interpretivist methodology and adopts a qualitative research approach to achieve the research objective. This technique formed foundation of the research design. By using thematic analysis, the researcher is able to bring meaning to the research data by identifying patterns and relationships within the data that are of paramount value in developing the main themes of the study.

The research themes provide the researcher with a platform to interpret the connotations of the themes in relation to the dialog of the question. This process creates the pathway to determine what businesses need to consider staying relevant in a widely adopted blockchain future and answer the subsequent research questions.

1.2 Problem statement

1.2.1 What causes or seems to be the problem?

The major shortcoming seems be due to lack of industry knowledge, experience and research in the field of blockchain technology (White, 2017). This in combination with the regulatory challenges supported by government and conglomerates has left many organisations unaware of blockchain's potential, its applications, the cost savings it can bring and the imminent threat that it may impose to traditional business models.

1.2.2 What is a possible solution?

The path of diffusion of blockchain in the industry is shaped by how it is hypothesised in terms of its risks and promises (Rogers, 2003). Solutions to reduce the knowledge gap in the subject matter can be catalysed through engagement in public debates, offering training to employees through specialised discourses, reviewing publications on the subject matter in prominent industry specific magazines; supplying a greater level of support and seed funding to start-ups researching the technology, benchmarking research and development topics of financial conglomerates, reviewing

organisation's operational and business strategies and by the promotion of blockchain content in educational institution's curriculums (Clohessy & Acton, 2019)

1.2.3 Intended contribution of the study

To bring awareness to business about the evolving business process management landscape that may give rise to new business platforms and flexible open business models. From this, business will be able to identify risk in the current operational models. Additionally, the researcher intends to identify new business platforms, areas of business that will best suit blockchain implementation. Furthermore, the researcher will pursue identifying the limitations of blockchain that will lead to future opportunities of the technology towards 2030.

1.2.4 Problem statement

There are many unanswered questions that arise when conceptualizing the transformation that blockchain can bring to industry. Some have compared it to the TCP/IP revolution that came about during the development of the internet (Fry-Revere, 2014). However, one cannot compare the rate of diffusion of TCP/IP to that of blockchain. The main difference is that blockchain operates on an existing platform and through existing infrastructure. While the technology is officially a decade old, and has made inroads into the field of cryptocurrency, it has become fatigued in its value offering to other sectors. As a result, there is yet to be any cases go live at a large scale (Piscini et al., 2017).

Deloitte has done extensive research in the field of blockchain to date. In a 2016 online survey, where they interviewed 308 senior executives at high revenue generating companies, 25% of respondents specified that by replacing or adapting existing legacy systems, they did not have the budget to invest in blockchain technology. The survey also identified that the trigger for widespread adoption would be applying technology to manufacturing (Piscini et al., 2017). However, the challenges and disadvantages of existing legacy systems and business models require multiple intermediaries that are susceptible to fraud and corruption, models that are closed, tedious, risky and require substantial maintenance. Additionally, the management and development of contracts and assets pertaining to these legacy systems and other areas of business; subsequently contribute to the degradation of organisation's bottoms lines (Yeoh,

2017). While executives are aware of these flaws, many are unaware of the solutions that blockchain can offer.

1.2.5 Importance of solving the problem

The blockchain mechanism accelerates complex purchasing procedures by eliminating the intervention of intermediaries, who may incur unnecessary expenses (Decaro, 2017). Unlike other transactions where the buyers, suppliers and banks require a significant amount of time to clear transactions, blockchain offers a more convenient alternative that depends on a trustless single system rather than chain of intermediaries to clear a transaction. Traditional processes to authenticate the release of documents, merchandise, and funds are avoided. Blockchain generates a clear audit trail of the time stamped documentation, giving organisations almost a live overview of the business cycle (Decaro, 2017). Consequently, blockchain can be used to enhance accountability in business undertakings.

According to Piscini, (2017); additional benefits exist in the application of smart contracts. These contracts are not only triggered autonomously, but their functionality also improves operational efficiencies through a paperless system, increases the liquidity of suppliers and significantly reduces the number of fraudulent transactions.

With so many possible applications of blockchain and the accelerated movement of industry 4.0, it is becoming ever more important for business to become more flexible and adapt their rigid business models to the likes of technologies such as blockchain. Through the awareness of what the technology can do and the dynamism it can bring to the way business, businesses can prepare themselves and change to remain competitive in the future.

1.2.6 Discuss potential causes of the problem

One of the most significant challenges of blockchain adoption is that it has become synonymous with being associated with Bitcoin. An analogy of this would be to associate the term electric vehicle only to Tesla brand. However, Tesla is only a business that utilizes the electric vehicle platform to solve a problem. As a result of Bitcoin’s association, discussions around the topic of blockchain have brought about a lack of interest, especially in the area of funding where investors have been deterred

from financing organisations associated with blockchain developments. While this reduces the risk of association from the investor's perspective, it becomes a challenge for blockchain development.

Subsequently, the involvement of governments and large conglomerates, especially banks on the imposition of regulation on the technology has been prominent, with some researchers even arguing that these entities are imposing regulations because they view the technology as a threat (A. M. Antonopoulos, 2019). Moreover, Antonopoulos, (2019) goes on to state that harsh regulations without the complete understanding of what blockchain is, will hinder its development.

Moreover, there is a lack of educational support in the subject matter from tertiary institutions. At an undergraduate bachelors' level, the incorporation of an in-depth discourse on the subject matter is almost non-existent. The result leaves many graduates unaware and misinformed about the technology going into the employment market.

1.2.7 Proposed solutions to the problem

Although there seems to be an uprise in blockchain research it is not significant enough as many of the research conducted has been theoretical and qualitative based research. There is a need for more quantitative research into the subject matter as this is a realm that will especially get the attentions of the business world. Furthermore, universities need to infuse knowledge of the technology into their curricula, as firstly it will not only increase the number of academic research proposals in the subject matter but also increase innovation developed through research. Secondly, it will facilitate awareness for graduates to bring new innovations into the marketplace.

A study by Yeoh, (2017) conceptualizes the regulatory challenges impacting blockchain in the US and EU. With too much regulation around an instrument, there is more cost involved in adhering to compliance and, as a result, this deters adoption. For the technology to thrive and develop there needs to be more interest ensued through research. It is therefore advisable for government to be aware of the extent of the regulation imposed so as not to stagnate the understanding and development of the technology.

For business to envisage acknowledgement of the capabilities and applicability of blockchain there needs to be a greater sense of trialability, compatibility and relative advantage promoted. While these elements can be promoted from within an organisation, it is unlikely to bridge the knowledge gap. The second option is that it can originate from blockchain start-ups that are able to offer a competitive platform. Therefore, it is necessary for blockchain offering businesses to broaden the scope of marketing and increase the touch points and industries that can be influenced.

1.2.8 The management question

Management needs to prepare itself for a change of dynamics in the way business is conducted. End-users are getting connected directly with the source of the product or service offered, while other forms of business such as traditional auditing are becoming redundant. It is therefore necessary for organisations to relook/rethink their short- and long-term business strategies and adapt to digitisation change in order to stay relevant towards the year 2030.

1.3 Literature review

Blockchain is a digitised decentralised ledger that allows record keeping of all peer-peer transactions without the need for a centralised authority or escrow system. The technology was conceptualised in 2008 and used as the framework in the development of cryptocurrencies (Woodside, Augustine, & Giberson, 2017).

1.3.1 Theoretical Underpinning on Adoption of an Innovation

The Unified Theory of Acceptance and Use of Technology (UTAUT) model presents four main effects for end intention and usage. These dimensions are performance expectancy, effort expectancy, social influence, and facilitating conditions. According to Venkatesh, Thong, & Xu, (2016,) the model is a key element in forecasting the behavioural intention to use a technology. On the other hand, Francisco & Swanson, (2018), argue that trust is a key element in the adoption of an innovation such as blockchain technology.

In addition to Francisco, the Diffusion of Innovations Theory explains how an idea, product, or service is adopted over time. This adoption of innovation occurs following a bell-shaped curve. It classifies consumers, in accordance to the rate of adoption,

commencing with the early innovators and concluding with the late laggards (Woodside, Augustine & Gibberson, 2017).

1.3.2 Benefits of Blockchain Technology

Blockchain has the potential to replace escrow systems of banking platforms worldwide. While blockchain stems from cryptocurrency, the benefit of its application are seen across a variety of industries. As a result of Vitalik Buterin's proposal of smart contracts in 2013, other use cases of blockchain technology have become prominent (Buterin, 2013). These include; business process improvement, trades, health information sharing, automotive ownership, and voting. Early applications proved that Bitcoin could be used as a legitimate currency in the marketplace (Woodside et al., 2017). In addition, there is the hypothesis that Bitcoin and blockchain provide a distinct advantage to populations living in underdeveloped and tarnished economies. This is a result of the technology solving the problems of hyperinflation, exchange, counterfeiting, and inaccessibility (Presthus et al., 2017). To elaborate on how blockchain solved the problem of counterfeiting, it is worth understanding that public blockchains are viewable by all participants and cannot be altered, allowing trust of transactions without a required regulatory party. Therefore, it provides a medium to eliminate double transactions and reduce fraud. Blockchain has the ability to automate a number of existing functions; it lowers transaction costs and improves transaction time by removing the need for third-party intermediary (Woodside et al., 2017)).

1.3.3 The Barriers to Blockchain Technology

The notable barriers to blockchain include cryptocurrencies. Traditionally the central banks and governments control currencies and money supply. Intermediaries recorded the details of transactions in relation to the money supply. However, when transacting over a blockchain the description of the goods transacted is not recorded. This postulates malicious prospects, in particular; money laundering to incur over the blockchain. Other barriers include publicised concerns of transaction privacy and security incidents; resolution of speed, processing time, security and privacy concerns, and integration within existing systems and networks may also present challenges (Woodside et al., 2017).

Tsanidis, Nerantzaki, Karavasilis, Vrana, & Paschaloudis, (2015) et al. argue that while potential users lack information about the technology, such as usefulness, ease of use, and possible benefits like saving time and money; there are further factors that might hinder the adoption. This may include the lack of infrastructure, potential problems with networking, and fear of the unknown (Presthus et al., 2017). Another obstacle to user adoption may be lock-in or switching cost, meaning the time, money and effort it requires starting using a new technology or innovation. Further, blockchain has the potential to become a significant source of disruptive innovations in business and management (White, 2017).

Peansupap & Walker, (2006) provide insights into what drives and inhibits effective ICT innovation diffusion at the organisational level hence advise that organisations should closely manage their ICT initiative decision making and implementation using pilot studies and a reflective learning approach to maximize advantages from lessons learned.

1.3.4 Methodologies of literature

The literature reviewed lacks commonality in measurement methods, between any two or more studies. Due to the absence of research data in the field of blockchain, the most concurrent methodology employed has been qualitative studies with the application of case studies. Previous methodologies employed in blockchain studies include text analytics, a method used to find and extract useful patterns, directions, trends or rules from unstructured text (Woodside et al., 2017). Triangulation, is an approach that combines multiple methodologies, such as qualitative and quantitative methods (Woodside et al., 2017). White, (2017) on the other hand, postulates that Delphi studies, which are frequently employed in deductive research, however, may be combined with qualitative data-capturing elements in order to afford more pragmatic instrumentation. The best sampling techniques were non-probabilistic where instances were deliberately selected and descriptive statistics were used (Presthus et al., 2017)

1.3.5 Providing a theoretical / conceptual framework to solve / address the problem.

The theoretical framework used to solve the problem is through the adoption of a qualitative research approach. While the approach is flexible, the study is predominately centred around content analysis. The motivation for this study method originates from the fact that there is a significant absence of in-depth studies available on the subject matter (White, 2017).

Content analysis facilitates researchers in identifying patterns and relationships within the dialog of the research data. Additionally, it can illustrate the characteristics and features of different variables. Through the use of this distinct tool, inexperienced researchers can enhance the understanding of the data. As a result, it brings a researcher closer to the data that can identify patterns.

It's worth mentioning that judgement plays an important role during research. According to Burchardt, (2012), qualified based judgement is an influential tool in the research process. Researchers can re-classify the categories of data based on emerging issues in society. In addition, redundant data can be easily detected and deleted. Moreover Blair, Imai, & Zhou, (2015) argue that data needs to be scrutinised, while the researcher constantly engages with the data in order to develop appropriate patterns in order to induce authentic findings.

1.4 Purpose/ rationale/ contribution of the study

In an aim to reach a successful outcome, exploratory research is proposed as the methodology to effectively solve the research problem. Exploratory research is adopted when there are few or no earlier studies, to look for patterns, ideas, and to test or confirm hypotheses. As a result, exploratory data can assist the researcher in gaining extensive knowledge in the subject matter for examination at a later stage (Collis & Hussey, 2014b). According to Adendorff, (2013), exploratory studies are opportunity-orientated, whereby future opportunities can be investigated without there being a necessary consequence. Therefore, while this paper examines future applications of blockchain technology, the advantages and its challenges it may bring, however, it may not provide a necessarily conclusive solution. On the other hand, it can provide an opportunity to lead the way for future research on the subject matter.

While the exploratory research and a content analysis will be employed, ultimately this study is a future study. According to Adendorff, (2013), the detailed purpose of Futures Studies is to discover or invent, examine and evaluate, and propose possible, probable and preferable futures. With that definition in mind for the purpose of a future study, it can be directly applied to the purpose and contribution of the study presented herein. The direct benefactors to the study beyond academia include businesses exploring into the application of blockchain, legislative organisations, government entities, and those with special interest in the drive of new business platforms and business models.

1.5 Research questions

The primary research question is:

1. What businesses need to consider to stay relevant in a widely adopted blockchain future?

While the secondary research questions aim to expose more a deeper understanding of the subject matter in a future context. The secondary research questions are:

2. What industry specific factors lead to the success of a blockchain application by 2030?
3. What are the negative effects of not regulating blockchain by 2030?
4. What properties and functions will blockchain provide in the 2030?
5. What are the comparative advantages of blockchain over traditional business practice?
6. What are the positive and negative effects associated blockchain implementation?
7. Is blockchain a disruptive technology?

1.6 Research objectives

The primary research objective of this study is to determine the factors of blockchain that will promote sustainable business towards the year 2030.

The secondary research objective is to determine what future business platforms blockchain may bring, and how may this change the way traditional business is conducted.

1.7 Research methodology

1.7.1 Research paradigm

The foundation of this study will be based on an interpretivism methodical paradigm. According to Collis & Hussey, (2014), the aim of interpretivism is to gain a comprehensive understanding of phenomena through exploration of the phenomena, as opposed to the measurement of it. In addition, because interpretivism is shaped by perception, it is subjective by nature. Therefore, the choice of selecting an interpretivist research paradigm is motivated by the fact that the researcher plans to investigate the opinions, intentions, beliefs and perceptions of experts within a regular setting.

Many researchers prefer to describe data as either being qualitative or quantitative. In order to extract meaning from the opinions of experts the qualitative research paradigm is used in this study. Rather than developing an hypothesis, qualitative studies involve focusing on an inductive outcome (Stewart & Saren, 2014).

The main objectives of this study are to commence with observation, thereafter, to detect patterns and relationships during the analysis, and finally induce an outcome that can be repeated in similar situations. Moreover, a qualitative approach considers the values and beliefs of the researcher as mechanisms to establish the facts and draw interpretations.

1.7.2 Research approach / design

As a result of the study dynamics are typically inductive by nature. The research approach is interpretivist and follows a qualitative paradigm. The design is concentrated on content analysis methodology with elements of grounded theory. Both techniques prescribe to exploratory studies. The content analysis, specifically thematic analysis is concerned with identifying themes, patterns and relationships within the text of the content being investigated. There is flexibility permitted in the methodology, and the adapted methodology focuses on recruiting international experts in the field of blockchain, analysing their response data, and bringing meaning to the data so that the research objectives may be achieved and the research questions answered. Furthermore, motivation for this research approach is conveyed through the lack knowledge and availability of research in subject matter. As a result of this deficiency,

the methodology employment provides a mechanism for engagement with experts dispersed geographically, allowing them to facilitate in achieving the desired research objectives.

The application of thematic analysis with grounded theory is an effective way of identifying and exploring qualitative data. According to Thornberg & Dunne, (2019), the combination of thematic analysis and grounded theory is useful in qualitative analysis as it facilitates in establishing an open and unbiased way of collecting the data. Researchers using this methodology identify the concepts and issues that explain the dynamics of different activities (Thornberg & Dunne, 2019). Furthermore, Rose & Lennerholt, (2017) point out that researchers need to remain impartial in their choice of extracting data from different categories. This is because it is still possible to merged varied data collection categories, which maybe the optimum solution to the research needs.

1.7.3 Sampling design

1.7.3.1 Population

The sample population consists of industry experts in the field of business process management, information technology, and hobbyists in the field of the subject matter.

1.7.3.2 Sampling frame

The sampling frame is permissible through the use of both primary and secondary data sources. In the case of the latter journal articles and web sources are used. In terms of primary data, it is through a survey questionnaire that targets an international audience of expert practitioners in business process management and information technology who have in-depth knowledge of blockchain.

1.7.3.3 Sampling method

Non-probability, purposive sampling will be initially used, as specialist and influential individuals are representative of the sample, which can bring a more expansive outcome. Although with the shortage of expertise in blockchain, it might be necessary to adapt and / or incorporate snowball sampling. Both sampling techniques involve

participants that are preselected by the researcher according to the strength of their knowledge and experience in the phenomenon being studied.

The main difference between the two techniques is that snowballing asks the respondents to refer anyone who is of a similar experience whereas judgmental/purposeful sampling does not pursue any further contacts during the study (Collis & Hussey, 2009). The criteria for the selection of participants will be based on their experience with the objective of acquiring homogenous samples based on the criteria of their experiences and expertise.

1.7.4 Data collection

The most suitable data collection mechanism that can be applied to this study is a system of online questionnaires. It is a method for collecting data whereby a respondent answers a survey over a web-based platform. This motivation for utilizing this mechanism is due to it being able to reach an international population on account of a scarcity in candidates locally. Therefore, in the context of this study, which is based on participants from multidiscipline and diverse geographical locations it is not feasible to have chosen other data collection methods such as face to face interviews.

The questionnaire follows a semi-structured approach incorporating both open-ended and probing, elaborative type questioning. To promote an expansive and explorative response; what, how, and which type questions are integrated into the questionnaire. The medium by which questionnaires will be distributed and candidates recruited is social media and blockchain forums.

The Research ethics protocol will be maintained through an ethical clearance, which will be submitted to the university; also, by offering autonomy and informed consent which will be included together with the researchers details on a covering letter explaining the purpose of the research. In addition, the cover letter offers participants the right of self-determination. That is to allow them the liberty to depart from the study at any time without penalties. Not only does this pragmatically maintain the research protocol but it also enhances the participant's willingness to contribute freely towards the study. Lastly, anonymity and confidentiality provide a backdrop for participants to think freely, without having to be concerned with the repercussions of their answers (Shariff, 2015).

1.7.5 Data analysis

According to Collis and Hussey (2009), although qualitative studies use different approaches for analysis, a generic approach can applicable to all based on four key foundation elements. The first element is to comprehend, which requires the research to ascertain a full understanding of the setting, culture and research topic before commencing with the research. The second element is synthesis of themes and concepts from the research to detect and establish new patterns. In addition, the third element is theorizing which involves the development and theorizing of schemes, until the best theoretic scheme is developed. Finally, the last element encompasses recontextualising which involves using the concept of generalisation to develop theory from the study and apply it to other settings and populations.

Similarly, applying this process in conjunction with certain thematic analyses creates a framework for deeper understanding of the data. Analysis is to be conducted on both primary and secondary data. The shortcoming or gaps identified in the analysis of the secondary data will be further investigated through acquiring primary data. As a result, the analysis of the primary data through developing nodes, themes and subthemes, enables the researcher to identify patterns in the data to construct meaning in a way that answers the research questions.

The intended research instruments for analysis are in the form of qualitative research software, namely Atlasti and Nvivo.

1.8 Reporting synthesis

As a result of the study's roots in interpretivism, as well as the fact that the primary data is based on the opinions of participants, and the researcher to some extent sharing their view on the subject matter, the approach of the study is subjective in nature.

The structure of the reporting will be synthesized, as will be the dynamics of analysis. The analysis outcomes will provide a roadmap and guidance to synthesise the reporting of the results in a meaningful way that will identify key areas and themes needed to answer the research questions.

1.9 Study outline

1.9.1 Chapter 1: Research proposal and design methodology

Chapter 1 introduces blockchain and goes on to identify the challenges faced in bringing about awareness of the subject matter. Furthermore, it provides arguments of why the technology is important to business. The chapter additionally highlights the research question, the research objectives, the research design and how it is intended to address these dilemmas.

1.9.2 Chapter 2: Literature review

In this chapter a review of literature on blockchain is pursued. The purpose was to identify major themes and data knowledge gaps that require further investigation. The literature review presented 5 primary themes, namely; a description of blockchain, the characteristics of blockchain, the framework under which blockchain operates, the economic considerations involved with blockchain and the regulation of blockchain.

1.9.3 Chapter 3: Literature review

Chapter 3 outlined the schematic that was used to achieve the research objectives. The chapter describes the methodology in which the research study was conducted. The research paradigm was identified in the form of qualitative analysis and this approach was to induce meaning to the research data. Moreover, the identification of the tools used and how they facilitated in the development of findings and synthesis of the report was achieved.

1.9.4 Chapter 4: Analysis and discussion

Chapter 4 details the analysis of the study and discussion. It provides a framework for the interpretation of the findings. Thematic analysis gave great depth to the research data that drove analysis up to 5 levels. The outcome established 4 primary themes in the form of business modelling and blockchain; properties, functionality and impact, challenges and threats, and drivers and capabilities. From these themes it was possible to envisage a roadmap that answered the research questions. Additionally, a

discussion of the credibility, transferability, dependability, and confirmability of the research study is given.

1.9.5 Chapter 5: Findings and conclusion

In this chapter a brief overview of the study as an introduction to answering the research questions is given. Additionally, recommendations for future research and the limitations of the study are listed, whilst the concluding thoughts are provided.

2 CHAPTER 2 LITERATURE REVIEW

2.1 Introduction

Through the vast amount of blockchain literature reviewed and analysed six basic themes became prevalent. These themes in essence highlight the limited knowledge and infancy of blockchain development. Therefore, the focal point and impending outlooks for much of the research is future orientated. The future themes orientate around developing new ways of thinking when applying the technology, the characteristics of blockchain, and the beginning of relevant of use cases.

During the 1970s TCP/IP architecture was first introduced. The technology didn't receive much traction at that point, and not many envisaged the possibilities of using the architecture for anything beyond text communication. As a result when large conglomerates in the 1980s started using the architecture for local private networks, and research ensued towards scaling and using the architecture not only for messaging but also for video and voice connections it was met with much scepticism (Lansiti, Lakhani, & Mohamed, 2017). Similarly, blockchain is in a period where researchers realise its potential. However with the limited knowledge, skills and a standardised framework it appears that the technology requires a significant amount of exertion before it is stable and can become widely adopted (Clohessy & Acton, 2019).

The six themes identified in the literature review were categorised from a plethora of 102 codes. These six themes were namely; description, framework, characteristics, description, economic impact, and regulation. There are many subthemes developed and categorised within these six basic themes. For instance, the theory belonging to diffusion of innovation as well as decentralisation has been clustered into the theme of characteristics. The subthemes are further elaborate for the need to conduct additional research in the subject matter of blockchain.

The literature review is comprised of 2 sections. In particular, section 1 describes the type of research conducted, the research objectives, methodology and research gaps. Whereas, section 2 details an in-depth discussion of the 6 predominant primary themes.

It is worth noting that the literature review was analysed and codified according to its relevance to the research questions. Because of these reasons, the approach was to find an alignment between the literature and key events that signal the future of deliberations of blockchain in the business environment and society at large.

2.2 Section 1- dynamics of the literature

2.2.1 Research questions and study objectives

The majority research objectives and research questions centre around the challenges of blockchain, the application of blockchain, the future course of blockchain and comparative testing of the technology.

According to Maree (2016); some of the key characteristics of a good research question include; it needs to be concise, clear and unambiguous, it should be open-ended, self-explanatory, and grammatically correct. Preponderance of the research questions analysed in the literature displayed these basic characteristics. For instance, a study a study by Milani, García-Bañuelos, & Dumas, (2016), on blockchain applications for business process management, the research question proposed was, “what business process improvement opportunities does blockchain technology enable?” Elements of its open-endedness and concision are evident. Similarly, a study Grover, Kar, & Vigneswara, (2018) detailing how applying blockchain to different environments, enforced a research question of “how will blockchain facilitate instant payments, trusted interfaces and traceability of goods for customers?” It is fitting that while these questions are open-ended, they remain precise. Consequently, a combination of this nature provides benefit towards developing a singular direction for the research.

2.2.2 Methodology

The majority of literature reviewed shares a commonality in methodology. Due to the absence of research data in field of blockchain, the most concurrent methodology employed was qualitative, with the application of case studies and the use of secondary data. One of the most prominent methodologies employed by researchers include text analytics, a method used to find and extract useful patterns, directions, trends or rules from unstructured text (Porter, 2009). In addition, content analysis-a

methodology similar to text mining was also adopted by a number of researchers. Triangulation, which combines multiple methodologies, such as qualitative and quantitative methods (Woodside, Augustine & Gibberson, 2017), was employed in the study of “Blockchain adoption status”. On the other hand White, (2017); posits that Delphi studies, which are frequently employed in deductive research, may be combined with qualitative data-capturing elements in order to afford more pragmatic instrumentation.

It is worth mentioning that the literature did provide occurrences where other methodologies where adopted. In particular, two qualitative studies; first Gilad et al., (2017), which compared the characteristics of Algorand to traditional blockchain frameworks, and second Rimba et al., (2017), evaluated the cost of the executing blockchain in a business environment verses cloud respectively. Both these studies utilise experimental methodologies located in laboratory settings. Experimental methodology is a technique in which the relationship between two variables are explored, whereby the independent variable is purposefully altered to observe the change on the dependent variable (Collis & Hussey, 2014a).

The sampling techniques were non-probabilistic- where instances were deliberately selected and descriptive statistics were used (Presthus et al., 2017).

2.2.3 Findings and Research gaps

Although researchers provide various applications of blockchain in different environments, there was a multiple knowledge void in terms of how to achieve such proposals. The voids certainly provided an array of research gaps.

The research gaps identified by the researchers were proposed as limitations to research, as well as opportunities for further research. One of the most significant research gaps identified that is crucial towards the future development of blockchain is blockchain integration (Piscini, Dalal, Mapgaonkar, & Santhana, 2018). There are a number of different platforms that support blockchain with different architecture and consensus algorithms. Integration plays an important role for many organisations choosing to adopt a technology for business operations. A central challenge for blockchain at present is combining blockchains from two different fabrics of architecture. This research gap for future insight is concisely described by (Piscini et

al., 2018) in their research on blockchain integration. I will discuss this case in more detail in the section on blockchain characteristics.

Additionally another research gap established by Francisco & Swanson, (2018), proposed future insight into the mechanisms of blockchain. While most researchers focused on the adoption of blockchain, infrastructure and business models; there were very few researchers that focused on cultural and societal influences on blockchain adoption (Francisco & Swanson, 2018).

Acknowledging research gaps, for future insight plays a crucial role in laying down the foundation for further research. Additionally, identifying research gaps in the methodology are equally as future insight may play a crucial role in order to lay the foundation for further research so that a comprehensive theoretical framework may be built. Methodical scrutinising is achieved when a study becomes inconclusive as a result of the functional research method (Müller-Bloch & Kranz, 2015).

An illustration of such methodological gap can be seen in White's, (2017) study. The researcher used a Delphi methodology as a part of their research design. In carrying out the research the potential outcome was hindered due to a relatively low response rate. This may have been avoided as with blockchain being a relatively new subject matter, using another sampling method may have been more appropriate. Moreover, this is evident in the Grover, Kar, & Janssen, (2019) study, whereby only journal articles were considered as a source for the study. This limited the relative new knowledge that could potentially be introduced into the blockchain space.

2.3 Section 2- thematic of literature

2.3.1 What is blockchain?

The premise behind the creation of blockchain spans back to 1982 when such a framework was first postulated by David Chaum in his dissertation on Blind Signatures for Untraceable Payments. His idea was to create an anonymous form of digital cash whereby his proposed system would protect consumers' personal privacy, as opposed to the vulnerable electronic payment system setup by the banking consortiums at the time (Hayes, 2016). This is the foundation behind the idea of today's bitcoin and

blockchain alike; to protect the people's right to privacy through anonymising their transaction of conversations and exchanges (Hayes, 2018).

2.3.1.1 Description of blockchain

To explain what exactly blockchain is, we first have to understand on what basis the technology was founded. Blockchain was established on the principles of double-entry bookkeeping. General ledgers are at the centre of the double entry accounting system; this is a record that documents a company's entire transactional history. The DNA of blockchain is infused with the ideologies of general ledgers (Piscini et al., 2018).

In conventional double entry accounting systems when a seller makes a sale; he or she enter the sale transaction on the left-hand of the general ledger as a debit for cash received. On the other hand, when the buyer of the goods enters the transaction in the general ledger the transaction is entered into the right of the ledger as a credit for cash spent. The records are maintained separately in the books of each party. At the end of the month these records are compared to ensure they are in agreement (Hansen & Kokal, 2018). This process is formally known as reconciliation. Blockchain conducts this entire process through the means of a decentralised ledger system (DLS). A DLS is a computer based ledger network is where active users cooperate over an agreed distributed ledger structure (Conte de Leon, et al., 2017). Blockchains are DLS, and in essence this means that both the buyer and seller are active members of the DLS whereby when a transaction is conducted the details of the debit and credit are coded, linked and recorded into the network. It is because of this reason each party does not have to keep separate records of the transaction, more over their complete trust is in the reconciliation. Consequently, Milani et al., (2016), supports the process of applying trusted reconciliation which is needed in every avenue of business and therefore sectors such as banking and supply chain have recognised this and have invested heavily into blockchain.

Although researchers have provided voluminous descriptions of blockchain that are common in nature, the researcher postulate a concise description of blockchain's mechanics based on the views of other researchers. Blockchain is a DLS that stores an auditable and indisputable record of transactions and assets through a peer to peer network (Conte de Leon et al., 2017). The ledgers themselves are saved in the network in mechanisms called blocks. Each new record added to the network included the

transaction identification of the previous transaction. This links the blocks chronologically, hence adopting the term blockchain (A. M. Antonopoulos, 2014). The network, transactions and blocks are secured through advanced methods of cryptography by means of 256 bit encryption. Multiple copies of every transaction are saved by each member of the network. The network members are accountable for updating and monitoring the network and authenticate every transaction through consensus (Zheng et al., 2017). No transaction can be deleted from the network, neither can foul play go unnoticed. Similarly, no transaction can be successfully added to the network with blocks created unless by the consensus of the network (Sudarshan, 2018). Data transacting through a P2P (peer to peer) shared network rather than a central agency ensures trust, security and lower transactional cost (Rimba et al., 2017).

Additionally Hayes, (2018), goes on to describe blockchain as a triple entry accounting system suggesting that the third entry in the system is the immutable encrypted entry shared in the same ledger. This notion is supported by Hansen & Kokal, (2018). However, Hayes goes on to postulate that double entry bookkeeping laid the foundation for capitalism, therefore there is no telling what triple entry bookkeeping might bring. This paradigm will be discuss this notion in the coming sections. Controversially, Hayes, (2018), further suggests that blockchains can be thought of in three paradigms. In particular, blockchains as systems of accounting, blockchains as institutions and blockchains as a nexus of contracts. The ideology of blockchains being a system of accounting can be envisaged through our earlier description of blockchain, in addition to it being self-referential and autonomous.

On the other hand, the paradigm of blockchain being an institute originates from the fact that (Hayes 2018) describes institutes to be systems of reputable social rules that organise social interactions and prospects. It is for this reason that blockchain follows this paradigm as the mechanics of blockchain imposing property rights in addition to promoting interaction and exchanges it structures both behaviour and expectancies (Hayes, 2018).

Speculatively, the third paradigm describing blockchain as organisational form is the most controversial. Hayes explains based on Oliver Williamson's (1979) claim that firms exist because contracts will always be unfinished due to speculators taking

advantage and evading their obligations-creating a barrier against trust. Moreover, the cost associated with ensuring that contracts are enforced and monitored are too substantial hence business is chosen to be carried out by decree in preference over contracts resulting in the formation of firms. In this regard blockchain smart contracts provide a mechanism to dissolve Williamson's ideology of firms as they are easily enforced at low cost, additionally scaling low cost to monitoring. As a result, Hayes(2018) argues that blockchain smart contracts replace firms as an organisational form in accordance to Williamson's ideology. In addition, Hayes(2018) proposes that firms are established on a nexus of interrelated contracts that function within the precincts of operational interaction. This further establishes blockchain smart contracts as organisational forms as smart contracts can be self-enforcing and autonomously interact with each other, to the extent that they can establish Decentralized Autonomous organisations (DAO) (Hayes, 2018). Consequently, this realisation could motivate a future where firms are decentralised with an ability to source talent globally (Bridgers, 2017). While this may increase competitiveness and overall innovation, governments would have to consider what impact this will have on their strategies for localised job creation and upliftment.

Smart contracts are digital mechanism codified contract that binds individuals similar to the enforcement of regular contract(Sudarshan, 2018). Additionally the WEF (2018), smart contracts as having the ability to be self-automated, with triggers that can allow them to self-enforce and autonomously conduct transactions with other smart contracts. Smart contracts are a substrate of bitcoins' original open source code and has been coined as blockchain version 2.0. The most popular platform for establishing smart contracts is over Ethereum. The idea was releveled by Ethereum's founder-Buterin in 2014 (Zheng et al., 2017).

In view of these paradigms it is important to acknowledge that blockchain 2030 is only a decade away, and the traditional structures and thought of doing business have already been questioned and transformed significantly. For business operating on a traditional capitalistic approach, relooking at their technological and business strategies is paramount for competitiveness in the 2030 dynamic business environment.

2.3.1.2 History

The conceptualisation of the elements of blockchain dates back further than the 1980s when Chaum first proposed his idea of digital money. An auxiliary element of blockchain-cryptography, emerged as a high-quality instrument during the 1930's with the introduction of the enigma machine. The enigma machine was used by the Nazi Germany military to encrypt messages during world war II (Sun, Yan, & Zhang, 2016). Since then Enigma machine cryptography has advanced substantially. According to Zheng et al., (2017), one of the greatest developments in modern age cryptography came about through the introduction of public keys and private keys for asymmetric encryption. It comes as no surprise that this leading technology was first presented by Chaum in his first dissertation of the digitisation of money.

Throughout the 1980s and 1990s there were many developments in the crypto space. In 1983 the first electronic wallet was conceptualised-electronic wallets hold cryptocurrency and function similar to how banks accounts holding fiat currency. 1980s also saw the great conundrum of "double spend" solved through a concept called zero knowledge proof. Double spend is a phenomenon where several copies of the same digital coin or token is used at different locations to conduct transactions. The early 1990s saw the first glimpse we know now as proof-of-work, the concept was originally introduced to combat against spam emails. The latter part of the decade also envisaged important milestones that paved the way for blockchain. Particularly, internet company Nabster popularised P2P networks by offering file sharing capabilities to members of its network. Nick Szabo latched onto the idea of P2P networks during this same period and proposed Bitgold,a Bitcoin predecessor. Bitgold's architecture was designed to allow the transfer of property rights over a P2P network. While Bitgold was not implemented it became the key framework for establishing Bitcoin(Hayes, 2018).

2009-2010 was the most significant period for blockchain. In 2007 hash function only cryptograph was announced by newly established internet security startup- Guardtime (WBC, 2018). According to Guardtime, (2007); their cryptography utilised security authentication by means of hash functions only and the availability of ledgers in a decentralised manner without the need for a centralised body to authorise a transaction. Guardtime's hash function was revolutionary and distinguishable from

traditional asymmetric cryptography (Conte de Leon et al., 2017). At a period of global economic downturn, a technical white paper was strategically released titled: A Peer-to-Peer Electronic Cash System-by Satoshi Nakamoto. This was the birth of Bitcoin. Satoshi Nakamoto combined the elements of Nick Szabo's Bitgold and Guidetime's hash function to create a DLS that: uses a P2P network to form consensus to mitigate against double spending, does not require any escrow parties for authentication, proof-of-work (POW) generates a reward token/coin for hash values generated by its members, and allows members to be pseudo-anonymous(Hayes, 2018). The first blockchain proof-of-work function came about in January 2009. The transaction creating the first bitcoin block known as the genesis block in addition to the first set of bitcoins(Hayes, 2016).

During the period from 2010-2015, a vast array of activities happened in the blockchain and cryptocurrency space. For the purpose of staying within the scope of the research question, mostly blockchain events are highlighted. Not long after the first Bitcoin exchange was establishment, bugs were identified in the protocol causing 184 billion Bitcoin to be created (Sedgwick, 2019).

By 2012, on the framework of the Bitcoin's open source code and POW, new blockchains started developing with revolutionary architecture. While, 2013 achieved a great milestone by introducing a new form of investment established to aid blockchain and cryptocurrency start-ups. The new form of funding known as initial coin offering (ICO) is similar that of an IPO (Initial Public Offering) (Purva, 2019). During 2015, Ethereum a newly founded start-up revealed the potential of blockchain to be applied to a number of different avenues of business through the use of self-executing contracts called smart contracts (Zheng et al., 2017).

2016-2018 was a period when Ethereum smart contracts grew in popularity, however, it was soon hacked and consensus was taken to fork the chain(Conte de Leon et al., 2017). Forking is a phenomenon where the blockchain splits and follows a new pathway. The valid chain subsequent to the split is the longest chain. Forking organically occurs when miners find blocks and broadcast them simultaneously (Lisk, 2019).

Additionally, this period many saw the realisation of the technology, as a result investments in start-ups and different projects took flight. For instance, Piscini et al.,

(2018) describes R3 project which was a collaboration of a consortium of major financial institutions, including 13 major banks, who started researching blockchain and developed a DLS specifically for financial institutions that worked on the architecture of dedicated-proof-of-stake (DPOS) and could be used intracompany. Similarly Conte de Leon et al., (2017) researched another consortium collaboration of IBM and Linux that developed a project known as the hyperleder. These types of collaborations have led to further research and development within the last two years. Consequently majority of the research is focused on innovative ways to optimise throughput and mining. According to Zheng et al., (2017) Segwit and proof-of-burn were some of the concepts developed during this period. The last year has seen the development of many decentralised applications, permission based blockchains for private business and the introduction of Multichain- a company with the ability to connect chains.

The literature has presented a guide of the exponential growth of blockchain in the last decade. Although there have been challenges in both the blockchain and cryptocurrency space it has not dissolved the development of further innovation. Furthermore the history of blockchain illustrates the need to promote academia as a source for further and future innovations. The answers for what blockchain will be in a decade from now lie in the concepts and problems of today.

2.3.1.3 Types of blockchains

According to Weber et al., (2017) blockchains can be categorised in forms; namely public/open blockchain, private blockchains and consortium blockchains.

A public/open blockchain emulates the architecture of bitcoin. It functions on the proof-of-work concept for security and authenticity. Trust is established through the proof-of-work consensus algorithm which requires a significant amount of computing power (energy) to prevent bad actors from attacking the system (Zheng et al., 2017). Public blockchains also have the potential to function on a proof-of-stake concept; this however, is shunned upon and will be discussed in a later section of this paper. The setting of the network participants for public blockchains is neutral with all of them being decentralised. The visibility and accessibility of data on a public blockchain is high, with almost anyone given rights to view the data. Once the rules of the system are founded it's difficult to change them (White, 2017). Additionally, the architecture of

the system also poses a challenge with transaction speed and makes it difficult to expand or combine with other blockchains (Gilad et al., 2017). Finally, public blockchains offer some degree of anonymity through pseudo-anonymity. Besides its current use in cryptocurrency, it could, for instance, be used to track government spending (WEF, 2018).

Private and consortium blockchains work somewhat differently from public blockchains. While the basic principles are similar, the architecture works are slightly different. Private and consortium blockchains function on a proof-of-stake and delegated proof-of-stake concept. This means that it is given to a dedicated actor. In a pure proof-of-stake framework trust and authentication is through an actor that holds the highest value of currency in the blockchain (Lansiti et al., 2017). Whereas in the case of delegated- proof-of-stake blockchain trust and authentication is through a predetermined/assigned actor or set of actors. Because trust is easily established high volumes of computational power are not needed (Zheng et al., 2017). Additionally, both private and consortium blockchains have the ability to expand with transaction speed being significantly faster than public blockchains. When it comes to the rules of blockchain, these can be easily changed according to the judgments of the consortium or private institution (Zheng et al., 2017).

2.3.2 Framework of blockchain

This section of the research reviews the technical attributes of blockchain and how these attributes inertly may constrain business in 2030. The notion of technology limitations impacting on a company's bottom-line was supported by Marchand et al., (2000). The researchers discuss how a utility company is constrained by capacity of its turbines as this is essential in understanding how much electricity they can produce. Similarly companies may have a vested interest in the technical attributes of blockchain.

2.3.2.1 Peer-to-peer network and nodes

As highlighted in previous sections, blockchain operates on a P2P network. To get a full overview of how P2P networks work, there also needs to be an understanding of the involvement of nodes. Let's first understand the dynamics of a network. Networks are a set of interconnected devices that interact with each other through the sharing

of information. Traditionally computer networks have, and still are operated centralised client server archetype. This type of model calls for a solitary server operated by a single institute. All users connected to the network transfer information via the centralised server. The central server is a single point of control for all of the information on the network. The problem with this setup is that failure at the central server will result in failure of the entire network (Lisk, 2019). Expanding on this the central server will not be liable for the loss of user data. Therefore, Grover et al., (2018) postulate that it can be assumed that the administrators of the central server have ownership of network user data.

A P2P network functions significantly differently from the single point of failure centralised client server model. According to Lisk, (2019), the network members of P2P networks are connected directly with one another in a decentralised manner; the network data is stored by all the participants of the network without the need for a centralised intermediary. This makes the data on the P2P network more secure and less susceptible to attacks from hackers. Unlike client server model the dependency of the users of a P2P networks have an interdependency with the network (WEF, 2018). This is supported by Sudarshan, (2018), who states that members of the network are dependent on utilising the network; the network itself is dependent on the users resources for its sustainability. According to Piscini et al., (2018) network members of a P2P network have to dedicate disk space and computational power to the network. Because of this reason, P2P networks have a propensity to reduce latency with an increase in network members. This is contradictory to what happens on centralised client server networks (Gilad et al., 2017). Furthermore, each member of a P2P network stores numerous copies of the network data. This is a key element in getting P2P networks distributed (Sudarshan, 2018).

Expanding on this background, the next term to consider is “peer” also known as nodes. The main purpose of a node is to maintain a copy of the networks data. Nodes in a P2P network are any device that makes its computing resources available to other members of the network (Lisk, 2019). A Node can be any electronic device as long as it has an IP address and available disk space to keep a copy of the network information-in the case of blockchain the blockchain itself. In certain cases nodes are used to process transactions (Zheng, Xie, Dai, Chen, & Wang, 2018).

According to WEF, (2018) every node on the network is equal, although nodes can have different tasks and functions on the network. In the event of a node choosing to process transactions, the node is rewarded for offering its computing power to store and validate the transaction; this process is known as mining. The actual computation ensuring validation is referred to as proof-of-work, and in most cases the rewards met are in the form of cryptocurrency (Zhao, 2019). Proof-of-work will be further discussed in a later section of this paper. Nevertheless, Woodside, Augustine, & Giberson, (2017) suggest that while the incentive is important in keeping nodes active and sustaining the network, it has created a lot of competition amongst nodes. This can be explained by using an example of bitcoin. Bitcoin's framework is such that there is dedicated number of coins that can be rewarded; before all the coins are exhausted. It functions on the principle of supply and demand- as the state of the reward coins deplete, the computational power required to solve a proof-of-work algorithm becomes greater (Hayes, 2016). In addition, Weber et al., (2017) further explain that the more miners on the bitcoin network trying to accomplish proof-of-work, the more difficult the proof-of-work algorithm becomes and therefore, again, more computational power is needed. As a result miners have invested in extremely powerful computers and have created mining pools to compete for the reward of validating a transaction. Mining has become such a big market that even computer graphics card producer Nvidia have designed dedicated mining chips to meet the demands of miners (Hamilton, 2018).

According to Conte de Leon et al., (2017), mining being such an expensive trade as a result of its constraints, and at this point in time it's worth noting that the cost of running and transacting through a centralized client based server such as AWS is cheaper.

By the year 2030 it can be assumed that computational power will be significantly greater, and with quantum computing becoming a reality I would argue that the hardware and setup of many data centres and mining pools would become insignificant. This begs the question of sustainability, what would become of the hardware at the point of redundancy? Could the data centres and hardware be used for an alternative purpose? Furthermore, with supreme computational power having the ability to find solutions more easily and dedicating less resources, does this mean the value of the reward for mining would change significantly?

2.3.2.2 Cryptographic techniques

Cryptography in its element is the literal key and foundation of blockchain. Cryptography comes in the form of two functions on the blockchain, namely digital signature and hash functions. Earlier we discussed cryptography briefly in an effort to get a general understanding of the history of blockchain. Nevertheless, it's worth expanding on this discussion through reviewing in greater detail. Further to this we discuss the consensus algorithms of hashing going in the rudimentary dynamics of blocks (forks).

2.3.2.3 Digital signature

Digital signatures are mechanisms to ensure that a transaction requested to be validated, is from its rightful owner. Digital signatures function on the architecture of asymmetric cryptograph. The main attributes of digital signatures are its abilities to drive authentication data integrity through the use of private and public keys. Both public and private keys are strings of alphanumeric combinations. The digital signature itself comprises of two phases firstly the signing phase, then the verification phase (Lisk, 2019).

To describe the signing phase Zheng et al., (2017) proposes the following situation, suppose John wants to send a private message to a colleague over the a blockchain, John would need a public key for the message- which he can share with anyone but especially the person he is sending the message to, and a correspond private key which he keeps to myself. John then puts his message through a hashing algorithm, the output is known as a digest. Digests are an array of alphanumeric characters. Finally, John encrypts the digest with his private key. Thereafter the message is broadcast /digest over P2P network. The alignment of his private key and the message with the message that it encrypted is my digital signature.

Zheng et al., (2017) further describe the receive phase through the same event. During the receiving phase John's colleague receives the message after the network validates the transactions. John's colleague then puts the message through the same hashing algorithm and receives a digest. The colleague then adds John's public key into the digest that was generated from the hashing algorithm. This will in turn produce another digest, and the colleague can then evaluate both digests to ensure that they are

aligned, which will give an indication of whether the message was tampered with or not, and to verify if John was the actual sender of the message. Finally John's colleague will use their private key to decrypt the digest and receive John's message, if all previous authentications were successful. According to WEF, (2018) elliptic curve digital signature algorithms (ECDSA) are most commonly used for blockchain.

2.3.2.4 Hash functions

Hash functions are performed at a number of different intersections within the blockchain validation process, as illustrated in the previous section. This is supported by Lisk, (2019), who states that hash functions are used during the validation and consensus phase after a transaction has been broadcast to the network. A hash function is essentially a mathematical instrument for encryption, similar to that of the enigma machine. Its purpose is to convert any input message into a fixed string of alphanumeric values (Sudarshan, 2018) .

The conversion process is referred to as hashing and the converted message is known as the hash value. In order for a hash function to be of high quality Conte de Leon et al., (2017) state that it needs to exhibit three qualities: (1) the hash value produced should be unique, that is the function should always produce the same hash value from the same message, (2) fast hashing speed, hash values must be created swiftly, (3) the hash function needs to be secure, it should be impossible to determine the input from the hash value.

One of the key benefits hash functions have, besides security through the means of encryption and verifying authenticity, is providing leverage for blockchain's immutability. This will be discussed a little further in the next section. The most popular hash functions that are currently used on blockchain are SHA-2, CRC32 and MD5, they all work on 256 bit encryption (Zhao, 2019). That means in order to crack the security of the encryption one would have to predict a specific string of 256 bits. The computation is so difficult that the only option is to generate and check a multitude of random sequences, this would require 2^256 guesses in order to achieve the correct answer. As a result the calculation is extremely difficult to achieve with a regular computer. Even though miners in the bitcoin network achieve an average of 5 billion hashes per second, they achieve this by using special hardware called application

specific integrated circuits. These circuits are specifically designed for the hashing and not to run general computations (WEF, 2018).

2.3.2.5 Dynamics of a block-consensus protocols

When working with a centralised network, trust is easily evoked through the central authority of that network. However, on a decentralised network establishing trust is a bit more complicated, especially on a public network where members remain anonymous and potentially bad actors can easily infiltrate public network by attacking its protocols (Oh & Shong, 2017). Therefore, (Zhao, 2019) argues that in public P2P networks there needs to be a mechanism to verify that someone is who they say they are, actually owns what they claim to own and actually achieved what they declared to have done. The means by which this is achieved on a decentralised network is through distributed consensus by network members. The most prominent consensus algorithm used in a public network is POW [Proof of Work] (Grover et al., 2018). To get a deeper understanding of POW we need to understand the fundamentals of the distributed consensus. A classical interpretation of this is best described through the Byzantine's general problem.

The Byzantine Generals' problem is a logical dilemma of how a decentralised army would coordinate an attack on an enemy's city effectively. The strategy of attack or retreat is agreed upon by the generals of each decentralised battalion who are miles apart, the battalion need to coordinate the agreed strategy at the same time to succeed. But how do the generals of army achieve this successfully? If a message is sent by messengers with a command, how does the General know that the message received from other Generals is authentic and has not been intercepted or altered by a traitor commander? Furthermore, what if the general does not receive a message? There can be an instance where the messages received from different battalions have opposing messages of attack and retreat. Consensus can be very difficult to achieve and if the army doesn't coordinate attack collectively, they will fail (Sudarshan, 2018). Therefore, the Generals need to have a mechanism that ensures that they all agree on a common action.

In the case of blockchain this mechanism is achieved through the consensus algorithm-POW. The algorithm was first proposed by Satoshi Nakamoto in his

whitepaper on Bitcoin (2017). Sudarshan, (2018) further illustrates the Byzantine general's dilemma in relation to the Bitcoin network; suppose that the nodes on the P2P network are the generals of the Byzantine general's problem. They need to agree on messages sent over the network; here is where hashing plays a key role. Every node in the network is simultaneously hashing; thus; trying to find the solution to the complex math problem previously mentioned. When a node solves the problem, the node broadcasts it to the network and the network stops working on that problem, changes focus and works on the new problem presented to the network. This intersection is where distributed consensus comes into play.

The hash generated from solving the problem acts as a cryptographic unique identifier that contains the hash of previous mathematical problem. This connects the hash of the new mathematical problem to the hash of the previous mathematical problem. Because blockchain is immutable, every hash is recorded. As a result, a block identity and dependency is linked to its predecessor through the relationship of their hashes (Zheng et al., 2017). This relationship of including the hash of the previous block in the current block goes all the way back to the genesis block, which additionally contains a unique identifier. As a result Gilad et al., (2017); suggests that the existing state of a blockchain can be represented by its hashes and the timestamps of its listed blocks.

It is for this reason consensus is achieved, nodes validate the sequence of hashes against the times the hashes were sent to other nodes on the network; this alignment can easily validate if the data is authentic and has not been altered. Therefore it can be concluded that consensus does not only have to be achieved on the content of the blocks but also on the sequence of the blocks (Weber et al., 2017).

Antonopoulos, (2014) discusses further elements of the block's content, for instance the transaction ID (TXID) of the reward to the miner for the current mined block. TXIDs are hashes that contain the combined data of the transferred amount or message, address or public key and timestamp of the transaction. The aforementioned information is also contained in the block header. Moreover it worth mentioning that there can be multiple transactions in a single block.

Although Satoshi Nakamoto's solution to the Byzantine general's problem solved the dilemma of authenticating a message, it also provided a solution for the occurrence of nodes failing, known as the Byzantine fault tolerance.

Zheng et al., (2017) argues that the POW algorithm is the most secure mechanism for a public blockchain. However there are some significant draw backs from using this method to establish trust. Firstly the energy required for a successful hash is considerable high and to be equivalent to powering 285,833 average U.S households (Bradbury, 2018). Furthermore the transaction take on average 10 minutes to confirm however can take up to an hour(Weber et al., 2017). These challenges will be discussed further in the section on the challenges of blockchain.

There are a multitude of different consensus algorithms that are currently active on the market. Each one built on the framework of POW but relevant to its own application. Prominent names include; Ripple and Tindermint. While these two consensus algorithms are application specific, we will discuss further three algorithms that have a broader application viz. proof-of-stake (POS), delegated-proof-of-stake (POS) and proof-of-burn (POB)

The commonality between POW and POS is that both are suited to be applied in public blockchains. However, the difference between the two is in the mechanisms of trust. As earlier detailed POW evoked trust by making the members of the network solve a complex mathematical problem, on the other hand POS evokes trust through nodes with the highest vested interest in the blockchain in terms of capital (Hayes, 2018). Hayes further explains that there is no complex mining involved, as result the nodes with the highest stake validates and controls the blockchain. Although this process is expressively beneficial in compensating for the weaknesses of POW- it allows for quicker transaction times and minimal energy consumption; it also has a number of constraints. Firstly, it moves away from the ideology of decentralisation and a distributed trust-less system to a system of trust in the highest stake holders. Secondly the system is more exposed to malicious activity. Should a controlling node be a bad actor they can create an opportunistic event of declaring one block to the network and presenting another block in isolation. Additionally, other malicious activity can include nodes colluding with the controlling node. Lastly, the system follows capitalist design that benefits the rich (Weber et al., 2017).

DPOS is similar to POS in terms of trust being centralised. Although Zheng et al., (2017) state that the major difference between the two system is the DPOS is representative democratic and its application is suited more towards private blockchains. Comparable to trust being evoked to an individual with the highest stake in POS, in the case of DPOS trust is evoked through individual nodes that have been nominated in advance. With many nodes validation process, transaction time is reduced significantly. Additionally, DPOS shares many of the other cost saving benefits of POS. Nevertheless, the system can similarly be flawed with the malicious colluding activity by nodes. DPOS aligns well with private, and to some extent government intra and inter business activities (Zhao, 2019).

A further consensus algorithm worth mentioning is POB. This is a very similar concept the POS with subjective democracy. The idea behind the algorithm design is that the trust in mining the next block is evoked to nodes that burn the greatest value in currency. The more currency a node burns the greater the odds are for that node mining a block(Hayes, 2018). The currency is sent to an Eater address- a public key in which the currency cannot be recirculated or spent. The context of this concept is an investment were miners experience short-term loss for potential long-term gains. This system however is flawed in 3 ways. Firstly, resources are wasted in the form of currency which would have potentially come from a POW concept. Secondly, there is no assurance that the reward for mining a block is greater than the currency that was burned and the system will start creating scarcity of cryptocurrencies. Lastly, the system as in the case of POS, has a propensity to be capitalistic in favouring the rich(Hayes, 2016).

The current outlook of consensus algorithms depicts a struggle between cost and trust. Essentially in terms of security, POW is at the forefront of trust being built into the system. However, at this point in time it comes at an extremely high cost (A. M. Antonopoulos, 2019). Although there are many substitute algorithms to POW, it has the greatest potential and it will be in a very commanding position a decade from now. If not Satoshi Nakamoto's POW, a very similar consensus algorithm where trust is built into the system and it is commutative, autonomous and consumes considerably less energy.

2.3.3 Characteristics of blockchain

Many of the characteristics of blockchain have already been briefly discussed in the previous sections. The objective of this segment is to identify and discuss in greater detail the characteristics, challenges and benefits of the subject matter; with particular focus on technical attributes of the technology.

2.3.3.1 Decentralisation and Openness

One of the most profound attributes of blockchain is in the fact that it is open source and everything it stands for is a representation of openness ideologies(Hayes, 2018). However, what does it mean to be open source and why can this be beneficial? According to Antonopoulos, (2019), for any entity even beyond the scope of technology the key feature of being open means to be transparent, immutable, to be control-less (no single entity has a monopoly on control) and having the ability to share and collaborate with anyone at will. Antonopoulos conveys it as being boundary less, there is no external entity or authority that prevents the visibility and sharing of the information, or controls the interactions made about the information. Although we as society yearn a utopia of openness, we have supported entities that have created closed systems. The main reason for us supporting such entities originates from the issue of trust. This notion is supported by Hayes, (2016) who claims that we have trusted in these entities because we have been incapable and not resourceful in establishing trust between each other independently.

Through history and recent times, it has become evident that we cannot fully trust these entities. Governments have been involved in unscrupulous activities; including corruption and providing bailouts to bad actors, banks have withheld customers funds because of their instability, large corporations have controlled and censored the flow of information from us and between us, in addition to putting our privacy at jeopardy. Therefore, it is a risk to both our social and economic wellbeing to commit all our trust to such entities(Peterson & Wrighton, 1998). As long as there are people to establish trust in isolation, the validity of that trust is questionable.

Although, how would society and business underpin trust without the services of intermediaries? Bridgers, (2017) proposes that the answer to this question is represented through the characteristics of blockchain. Blockchain takes trust and

information away from human control and establishes it through a system that can be both transparent and private at the same time, decentralised, immutable, auditable, natural and borderless. Sun et al., (2016); even goes to the extent of referring to blockchain as a “trust machine”, resolving trust issues amongst individuals. Beyond solving the trust issue, further benefit blockchain has over intermediaries is the saving on transaction costs and time that intermediaries charge. These charges can be substantially high especially for businesses(Oh & Shong, 2017).

It is worth noting that while most of the researchers focused on the above attributes of blockchain, only a few focused on theoretical framework of it being a shared service, and the new generation of the shared economy. The shared economy has been coined as the “big disruptor” of traditional business models and the reason to consider blockchain from the shared economy perspective is because blockchain may potentially disrupt the “disruptors”. Conglomerates such as Uber and Airbnb have been associated with such a share economy business model. Bridgers, (2017) states that although the share economy business model allows individuals to connect and share resources that weren’t previously possible, the platform from which it is achieved is still through an intermediary in the form of the conglomerate. Furthermore Hayes, (2018) claims that users utilising such networks like Uber and Airbnb are not operating on a true P2P network. This notion is supported by Bridgers, (2017) however, who argues that the key component of P2P networking is decentralisation, with no intermediary. With most conglomerates operating in the “shared economy” the network is structured such that centralisation is put back into the hand of the conglomerate, and certainly which contradicts the ideology of a pure P2P network. Antonopoulos, (2019) warns conglomerates operating on these so called “P2P” business models, that they are at threat from blockchains’ ability to connect the end-user directly to the source. It is for this reason that the blockchain has been considered as the next generation of the shared economy- it is based on a true concept of being P2P, it is shared, communitive and a genuine reference to being opensource (A. M. Antonopoulos, 2019).

Although the characteristic of openness will impact on the broader view of business models, the details of open source code has already given rise to alternative means of doing business, such as smart contracts and DAO (Hayes, 2018).

Even though smart contracts were only a concept proposed by Nick Szabo, the faculty of blockchain's open source code brought the Ethereum protocol into fruition to create smart contracts. According to (WEF, 2018), smart contracts are autonomous algorithms that run on the blockchain that have the ability to enforce and monitor process/contracts. Trust in a smart contract is validated through trust in the relevant blockchain. The fulfilment of a process is marked by trigger defined in the algorithm; thus, every process/contract can be fulfilled automatically until a transaction reaches a conclusion. Triggers can include price, quantity, delivery, and quality- with every process being automated there is no need for any intermediary(WEF, 2018). The Ethereum protocol even goes to such an extent as to automatically match supplier to potential customers. It is for this reason that smart contracts have given birth to DAO. This organisational form has the ability to associate a string of interconnected smart contracts with premise to integrate, monitor and execute them(Conte de Leon et al., 2017).

On the other hand, while smart contracts can save on the costs of enforcing and monitoring contracts, this does suffer from a few challenges(Conte de Leon et al., 2017). Firstly, malicious actors can steal user data and bias against execution of contracts through persuading users to use their storage and computational resources. Secondly, the history behind smart contracts particularly DAO, is that it threatens the characteristic of being immutable. When the first DAO went live on Ethereum, it was hacked. The hacker found a weakness in the code, exploited it and managed to allocate a substantial amount of currency to themselves. The repercussions of this event lend to the DAO code being improved, but more interestingly there was consensus among those in the Ethereum community to fork the blockchain on the introduction of the new code (Reijers, Brolcháin, & Haynes, 2016). This event shows that there are circumstances that can lead to the chain being muted. Although immutability provides a special characteristic to blockchain, it creates a challenge in trying to control exposure to malicious content. Particularly content that has been published with the purpose of inciting hate speech, hate crimes and propaganda.

In conclusion being decentralised is what gives blockchain its special characteristics. The more closed a system becomes the more authority and control is handed over to a central entity. Which evidently makes the system less neutral, operational within boundaries and censored. The factors of trust and decentralisation go hand in hand

to create the other valuable characteristics of blockchain. The more decentralised a system is the easier it is to trust in the system; knowing that the consequence of decentralisation and openness lead to the assurance of censorship resistance, neutrality and being borderless(A. M. Antonopoulos, 2019).

2.3.3.2 Sustainability

It is worth note noting that while algorithms such as POS and DPOS save considerable amounts of energy, their ideology moves away from being decentralised, open and democratic. To have a truly decentralised platform of trust requires a tremendous amount of security. The only platform that emulates this level of security is POW (A. M. Antonopoulos, 2019). Unfortunately, at this point in time using POW as a mechanism for trust requires a significant amount of energy.

To put this into perspective, the bitcoin network alone consumes 343 megawatts of electricity/month (Bradbury, 2018). Relating this to residential consumption, which for the average US home is 1.2 kilowatt/hour/month, the mining operations is 285 times greater. This implies that the monthly electricity consumption of the bitcoin mining operation has an opportunity cost of supplying electricity to 285 US homes (Bradbury, 2018).

However, Antonopoulos, (2019) argues that if one had to do a direct comparative study with the energy wastage in other sectors, such as the financial sector, one would find the results of particular interest. For instance, much of the measurables for energy wastage in production of money is hidden. The hidden energy wastage costs are envisaged through the facilities used to produce, move and store money. For instance, the printing, the operational costs of banks, and the carbon footprint of the armoured trucks required to transport the money all waste energy and have not been quantified. Nevertheless, this highlights that energy wastage is encountered in both arenas of economic activity proving that a system that does not use energy is a system that is not secure and susceptible to attack (A. M. Antonopoulos, 2014).

Although POW uses significantly more energy than the other consensus algorithms, and also, POS and DPOS are still not oblivious to energy consumption. Both these algorithms need to consume energy in order to hash the block header (Zheng et al., 2017). Additionally, a further benefit of POS and DPOS over POW is in the reduced

amount of hardware need in the mining process, especially investment in hardware required for establishing mining farms (Clohessy & Acton, 2019). It is worth mentioning the miners have two main criteria when deciding where to establish mining farms. Firstly, they seek locations where the cost of electricity is significantly lower. Miners have chosen a variety of countries to setup mining farms based on the cost of electricity within the boundaries of those counties. At least 70% of mining farms on the bitcoin network originate from China (Chepkova, 2019). Although China presents an opportunity for miners to acquire electricity below the mining average, most of the electrical energy generation in China is fuelled by the burning of coal. As a result, the carbon footprint on mining activity is substantial; it said that blockchain mining activity accounts for 1% of the world's electrical consumption (Hankin, 2018).

The second factor that miners consider when choosing where to mine is reduced ambient temperature. Miners weigh their options to create a balance between countries that offer reduced electricity costs and optimum operating temperatures for their mining hardware. Some countries chosen are in remote locations, such as Greenland which provides most of it power by means of hydro generation (Hankin, 2018).

The notion of using renewable energy in the mining process leads to the subject of sustainable development. Antonopoulos, (2019) discusses how capital investment in renewable energy sources in remote locations can power mine farms resulting in the 3 pillars of sustainable development being satisfied. Firstly from an environment perspective there will be an unquestionably reduced carbon footprint from the facility. Secondly, through a social stand point, there is long-term job creation factor from creating and sustaining the renewable energy power plant as well as the mining farm. Thirdly from an economic perspective the capital expenditure on the renewable energy power plant will be recovered in 2 years instead of 10 years through the mining farm (A. M. Antonopoulos, 2019). Furthermore, as earlier mentioned the computing power a decade from now will be significantly faster with less resources being required as a result there is a high propensity of the renewable energy plant having access capacity in the future, and being able feed energy back to the grid.

Besides environmental considerations, the sustainability of a technology is dependent on a number of other facets; including political and regulatory (Woodside et al., 2017).

There is no better place than China for demonstrating the political influence on blockchain and cryptocurrency in particular. The Chinese government realised some time ago the potential of blockchain and investing substantially into research and development of the technology. Paradoxically the ideology of blockchain does not align with the regime of tight control. The governments' notion is to have strict conduct of all activity within the country, thus making it perfect representation of centralisation. It is for this reason that the government has put a ban on a lot of blockchain activity, especially cryptocurrency. Recently however the government has even gone as far as making a public consultation to enforce the banning of the use, manufacture and sale of mining equipment. It is believed that the main objective behind this proposal is to eliminate the loss in taxes and capital outflows related to mining (Chopkova, 2019). Furthermore, within the borders of China there is a substantial amount of censorship particularly with respect to media. An open blockchain would prevent such censorship or muting that may oppose against the country's narrative (A. M. Antonopoulos, 2019).

Grover et al., (2019) point out that when considering the social aspects that may influence the success of blockchain, an interesting angle of analysis from a business prospective is the application of diffusion of innovation. According to Rogers, (2003) diffusions of innovation is the process from which an innovation is adopted by its intended social network. In order for this adoption to be achieved, the innovation must overcome five characteristics also known to be the five barriers of adoption. These barriers are namely relative advantage, complexity, compatibility, trailability and observability. Examining the five barriers, gives a us a relative understanding of where blockchain is in its current lifecycle and what challenges need to be overcome for it to be more widely adopted.

Firstly, when considering the relative advantage of blockchain over other data structures and storage mechanisms, its characteristics of decentralisation and the benefits thereof have been the overrated throughout this paper. Rimba et al., (2017) support this notion by justifying the convenience and social prestige that blockchain has over competing technologies such as cloud storage services. However, Rimba et al., (2017) further argue that, at this point in time, it is at an economic disadvantage. Aforementioned was the conclusion of their study that pointed out the cost of executing a smart contract over blockchain was substantially more than executing the same smart contract over cloud. Nevertheless, as the engineering of blockchain code

evolves and new hardware develops the future of economic competitiveness of blockchain will effusively challenge that of cloud computing.

Secondly and perhaps the most challenging barrier of blockchain is its compatibility and ability to integrate with other systems. Firstly, compatibility is not difficult, blockchain can be incorporated it into ERP and CRM business management system, however it becomes a question openness. Does corporate policy allow censorship resistance, especially in regards the regulatory framework of GDPR (General Data Protection Regulation) and their own corporate strategy (Robert, 2018). Secondly in terms of integration there is a more imminent technical challenge, and that is the ability of one blockchain to combine with another. There are a variety of different blockchains platforms, each with their own set of rules and protocols. It is for this reason that it is difficult to integrate two blockchains as they may not be able to communicate with each other or speak the same language (Piscini et al., 2018). If there were case of acquisitions and mergers, companies that have used different blockchains there would have an issue. Piscini et al., (2018) suggest that this could be solved by introducing an integration layer where a single protocol becomes the new standard.

Thirdly when discussing the complexity of blockchain, Clohessy & Acton, (2019) highlight one of the most significant drawbacks of why people consider blockchain complex is their limitation of experience and gap in knowledge. As a result, a skills gap has developed when it comes to knowledgeable people that have the ability to conceptualise and apply blockchain in both large enterprise and SMEs levels (Piscini et al., 2018). However Clohessy & Acton, (2019), propose a solution to the problem by suggesting that organisation introduce training material on the subject matter, and for universities to introduce blockchain into multiple curricula.

Fourthly, trialability of blockchain is easily achieved. This is supported by blockchains opensource feature, it gives organisations the opportunity to freely work with blockchain in a sandbox environment (Clohessy & Acton, 2019). While trialability is foreseeable with low initial costs, the challenge of the knowledge gap comes into fray and may differ organisations from opting to trial. It is therefore essential that greater awareness be driven through business forums and tertiary educational institutes.

Finally with regards to observability, Francisco & Swanson, (2018) propose that company culture and social acceptance could possibly be a large influence on

adoption. However Clohessy & Acton, (2019), argue that larger conglomerates have a higher propensity and willingness to adopt blockchain because of their resourcefulness in terms of technical expertise, competitiveness, and cooperate structure that supports innovation and its perceived benefit. On the other hand, Antonopoulos, (2019) argues that blockchain in its pure form exhibits all the characteristics of openness and many conglomerates may be opposed to it as it takes away centralised control which is needed for their business strategies and the success of their business model. If anything, conglomerates will not advocate for open blockchains as they are their direct competitor.

A further concept of diffusion of innovation is the process of adoption. Rogers, (2003), explains that adoption is defined through 5 stages namely knowledge, persuasion, decision, implementation and confirmation. Rogers also explains that an innovation adoption does not happen instantaneously but rather over a period; this is known as the rate of adoption (Rogers, 2003). In the case of blockchain it is worth noting that across different industries the stage of adoption varies. For instance the finance and real-estate industries are at the confirmation stage, while the service industry is within the implementation stage, on the other hand the energy, transport and communications industries are within the decision stage, while most governments are at the persuasion stage and finally the manufacturing industry is within the knowledge stage (Grover et al., 2019). Researchers have theorised that once the manufacturing industry is the confirmation stage, blockchain would have reached widespread adoption across all industries.

2.3.3.3 Security

According to Weber et al., (2017), the building blocks of security are comprised of coherence of integrity, availability and confidentiality coexisting. Systems that can identify substantially with all of these characteristics intertwined are secure. Analysing blockchain from this perspective brings to light the high level of security that blockchain presents. Aforementioned in this section we first consider security in terms of blockchains characteristic strengths thereafter we review the weaknesses in its protocol.

Firstly when looking into the integrity characteristic of security, blockchain enforces integrity through immutability. Its distributed ledger ensures there are multiple copies

of data available, which makes the data seamless to validate. Furthermore validation is democratic and open(Sudarshan, 2018). Secondly when considering confidentiality, blockchain ensues confidentiality through anonymity by means of cryptographic public and private keys (Piscini et al., 2018). Finally availability in blockchain can be considered through two chains of thought. Firstly, with blockchain being decentralised and open, availability is perpetual. Secondly, POW is a mechanism that supports the availability of only authorised/hashed actions (Berberich & Steiner, 2016).

Although blockchains provide a high level of security, Wirth & Kolain, (2018) argue that there are flaws within the protocol. It's worth pointing out that these flaws are more applicable to public blockchains. Firstly, the nature of the public and private keys. It is possible in certain cases for an individual endowed with cryptographic skills to access a public blockchain, conduct chain analysis and mine data to figure out the trajectories of a specific private key to align it with an individual (Wirth & Kolain, 2018). Therefore Clohessy & Acton, (2019) proclaim that blockchain is pseudonymous rather than anonymous.

The second security flaw exhibited by public blockchains is in a phenomenon called sybil attack. The background of understanding this phenomenon stems from understanding blockchain's key feature-POW. From the previous discussions on POW, it's clear to identify computing power as the key measurable when mining blocks. With this in mind Conte de Leon et al., (2017) define the phenomenon of sybil attack as an attack that occurs when at least 51% on the computation investment in the network and in every transaction originate from the same source. If a sybil attack is accomplished, the blockchain infrastructure and ideology becomes compromised as malicious actor/actors will have control of the entire blockchain. The malicious actors will be able to influence the trajectory of new transaction confirmations, resulting in bias regarding who receives the reward for POW. At this point in time there is no plausible process to identify sybil attacks nor counter against it.

A further phenomenon that challenges integrity of blockchain's security feature is known as selfish mining. Zheng et al., (2017) describe this phenomenon as an action taken by miners to create their own private chains through mining blocks without propagating it to the network. They create a fork and continue mining in isolation with no competition. They present the longer chain at some point in the future which will

maximise their returns. This is at the expense of honest miners that have invested computational power in sustaining the “imitation” at the point of the chain forking. If their private chain is significantly long, it is easily identifiable by the other miners, and the malicious actor may be disciplined. However Weber et al., (2017) point out if the miner keeps the private chain at a minimum before propagating it to the network the act may go unnoticed. To negate the occurrence of a fork presenting a longer chain than that of the current one, emerging chain networks have created checkpoints. For the blockchain network the waiting period is 6 blocks and for the Ethereum network the waiting time unerringly 12 blocks (Weber et al., 2017).

While the above discussion highlights blockchain’s high-level security characteristics, the security challenges discussed bring forth underlying malicious activity that can possibly disrupt the fabric of what the blockchain represents- openness and neutrality. Nevertheless, these flaws can be seen as opportunities for improvement with the cases presented now for future innovation.

2.3.4 Economic considerations

The impact of blockchain on the socio-economic global landscape is instrumental. In this section we review the economic benefits of blockchain, in addition we consider the technical economic challenges and impact of implementing blockchain. The dialog follows suit in 3 parts discussing the economic factors related to mining, throughput and employment.

2.3.4.1 Mining

The success of maintaining a blockchain is highly dependent on mining activity through the POW mechanism. Rightfully miners are rewarded economically for their efforts and their investment in hashing power. However, the rewards may not always be beneficial as in certain cases miners don’t maximise returns through hashing. According to Zheng et al., (2017) the contributing factors are the instability of the reward gesture coupled with growing utility costs. In most cases the medium of reward is cryptocurrency and at times when the currencies performance is weak it becomes unprofitable for miners to continue mining on that blockchain (Sudarshan, 2018). In most cases miners switch to a different blockchain with a different medium of exchange to optimise their return, alternatively they switch off their mining equipment

(Robert, 2018). Conversely with miners switching to a blockchain that is more profitable, a greater concentration of miners envelope on the same blockchain resulting in a greater hash difficulty subsequently consuming more hashing power.

2.3.4.2 Throughput

Blockchain is seen as a game changer, especially with the benefits it provides over traditional systems. The vast majority of researchers endorse blockchain's ingenuity in reducing both transaction costs and time. However, this is relative. From the perspective of reconciliation, blockchain has unquestionably provided advantages; improved accuracy, indisputability, and time saving with little to no effect required to reconcile (Konfidio, 2018). On the other hand, at this point in time depending on the circumstance, the relative advantage is conditioned to financial transactions. WEF, (2018) argues that although transaction costs are holistically cheaper over blockchain than by traditional facilities, the time required to confirm a transaction is not always at an advantage. For instance, when making an international bank transfer or an interbank transfer, the administration and transaction confirmations are tedious processes that take a substantial amount of time. In this circumstance blockchain has an advantage. However, in terms of intrabank transfers and even PayPal transfer blockchain has no advantage in terms of transaction time (Zheng et al., 2017). The reason for blockchain's disadvantages stems from the engineering constraints of a block.

According to Gilad et al., (2017), the bottleneck in the current blockchain infrastructure is governed by the characteristics of block. Blocks limit throughput which increases the latency for confirmation. For instance, the Bitcoin blockchain propagates a 1megabite (MB) block every 10 minutes or 6MB per hour. While this block sizes may be adequate at this point in time for minuscule transaction, it cannot provide support to complex business processes (Konfidio, 2018). Although Gilad et al., (2017) argue that increasing the block size might not necessarily reduce latency, as more transactions would be required to propagate a block. To put this into perspective of transactions, the blockchain network can achieve an average of 7 transactions per second while Ethereum can handle as much as 30 transactions per second (WEF, 2018). This achievement however is not competitive on a commercial scale in comparison to financial conglomerates such a VISA who conduct an average 80,000

transactions per second and can go up to 120,000 transactions per second (Mccullagh, 2017). In terms of Roger's criteria for adoption, blockchain does not offer a relative advantage in this sense and a possible motivation towards the deliberated adoption. At present there are a number of researchers investigating methods of reducing latency and maximising block size. A worthy mention is Algorand, which within a controlled environment managed to achieve a 125 times greater throughput than Bitcoin (Gilad et al., 2017). Although this might not be in line with VISA's average throughput, it illustrates the power of opensource code and what accelerated advancements it can bring. Other proposed methods of mitigating the bottle neck include and scaling blockchain include; removing older transactions as well as breaking the block into two components; one part for leader selection and the second part for the saving of transactions (Piscini et al., 2018). Although both these proposals might not be entirely possible on open blockchains.

2.3.4.3 Employment

The impact of implementing blockchain on a large scale from a socio-economic perspective will change the nature of employment. Grover et al., (2018) argue that the implementation of blockchain could potentially result in mass unemployment. Motivation for this statement is based on the premise blockchain can automate many routine tasks that are considered to be fundamental to business. It is estimated that in the banking sector alone, 30% job loss will incur as a result of blockchain implementation (Woodside et al., 2017).

However Antonopoulos, (2019) responds with the argument that while private blockchain implementation may result in job loss, the public/open blockchain can have an opposite effect. The reason for this is based on an argument that was presented earlier, discussing how public blockchain could become the next generation of the shared economy. Antonopoulos, (2019) proposes if plausible, that it will mean that less people will be doing business through conglomerates, but rather conducting business on direct peer to peer interaction, with the elimination of the conglomerate/ intermediary. This paradigm is controversial, as it implies the phasing out of conglomerate and that the implementation of the public/open blockchain will create more jobs than the result of retrenchment from private blockchains. The public blockchain is a mechanism that could accelerate the shared economy thereby

enabling society to trust in a system and entrepreneurship rather than depend on the decree of a corporation.

2.3.5 Regulation

For a number of years since the establishment of Bitcoin, the regulation of blockchain; its underlining activities and applications have been a grey area. Although many countries have tried to enforce legislation independently, there has not been any global regulatory authority that has passed a legislation or guidelines as an international standard (White, 2017). This was until recently; a set of international guidelines was established by the Financial Action Task Force (FATF) (2019). According to Linver, (2019); one of the fundamental standards is that a transaction conducted over a blockchain using cryptocurrency, for a trade/exchange of more than $1,000 has to be reported to FATF. The responsible authority for reporting is the cryptocurrency exchange, who must provide a report on details of who is purchasing, what from who and for how much. While there are benefits from such reporting, it undermines the ideology of blockchain anonymity (Linver, 2019). It is for this reason that in this section of the paper we discuss the impact that legislation has on blockchain and whether the engineering of blockchain can meet the requirements of legislation. In doing so we firstly assess the motivation for regulation, thereafter examine which countries or regions are heavily regulated. Secondly, we focus our attention on Europe's General Data Protection Regulation (GDPR) and blockchain's compliancy thereof.

Although many are opposed to the regulation of the open blockchain it is necessary to find a balance between regulation and openness. The main objective behind the regulation, was firstly to enable authorities such as FATF (Financial Action Task Force) to track and investigate malicious and criminal activity. The benefit comes in the reliance of an entity to depend on the authority to protect their commercial assets (Linver, 2019). Over the course of blockchain's development, money launderers and criminals have exploited the key feature of blockchain's anonymity to move money illicitly and conduct unlawful transactions (A. Antonopoulos, 2019a). Secondly, many governments have seen blockchain technology has an adversary, causing an enormous amount of losses in tax revenues. The reason for this is due to blockchain's decentralised nature. With no controlling intermediary, blockchain has been a means to hide capital and capital gains, escaping taxation (A. Antonopoulos, 2019a). In

retrospect while regulation is necessary; it suppresses the fundamental characteristics of blockchain; decentralisation and anonymity become inhibited. Although FATF is not in full control of the open blockchain there is a sense of disparity that FATF centralising blockchain through their set of guidelines (Linver, 2019). In addition Antonopoulos, (2019) argues that the motivation to regulate the open blockchain is being driven by the banking sector as they recognise it as a threat to their business model.

Prior to FATF's intervention, many countries had already prohibited the use of cryptocurrencies. Chen, (2018) discusses these prohibitions by first pointing out its prevalence in China. In addition to China banning cryptocurrency for so called loses in tax revenue, China has also banned ICO's. Another Asian country that followed China's suit is South Korea. The Korean government claim that blockchain is favourable, however, they have still proceeded to ban ICO's. In the US, legislation was passed to ensure the collection of tax on capital gains from the appreciation of cryptocurrency(Chen, 2018). This was a tedious task when the regulation was first passed as they had to declare any amount in capital gains. Although it has now changed affairs so that users have to only repost on capital gains of more than $600 dollars when filing their tax returns (Antonopoulos, 2019). Europe is by far is most intricate when it some to the discussion of blockchain regulation. It is for this reason that we have chosen Europe to further asses blockchain performs in regards to Europe's GDPR.

2.3.5.1 GDPR and blockchain

GDPR is a data protection regulation that is pertinent across EU member states and at national level. The purpose of GDPR is to protect the personal data privacy of all EU citizens. The regulation is applied to any entity that is monitoring behavioural pattern of any person residing in the EU, and/or retaining customer data when selling goods or services in the EU (EC, 2016). Legislation has classified such entities as "data controllers" and "data processors"- making them accountable and responsible for the use of customer/user personal data. According to Robert, (2018); a data subject is any person who can be identified through the use of their personal data. To ascertain whether GDPR is applicable to blockchain there needs to be a clear definition of who the data controllers, data processors and data subjects are in the system.

When considering the mechanics of blockchain, it's difficult to ascertain GDPR's applicability from two perspectives. Firstly, as argued by Berberich & Steiner, (2016); on the open blockchain there is no mediatory, therefore accountability is negated as no individual can be classified as a controller. Secondly, according to Wirth & Kolain, (2018); the use of private data in blockchain is a grey area because the only "private" data used on the blockchain is a participant's public key. Furthermore public and private keys support blockchain participants in remaining anonymous. As a result Wirth & Kolain, (2018); argue that anonymity does not constitute infringement on a user's identity. It for this reason that blockchain is not within the regulatory scope of the GDPR (Wirth & Kolain, 2018).

Wirth & Kolain, (2018) challenge this paradigm by stating that while anonymity is grounds for exclusion, an open/public blockchain is not entirely anonymous. Through techniques of chain analysis as well as methods of associating a public key to someone's delivery address compromises that person's anonymity. According to Wirth & Kolain, (2018); anonymity decrees that in order for an individual to be classified as anonymous, there must be no possibility of determining a person's identity though linking their encrypted data with other sources of information to determine their identity. Even with there being a trivial chance of determining a participant's identity, this is classified as pseudonymous rather than anonymous. Under the framework of the GDPR, pseudonyms are a form a person data. As a result, blockchains do need to be legislated under the framework of GDPR (Wirth & Kolain, 2018). In this case it would imply that the open blockchain would need to account for plausible data controllers and data processors. With these roles not clearly identified nor endowed to any individual or entity in the blockchain space, we aim to argue for possible nominees.

A data controller is a central intermediary that is responsible for the control over data collected from the data subject; this includes defining the purpose and means for the data collection. In addition, the data controller is liable for implementing measures of defence, and ensuring principles of data protection are fulfilled (Wirth & Kolain, 2018). Based on this definition it is difficult to determine who would be considered as a data controller on the open blockchain. Nevertheless, Wirth & Kolain, (2018) argue that there are viabilities, in the form of; (1) the miners/ nodes and (2) the programmers of the blockchain. In the case of the latter, programmers of an open blockchain have no control or authority over the blockchain nor does the data once the blockchain goes

live. Therefore programmers cannot be considered as data controllers. Moreover miners are not apprehensive about the “personal” data on the blockchain; their concern is in the economic benefit from mining. It is for this reason that nodes seem to be the preferred possibility as data controllers. Essentially they do function as gate keepers of the data on the blockchain, through the characteristic of every node storing a copy of the blockchain, in addition to the fact that all data that is added to the blockchain is done so through the consensus of the nodes, and if there ever is a possibility of data being altered, it can only be done so through the consensus of the nodes.

However, Wirth & Kolain, (2018) point out that complications may yield as a result of nodes being plural, with no individual controller to be held accountable. Nonetheless, Czarnecki, (2018) propose the notion of joint control. Although, many blockchain pundits oppose this view, stating that the behaviour of nodes is not collective but rather the addition of their independent behaviours (Wirth & Kolain, 2018). Furthermore Kaufmann & Rechtsanwälte, (2018) state that in order for joint controllership to be valid there needs to be a joint agreement to have personal data processed; nodes have no such agreement, therefore under the jurisdiction of GDPR nodes cannot qualify as controllers.

2.3.5.2 Principles of GDPR

In the previous section Wirth & Kolain, (2018) classified blockchain as pseudonymous, supporting the idea that it needs to comply with GDPR. However, in order for blockchain to be GDPR compliant, data processing on the blockchain must adhere to the 6 principles of GDPR. These are namely; confidentiality, integrity, storage limitation, accuracy, data minimisation and purpose limitation. In this section we review these principles in relation to blockchain in order to determine if blockchain infringes on any data subject rights.

2.3.5.2.1 Lawfulness, Fairness and Transparency

The principle of lawfulness, fairness and transparency refers to the measures a data controller takes in order to be transparent with a data subject; detailing how their data will be processed (Magalhaes, 2018). For private blockchain compliance of this principle is impartial, with controllers easily able to declare this intention. However, in

terms of public blockchains the subject of a data controller is still a grey area (Berberich & Steiner, 2016), nevertheless the ingenuity of blockchain's decentralisation and openness contributes to a high degree of transparency, supporting a data subject's right to access their data anytime and anywhere.

2.3.5.2.2 Integrity and confidentiality

The principle of integrity and confidentiality refers to the securing of all personal data that are both online and offline (Magalhaes, 2018). Both open and private blockchains are in line with this principle, through the use of secure encryption techniques in the form of private and public keys, and consensus algorithms.

2.3.5.2.3 Storage limitation

Storage limitation is a principle that refers to the establishing of a data retention policy that stipulates that personal data will not duplicated, and is only stored for as long as it is required (Magalhaes, 2018). The architecture and engineering of Blockchain was designed for the purpose of immutability (Zheng et al., 2017). This makes it extremely difficult for blockchain to be in line with the principle of storage limitation for two reasons. Firstly, the nature of blockchains' perpetual storing is within the design of the technology. Every record is stored for an infinite amount of time, even if a user is no longer a participant on the blockchain (Berberich & Steiner, 2016). As a result this makes a compelling case of the impossibility of blockchain to comply with this principle of storage limitation. It is for this reason Wirth & Kolain, (2018) argue that blockchain infringes on a data subject's right to erasure. However Berberich & Steiner, (2016) point out that it still might be possible to support a data subject with their right to be forgotten, although it is not practical and a danger to the entire blockchain infrastructure. Berberich & Steiner, (2016) further explain that in order for a record/transaction to be deleted from the blockchain it would require every node of the network to do a backward verification of every transaction leading up to the transaction delete request, and then rebuild the blockchain to its current state. In doing so regular blockchain activity would have to cease for a significant amount of time, moreover this would require an enormous amount of computing power (Berberich & Steiner, 2016). The second reason why blockchain cannot support the principle of storage limitation is its characteristic of decentralisation, where every node stores copies of the

blockchain (Sudarshan, 2018), and therefore goes against the framework of the principle, in that data should not be duplicated.

It could however in both circumstances be argued that the infinite retention of data and duplicate copies are a requirement of blockchain, a necessity for its functionality and its sustainability.

2.3.5.2.4 Accuracy

The principle of accuracy refers to the accuracy and validity of the data for its purpose (Magalhaes, 2018). This principle to some extent is supported by blockchain. Consensus of the network and consensus algorithms ensure both accuracy and validity. Conversely, the right to rectification is somewhat of a grey area as immutability is almost impossible. If a data subject needs to have their "person details" rectified or updated, it would be impossible to amend the existing block information (Sudarshan, 2018). However Antonopoulos,(2019) points out that it is possible for a new block to be created, with the update or rectified data and linked to the incumbent block.

2.3.5.2.5 Data minimisation

Data minimisation is a principle that refers to processing data limited to its purpose. The limitation can be classified as both periodically and geographically (Magalhaes, 2018). Blockchain's key features of perpetually distribute storage and decentralisation takes it out of compliance with this regulation. This is because the structure of the blockchain is one that uses a participant's "personal data" beyond the purpose of their transaction, and uses it to some extent to create other blocks(Berberich & Steiner, 2016). As a result, a data subject's right to not be subject to automated processing is infringed upon. Furthermore, the open blockchain is borderless, nodes can be distributed all over the world and are not limited to a geographic jurisdiction. As a result "personal data" may leave the EU, which compromises GDPR's data privacy policy. (Robert, 2018).

2.3.5.2.6 Purpose limitation

The principle of purpose limitation refers to having a lawful and legitimate reason to process a data subject's person data (Magalhaes, 2018). Blockchain supports this

principle because to process a data “subject’s person data” is a requirement for the functionality of the technology.

2.3.6 Current and future applications

Blockchain has a vast array of applications in almost every sector, some are currently being applied while many more have been theorised. As we have seen, there are both benefits and challenges in utilising the technology. A case for business is to determine the cost benefit, if any in implementing a technology like blockchain. It is for this reason that researchers from the Law Futures Centre at Griffith University introduced a model to facilitate businesses in determining whether blockchain is a viable solution for their business requirements. The model came to be known as the Fraud, Intermediaries, Throughput, and Stable Data (FITS) model (Mccullagh, 2017). In this section of the paper we will discuss the dynamics of the FITS model; in addition, we will review the applications of blockchain in a variety of industries in relation to the functionality.

2.3.6.1 Addressing the need for blockchain

The FITS model is a gauging tool to determine blockchain usability in an organisation. The model uses four criteria to determine if blockchain can provide a viable solution for a use case, or the organisation in its entirety. It is not necessary for all four elements to be aligned, however the more elements found relevant the greater the motivation to apply blockchain (Mccullagh, 2017).

The first element of the FITS model is fraud. The fraud element defines an environment where there is an excessive degree of compliance requirements, due to a high frequency of fraud cases (Mccullagh, 2017). Blockchain features like immutability, trackability and secure cryptography will facilitate with this sort of environment.

The second element of the model is intermediaries. Here the environment is such that revenue is lost due to a high latency in concluding transactions as a result of the involvement of multiple intermediaries. A typical industry where delays in a transaction result in losses, is the securities industry (Mccullagh, 2017). According to Mccullagh, (2017) blockchain has the ability to confirm a transaction in one hour at worst, giving it a relative advantage over the industry standard of two days.

Throughput is the third element of the FITS Model. In contrast to the first two elements blockchain provides a limitation in throughput. If the environment or use case is dependent on a high number of transactions per hour, blockchain can only facilitate to a certain extent, with a maximum of 5000 transactions per second (Mccullagh, 2017). The threshold of 5000 transactions is a future optimistic outlook based on R&D lab projects; in reality the number of transactions is substantially less (WEF, 2018). As a result, at this point in time blockchain is not suited for an environment with a high throughput requirement.

The final element of the FITS model is stable data. Stable data concerns the c h u r n. rate of data. Here the environment is such that the ownership of property rights doesn't change hands frequently. This may be beneficial in the commercial property sector where at times deeds get lost, as the properties are older than 100 years; with no traceable of records of it changing from one generation to the next (Mccullagh, 2017). Moreover Mccullagh, (2017) suggest that additional opportunities for stable data include identity and health data. Blockchain's immutability provides a framework to sustain such data environments for long period of time.

2.3.6.2 Where and how can blockchain be applied

Researchers have focused on one of two paradigms when investigating blockchain. They have either presented studies that broadly focused on the application of blockchain or studies that investigate the features and functions of blockchain. As a result, and going against the narrative, we have developed a table that combines application and functionality. Table 1 depicts how blockchain can be applied, the industry where it can be applied and in what way the special characteristics of blockchain can facilitate in the application.

Table 1.

Industry application of blockchain referencing functionality

Application	Industry/user	Function			
		verify	track	record	disintermediate
Establish digital money/digital assets	Banking Reserve bank Stock exchange	✓		✓	✓
Authenticating; art, food, pharmaceuticals and jewellery	Art Gallery Supermarkets Jewellery stores Pharmaceutical manufacturers	✓	✓	✓	
Establish methods of investments (ICOs)	Start-ups				✓
Leasing of cars, real estate and equipment	Commercial users Private users				✓
Data analytics	Marketing		✓	✓	
Digitally managing intellectual property rights	Innovators	✓		✓	✓
Digital identity management	Government Voting Commercial	✓	✓	✓	
Supply chain	Logistics	✓	✓	✓	
Manufacturing	Procurement Engineering Quality control and assurance	✓	✓	✓	
Bill Management	Medical Aid Banking Credit companies	✓	✓	✓	

Auditing	National revenue services Accounting Auditors	✓	✓	✓	

Note. Data on industry/user from White, (2017)

2.4 Conclusion

With the objective of ascertaining the impact that blockchain might have on business in the year 2030, we employed existed literature as our first information source to identify trends and challenges that may develop over the next 10 years. Majority of the literature was qualitative in nature, with broad focus on one of two paradigms; the application of blockchain or the characteristics of blockchain. The literature provided us with a plethora of codes, from which we identified 5 key themes. These themes were namely the description of blockchain, the framework under which blockchain operates, the characteristics of blockchain, the regulation of blockchain, and application.

Through the literature we were able to find a concise description of blockchain, in that it is a distributed ledger system that is both decentralised and distributed. It functions over a P2P network and relies on a network member's resources to maintain the network, provide consensus and validate activity on the network. The means through which blockchain achieves consensus is by its proof-of-work algorithm. The proof-of-work algorithm is the highest standard of public cybersecurity and the core of blockchains architecture. Blockchain's framework builds trust into a system rather than depending on intermediaries. It is the foundation of where blockchain will be 10 years from now.

Additionally, we identified blocks key characteristics as being immutable, decentralised, borderless, trustless, open, transparent, public, distributed and neutral. Although many of these characteristics bring benefit, they also pose challenges from a legal, political, economic, and environmental standpoint. However, these challenges can be seen as opportunities to improve and develop future business innovations.

For blockchain to flourish in the future, governments need to be more supportive and less regulatory about the technology. Blockchain has the ability to change social structure and provide benefit to the broader society by linking people directly. For business, this means having to relook technological and business strategies to remain competitive a decade from now.

The outcome of the literature review has provided us with a framework to design our research questionnaire based on the 5 primary themes identified. More importantly we identified a multitude of trends and challenges that answered a number of our research questions as well as identifying what businesses need to consider to stay relevant in a blockchain 2030. The literature review has presented us with an opportunity to further our thematic research comparably in chapter 4.

3 CHAPTER 3- METHODOLOGY

3.1 Introduction

The purpose of a research methodology is to identify analytical forms that would assist the research in achieving the research objective. In addition to formulating a plan to solve the research objective, the research methodology is also concerned with describing; why a particular subject matter is under study, how was the research problem derived, what data and data types were gathered, how was the data gathered and why was a certain type of analysis method chosen (Rajasekar, Philominathan, & Chinnathambi, 2013). Furthermore more Rajasekar et al., (2013) explain that a researcher needs to be cognizant of the research objective as well as being able to choose a suitable and efficient research method.

For a methodology to be efficient, it needs to maintain a certain level of consistency. In order to achieve consistency, the researcher needs to establish consistent procedures and guidelines in the data collection, coding, the integration of information, and the construction of the results reporting (Chong & Yeo, 2015). The starting point of the methodological outline was to determine what type of study to conduct, by choosing an appropriate metatheory and methodological research paradigm, that was in line with the research objects and the type of data collected.

Moreover, Morse et al., (2016) asserts that the paradigm involved with research methodologies takes the researcher from a point of the unknown when collecting the data to a point of understanding by analysis and interpretation of the information. For these reasons research methodologies provide a practical guideline and template for researchers to follow a process in developing their concepts in research (Morse et al., 2016).

In the methodology of this study, the researcher used the underlying themes identified in chapter 2 as a foundation to postulate the research population, the sample, sample size, sampling frame and sampling method by applying qualitative protocols. This gave an idea of what data and data types were required. In determining how data was collected, the researcher considered appropriate techniques that would allow for the acquisition of the most relevant information sources and have the widest reach. In cognisance of the sample and the data that was to be extracted, there was an ethical

risk involved and therefore the researcher needed to formulate an ethical protocol to ensure that the dynamic of the study was both ethical and legal. For the analysis of the study the researcher had to choose a qualitative technique that could enhance the content of the study and bring meaning to the data. Through the use of the tool sets from the analysis the researcher was able to structure and synthesize the findings in a logical way.

It is worth noting that, although researcher strived for consistency in the research methodology, flexibility played a key role in finding the most suitable tool sets and best fit to determine the factors of blockchain that will promote sustainable business in the year 2030.

3.2 Three metatheories of social science

Sociology has different schools of thought to use while carrying out research studies. The main traditions in conducting research methodology include positivism, interpretivism, and critical theory.

3.2.1 Positivism

Positivism is a research approach that uses mathematical proof in a logical way to scientifically verify a claim. According to Rahi, (2017), a positivist approach uses primary data to develop factual knowledge. In doing so, the findings of a positivistic study are both quantifiable and observable. Additionally, Rahi points out that the results of a positivistic study are taken through statistical analysis to ascertain an empirical view of the behaviour observed. The setting in which the behaviour observed takes place is normally artificial in nature.

A positivist approach in research is independent and impartial, and so there is no room for biased results. The results provide a framework for the type of outcome evoked. It is for this reason that Antwi & Hamza, (2015) argue that the positivist approach should aim to be deductive in nature, and not to be through inductive tactics. For a quantitative researcher, focusing on facts without human interference is paramount for giving meaning to a study and achieving a successful outcome. Taking a positivist approach in carrying out research is an indication of the researcher's confidence in the investigation. Because of these reasons the results of a positivistic study are objective

with no particular influence from the researcher. This notion is supported by Ormston, Spencer, Barnard & Snape, (2014) who state that the researcher should have minimal interaction with the participants of the research in order to give participants an opportunity to provide objective responses to the study.

According to Halfpenny, (2014), a positivist approach in research is based on five essential principles. The first principle of a positivist approach is to have an analysis that aims to predict or explain. While the second principle is to assume that there are no differences in the methods of inquiry for different scientific studies. The third principle is that research should only be judged through logic. Moreover, the fourth principle refers to the separation of common sense and science in the field of study. Halfpenny (2014) suggests that applying common sense in scientific research shows bias. Finally, through a positivist approach observation needs to take place across the human senses and use this view in testing the hypotheses developed. These five principles provide a framework to researchers using the positivist approach in carrying out their research study.

3.2.2 Interpretivism

Interpretivism is a research paradigm that is focused on human behavioural sciences. Unlike the positivistic approach, with interpretivism there is no distinction between the subject matter under research and researcher. It is normally associated with qualitative research, although it is not limited to the qualitative approach; it is most often used in studies of human sciences where developing a hypothesis and deductive reasoning is not the approach of the investigation. Moreover the paradigm is based on the assumption that there are many realities, therefore the researcher needs to carry out the research in a natural context as the realities cannot be understood in isolation from the context (Maree, 2016).

According to Thanh & Thanh, (2015) interpretivism is a form of qualitative analysis that uses observation and interviews in the collection of data to measure a given phenomenon. Chowdhury, (2014) explains that the use of interpretivism goes from a broad generalisation to develop a specific theory. Using methods like interviews assists in the collection of data to form findings that are both accurate and reliable by means of verification.

On the other hand Collis & Hussey, (2014) define interpretivism as an approach that is based on the premise that social reality is moulded by perceptions; and therefore the result of social study is highly subjective. Unlike positivism, in an interpretivism approach the researcher accepts the biasness and subjectivity of the result of the study. The research has to interact with what is being investigated as it is not possible to separate the social reality from the researcher's mind. As a result, investigating a social reality has an impact on it. The approach employs an inductive school of thought where the researcher is able to establish theories or patterns of behaviour for understanding. While positivism has a premise on the social phenomena being measured, interpretivism is based on the exploration of intricacy on social phenomena to ascertain an interpretive understanding (Collis & Hussey, 2014).

3.2.3 Critical Theory

Critical theory is an alternative research paradigm. The approach is a meaningful research methodology when used effectively in the research studies. It uses knowledge in social sciences to assess society, culture, and literature Tyson, (2014). Furthermore Maree, (2016) describes critical theory as an approach that is focused on the study of human experiences that arise from social oppressions such as inequality and separatism. By studying these social reforms, it presents researchers with an opportunity to understand the dynamism of human behaviour and interactions. Therefore, it can provide a framework resistance to respond against the injustices of the oppression (Maree, 2016).

In the application of critical theory there are two issues that surface. Firstly, because critical theorists investigate historical ontology, researchers argue that the current realities are shaped by the social, political, economic, and ethnic activities that have taken place over time (Robertson & Dale, 2015). However, critical theorists do not agree with this notion, and argue that each issue is a function of the real structures in place at present (How, 2017). The second issue that arises is that critical theory is based on subjectivist epistemology, and researchers using critical theory take into account their existing knowledge (Dieronitou, 2014).

In addition, critical theorists also aim to solve the challenge of objective and subjective issues (Green, 2017). Researchers using the critical theory should recognise the

differences in a bid to distinguish between quantitative and qualitative research. Eliminating the dualism between the subjective and objective nature of the research subsequently leads to confusion in the quantitative and qualitative methods of analysis.

3.2.4 Adoption of a metatheory

The research study on blockchain readiness for countries towards 2030 is located on an interpretivism metatheory. The reasons that we opted for this paradigm is motivated by the rarity of the subject matter. As a result of scarcity in knowledge and industry experts the methodical assumption was to apply a small sample size that would produce an inductive outcome. It was not possible for us to acquire a result from the opinions of experts on a blockchain business future positioning through statistical analysis. Rather, we were contingent towards exploring and interpreting themes of the future to find meaning that would otherwise be overlooked through the use of an overly structured positivistic approach.

From a philosophical viewpoint, the epistemology of the study was dependent upon on the analytical insight and experience of experts in the field of blockchain. Because the knowledge and opinions of the study participants were subjective in nature, the ontology of the study was orientated around multiple social realities. Each reality being a constituent of the social construct towards a future outlook, and towards the formulation of a comprehensive answer to the research question.

Moreover, the axiological assumptions of the study were crucial in the establishment of the social construct. It was formulated particularly by my values on environmental sustainability and regulation. As a result, my opinion shaped the research design and formed a bias to the outcome of businesses operating more openly.

3.3 Three paradigms of research

In carrying out research, the researcher may also need to use a model through which to carry out the research study. In general, there are three main research models that are applied to research, these are namely quantitative, qualitative, and participatory research.

3.3.1 Qualitative Research

Babbie, (2015) describes qualitative research as a research methodology that is prone to an inductive outcome whereby statistical tools are negated in establishing correlative patterns. The researcher however can use qualitative research tools to develop insights through the process of reflection. Babbie, (2015) further explains that the methodology that is focused on the investigation of subject matter that does not necessarily result in a direct numeric outcome. It largely depends on identifying patterns and ascertaining meaning from a given set of observations.

On the other hand Maree, (2016) describes qualitative research as an approach which is iterative, meaning there is no systematisms in the collection, processing and analysing of data, but rather there is an entanglement of these processes. Moreover, there are 3 fundamentals that form the fundamental of the qualitative research process. These are namely; noticing, collecting, and reflecting. Silverman, (2016) supports this notion describing qualitative analysis as an approach to investigate the relationships between different aspects within a phenomenon with the objective of establishing statistical trends. Additionally Taylor, Bogdan, & DeVault, (2015) state that qualitative methods of the statistical analysis entails the process through which the research establishes trends and the phenomena.

Different methods of the qualitative research can be applied to the research paradigm, through researchers' observations and immersions. These methods include the analysis of the interviews and open-ended surveys. Other forms of the model involved the study of oral material as well as visual content. Although the observations' qualitative analysis does not result in direct numeric output, further analysis allows the establishment of trends from the existing data.

Social scientists have mainly used qualitative research as it aligns well with the needs of analysis in sociology. The qualitative research systematically establishes meaning out of data to explain issues like behaviour, interactions, and actions of the people. Flick, (2018) describes the qualitative analysis as the research paradigm that provides the information which can be quantitatively analysed. The significant role of qualitative research is to establish meanings and relationships in social life through descriptions and interpretation.

3.3.2 Quantitative Research

Quantitative analysis makes use of data and presents it in numerical form. Once the data is presented it can be analysed to achieve an unbiased result. A quantitative research approach is normally associated with research studies that have a large population sample size. Moreover, in quantitative research the researcher may formulate broad generalisations from specific observations, leading the researcher to make explanations and predictions about the subject matter. The researcher achieves this through the use of deductive reasoning. The purpose of investigations in qualitative research is for the researcher to deduce an outcome though the study of cause and effect using a static design. The results of a research study using quantity analysis is highly accurate and reliable by ensuring the studies validity and reliability (Collis & Hussey, 2014).

A further description of quantitative research is defined by Watson, (2015) who states that there are instances in the research of social sciences where observations may need to be measured by mathematical and statistical methods. It is for these reasons that researchers use the quantitative research paradigm. Goertzen, (2017) reinforces this by describing quantitative research as a methodology where a researcher adequately expresses the observations through mathematical models in a bid to prove or deny a hypothesis. The data is then statistically analysed to get an unbiased result. In order for researcher not to confuse the use of quantitative analysis with qualitative research, Watson, (2015) provides a framework that would meet the needs of quantitative study. Watson's framework begins by describing that quantitative research generates mathematical models, theories, and hypotheses through which research can be conducted. Consequently, the analysis then creates instruments to use in measuring such models. Additionally, the researcher should have control over experiments in the form of variables. The empirical data collected for analysis is then presented in numerical form. These characteristics form the basis of quantitative research paradigm to be used in research.

Although quantitative research provides advanced methods in data manipulation to ascertain a research outcome, it does also have limitations (Babbie, 2015). According to Barnham, (2015) quantitative analysis does not represent explanations of the values and the responses presented in the study. As a result, the use of qualitative analysis

along with quantitative analysis is essential to create meaning and understanding of the values in quantitative research (Barnham, 2015). The combination of the methods of research would be useful in getting the most effective results to test and prove the hypothesis in the study.

3.3.3 Participatory Research

The participatory research takes a different approach from qualitative and quantitative approaches by providing the study participants the opportunity to influence the study results more than the researcher. The participants in the research define the research agenda, the actions, and the process of conducting the study (Israel et al., 2019). Furthermore, the participants would either individually or collectively analyse the results or provide the findings to draw conclusions out of the research. Participatory research focuses on having the participants of the study being at the centre of the research process.

Foth & Brynskov, (2016) provide methodology for conducting participatory research. Firstly, the researcher needs to form the Participatory Research Group (PRG) in order to identify the challenges and work on solutions that would positively impact on the lives of the people. Secondly, the PRG needs to discuss the problems affecting the people, propose answers, and the possible actions to take to solve such community challenges. The facilitation of the PRG enables the researcher to articulate the problems that affect the community.

The participatory research approach has a range of techniques that can be applied to the research study. In general, the process steps involved in participatory research includes stakeholder meetings, inquiries, and collection of opinions and stories. These steps are meaningful stages in getting the right strategies to get involved in the participatory research. Researchers, however, need to develop a research program that will aid in data collection, monitoring, evaluation and communicating across different stakeholders to ensure a complete process (Leavy, 2017). Each technique used in participatory research can facilitate the researcher in achieving the research objectives.

3.3.4 Adoption of a qualitative research approach

A qualitative research approach was adopted for the research study on blockchain readiness for countries toward 2030. Many of the motivations for having selected a qualitative paradigm overlap with being located on an interpretivism metatheory. For instance, the exploratory approach with a subjective bias was essential to the understanding of the subject matter. In addition, with the aim of exploring and finding meaning in the data through interpretation an inductive methodology was employed without the use of statistical and mathematical models.

Moreover, in addition to the research design calling for a small sample size, we utilized nonprobability purposeful sample as it was necessary to acquire only participants who were knowledgeable in the subject matter of blockchain. This allowed us to explore and interpret the opinions of those who are experts in their fields. The research setting was natural as surveys were sent out to candidates, whereby the researcher was used as the principal instrument/gatekeeper for the processes of data collection and data analysis. In order to achieve expansive and explorative responses we utilised open-ended question in the survey. Although when technical details were involved in some of the responses, we extended the question to become probing in nature to ensure a better understanding of the response.

By utilizing this type of methodology, we were able to establish a research design that had flexibility and was emergent towards our findings. Moreover, through using multiple sources in the form of the literature view and survey, we were able to achieve comprehensive and holistic findings.

3.4 The data sample

3.4.1 Population and sample size

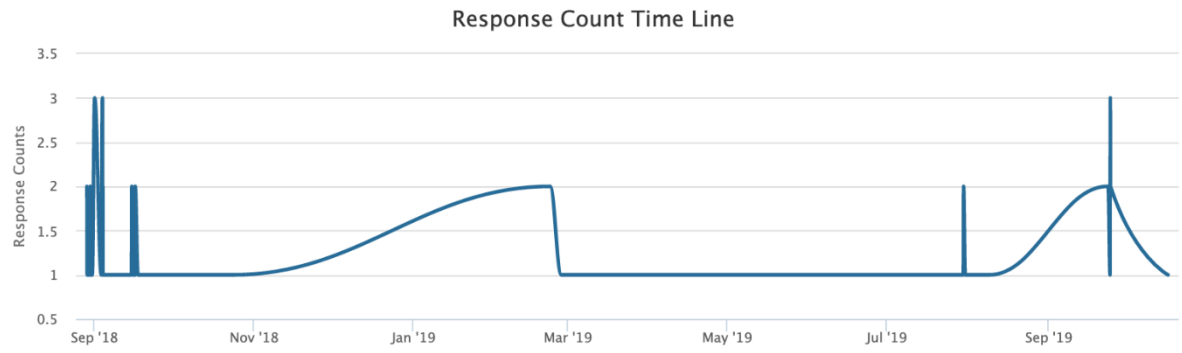
The participants of the study were recruited based on multiple social criteria related to the subject matter. The most prominent of the social criteria used in qualifying participants was their occupation. Specifically, the recruitment consisted of industry experts mostly from the information technology sector. Through the recruitment process the researcher able to develop a sample that had a high concentration of business people either involved with or exposed to blockchain.

The outline of the sampling design is based on concepts from grounded theory and thematic analysis. According to (Maree, 2016); grounded theory generally suggests sample size be 20-30 respondents; this is claimed to be the acceptable benchmark for respondent data saturation. However, due to the time and resource limitations, combined with a poor response rate the researcher was only able to recruit 17 respondents to develop the sample.

Due to complexity and nature of the response required, the study resulted in a high response dropout rate of 76 with only a 18% completion rate. It commenced on 29 August 2018 and was concluded by 24 September 2019, running for a period of 391 days. Figure 3.1 shows the response rate of the study over the period of 391 days with the last responses being registered on the 24 September 2019.

Figure 3.1

The number of responses received from 2018-2019



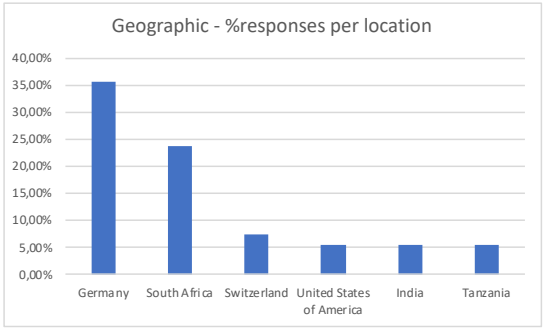
3.4.2 Sampling frame

The sampling frame employed to develop the sample consisted of working professionals in the space of blockchain. This included those who were in the occupation of blockchain, had exposure to blockchain through extra-curricular activities or were otherwise interested in the subject. More broadly the sampling frame included experts and working professionals who have a strong background knowledge of blockchain.

In terms of geographical reach the study was deployed worldwide, reaching 18 countries and 6 continents. Although the development of the sampling frame allowed the researcher to reach the sited 291 candidates, the initial participation rate was additionally poor at 40%. The majority of participants were from Europe and Africa with Germany and South Africa making more than 50% of the sample. Figure 3.1.1 shows 89% cumulative initial responses, with the top 8 locations arranged chronologically in descending order.

Figure 3.1.1

Percentage of initial respondents in order of geography



According to Muhaiyuddin, Abu Bakar, & Hussin, (2016) qualitative analysis does not have a systematically structured design methodology. As a result ground theory can be adapted and combined into multiple methodical designs to allow the researcher to best interpret the results. It is for this reason that the researcher chose the literature review as the secondary data source to identify concepts that needed further investigation. Next, the researcher applied the data collection model established by Maree, (2016) and utilized the identified research gaps in the literature to be a foundation for gathering further data. This was in the form of primary data that was collected by means of the research survey questionnaire. For the literature review the researcher used a sampling frame of multiple different resources in the form of journal articles, conference proceedings and internet sources to gather data. In the case of gathering further data, through the form of a research survey, which needed to reach blockchain experts, the researcher used social media and blockchain forums.

3.4.3 Sampling method

The sampling method selected for the study on blockchain readiness for countries towards 2030 was purposeful sampling, which is a variant of non-probability sampling. The reason for using this sampling technique is that the recruitment process for candidate participants was premediated as the researcher sought a particular type of individual based on their knowledge and expertise in the subject matter. As a result of the researcher bias, the researcher was able to recruit the most relevant participants.

It is worth noting that the bias in the recruitment process allowed the researcher to establish the required homogeneous samples. It was necessary for the sample to be homogenously based on the association with a common social subculture in the form of blockchain. All candidates in the recruitment process had a common background of some sort of exposure to blockchain.

Further to establishing a homogenous sample, the researcher adapted the sampling technique to include snowball sampling due to the limited number of experts in the subject matter. Snowball sampling is a technique whereby the researcher asks a respondent to refer a candidate with similar experience, judgement or knowledge in the subject matter. (Collis & Hussey, 2009). Snowball sampling allowed the researcher to recruit 24% of respondents through applying this methodology.

3.5 Data collection method

The primary research instrument used in the data collection was online questionnaires. The reason the online questionnaire was elected as a research instrument was due to it having the capability of reaching a wider audience globally, as opposed to using interviews. The questionnaire was semi-structured, utilising open ended questions in combined with probing elements. This gave respondents to the opportunity to answer freely and provide viewpoints that were deep in knowledge, expansive and subjective. These are components which are essential in the development of a social contracture that is multiple.

The types of questions that dominated the questionnaire were what, how, and which type questions. Moreover, probing questions, specifically elaborations or probes were integrated into the questionnaire to get a better overview and picture of technical

details discussed by respondents. The questionnaire was structured into two components. Section 1 comprised of technical and business related blockchain questions, while section 2 were descriptive questions. Descriptive questions were necessary to get an understanding of the sample, especially with regard to respondent's depth of experience.

For the primary data, the medium in which candidates where reached and the questionnaire broadcast was through social media and blockchain forums. The main source of social media utilized to recruit candidates was Linkedin. Invites to participate in study were sent out to the researchers' Linkedin contacts, and upon accepting the invite the researcher distributed the questionnaire to the candidate. From 62 invites that were distributed over Linkedin, only 5 candidates were recruited for the study. On the other hand, online forums- mostly private Slack blockchain channels had a worse recruitment rate, with only 2 candidates recruited. Table 3.2 shows the number of candidates recruited from each source, and through which mechanism they were recruited. The data was captured by the respondent, and recorded using Questionpro, an online web-based survey tool. The questionnaire can be found in annexure 2.

Table 3.2

Number of respondents/candidates recruited per method and source

Recruitment	Linkedin	Slack	1st connection/ peer
Organic	5	2	6
Snowballing			4

In terms of secondary data collection, the data collection instruments that the researcher used were journal articles, conference proceedings, and internet sources. The vast majority of data was collected through journal articles and web sources. The latter consisting of 21 sources in the form of videos, articles and webpages. The number of published sources (documents) used in the study, in conjunction with the repositories of where they were extracted can be seen in table 3.3. Within each

repository Boolean search criteria were used on the following keywords: blockchain, technology, business, data and digital.

Table 3.3

Number of relevant documents used per repository

Repository/publisher	Journal articles	Conference proceedings	Books
Sage	6		1
Emerald	2		
Springer	5		
Wiley	5		
Business source complete	6	8	
EBSCO	3		
Oxford	5		
Macmillan			2
Nelson			1
Van Schaik			1
Total	**32**	**8**	**5**

3.6 Ethical issues

3.6.1 Potential risks

By blockchain readiness for countries towards 2030 being a qualitative study there is to some extent a necessity to collect biographical information. With the association of a participants' biographical information to their identity there are certain ethical risks involved in the study. The potential risks involved in the study include social and economic risks, loss of confidentiality, and legal risks.

According Collis & Hussey, (2014) confidentiality is the assurance to the participant that although the researcher is aware of the participant's identity, he or she will not divulge to the public. In general, research participants have rights to privacy, and

having their private data protected. It is therefore the obligation of the researcher to support and comply with preserving the privacy rights of participant. Therefore in the study letter the researcher was transparent and informative about what was collected, in addition to assuring confidentiality upon receipt of the data. Peter, (2005) argues that the greater the invasiveness of the study, the greater the care taken by the researcher. It is for this reason that the researcher negated the loss of confidentiality risk by only collecting personal data that was absolutely essential to the study. It is worth mentioning that a major part of the study sample was from Europe. As a result, to further negate risk and assure confidentiality the researcher aspired for compliance with the data privacy rules outlined by Europe's GDPR.

The second risk to participants of the study was the legal risk. Although the respondents of the questionnaire answer in their own capacity, there was still a risk of exposing company trade secrets. These can be subject to legal action against the respondent. To reduce this risk, the researcher structured questions that were future oriented and advised respondents to have an approach that is incognizant of the current trends and the projects that they are working on, by focusing on a future outlook.

The final risk associated with the study was the socioeconomic risk. This risk surfaces as a result of the participant engaging in the study with the outcome of information being exposed causing economic loss (job loss), embracement, and negation of relationships and the loss of social statue. This risk overlaps with the loss of confidentiality risk. It is for this reason that the researcher employed similar safeguards as the loss of confidentiality risk, in addition to assuring participants of the anonymity.

3.6.2 Sample precautions and dynamics

As the research study being conducted with the intention of participants answering the questionnaire in their own capacity there were no institutional gate keepers necessary to gain access to the candidates. However access to the candidate was permissible through the internet, so in that regard the internet can be classified as the gatekeeper, more specifically Linkedin and the forums used. The study on blockchain readiness for countries towards 2030 did not recruit any participants from educational institutes,

private institutes, governmental institutes, an institutionalised population or anyone under the age of 21 years old.

Consent to participate is a consequence of the respondents accepting the researcher's invite through direct messaging to participate in the research study. The further confirmation to participate in the study is initiated by the respondent's willingness to proceed after reading the terms of the questionnaire on the study's homepage. The cover letter/terms of the questionnaire can be seen in annexure 1. In addition, the cover letter details that upon request for feedback, the researcher will provide participants with PDF copy of the study results.

According to Babbie, (2015) anonymity is when the researcher or the reader of the study is unable to identify the participant through his or her response. In an effort to maintain his or her anonymity the researcher provided safeguards in the form of early coding of the data and securing the data through a questioner encrypted database, whereby only the researcher had authority to access the data.

Moreover, other measures that were put into place to ensure the protection of participants' anonymity and confidentiality include; the destruction of participant details on completion of the study, coded and limited access to personal data, encrypting data on Questionpro's platform. The measures put in place to maintain confidentiality and anonymity collectively align with the 6 principles of GDPR, namely; confidentiality, integrity, storage limitation, accuracy, data minimization and purpose limitation. Further description of these principles can be found in chapter 2.

3.6.3 Method of analysis-thematic analysis

There are various types of analysis used in qualitative research. Researchers may choose to use a set of tools and methods to identify the key words, ideas or concepts within text of the study (Krippendorff, 2018). The process in which words are used to create a meaningful outcome from content is known as content analysis.

According to Collis & Hussey, (2014) content analysis is a methodology normally associated with positivism, however it used as a diagnostic tool in qualitative research to reduce high volumes of open-ended data into practical segments for analysis. The methodology of the analysis functions in such a way that qualitative data renders methodically numeric data. In most cases it is used in the analysis of documents,

however, it can be used for types of communication, for instance focus group, interviews and newspapers. Collis & Hussey, (2014) further reiterate that there are two approaches to content analysis in the form of mechanistic and interpretative. In the case of the latter the methodology involves breaking down the content of the text into smaller segments and describing each segment to get a better understanding of what is being communicated. The mechanistic approach on the other hand can be divided into two methods which are namely: form-orientated and meaning-orientated content analysis. Form-orientated focuses on the frequency of word count whereas meaning-orientated content analysis focuses on the theme depicted within the text. Meaning-orientated approach of content analysis is a similar approach to the analysis methodology that the researcher adopted in this study, specifically thematic analysis.

Maree, (2016) describes thematic analysis as an approach that results in the outcome of researchers being able to form categories and subcategories from the content of information analysed. It is through the data that the researcher establishes themes. This notion is supported by Javadi & Zarea, (2016) who state that themes in qualitative research refer to the patterns that bring meaning out of the existing data. To maintain flexibility in the study researchers may choose to apply different versions of thematic analysis. Although the choice would depend on the subject matter under study.

Moreover, Collis & Hussey, (2014) provide a framework to conduct content analysis, , similarly the framework can be to applied thematic analysis. The first phase of the framework involves establishing the reason for selecting a sample. The next phase is for the researcher to formulate code units using specific words, items, or themes. Finally, the researcher creates a coding frame which is used as the heart of the analysis, each communication of the study is scrutinized and referenced to the coding frame. In most cases the analysis is based on frequency of occurrence, although other factors may also be used as a basis. A further example of conducting the thematic analysis is through reflection. Thematic analysis is popular in studies of different subject areas as it presents an effective way of getting meaning out of existing data. It is for this reason that Nowell, Norris, White, & Moules, (2017) argue that thematic analysis is the most effective method of content analysis in the subject areas of sociology, education, and health sciences.

The imminent outcome of conducting research is for the researcher to achieve objectives and to conclude by answering the research questions. According to Vaismoradi, Jones, Turunen, & Snelgrove, (2016) thematic analysis is one of the most effective methods in conducting research through giving meaning to the data in a way that answers the research question. Furthermore Vaismoradi, Jones, Turunen and Snelgrove, (2016) recommend tools such as data coding, data familiarisation, and theme development be used in thematic analysis to identify patterns. All of the methodologies employed when using thematic analysis facilitate the researcher in achieving the research.

There are various advantages associated with thematic analysis that make it useful in the research process. For instance Drinkwater, Dagnall, Grogan, & Riley, (2017) explain that the theoretical flexibility in thematic analysis provides a relative advantage over other methods of analysis as it makes the method easy to use and apply. As a result of the flexibility, thematic analysis can be used with different theoretical frameworks in a way that enables the researchers to answer various questions. Additionally, thematic analysis would easily fit into the experiences of the individuals and capture their views.

The application of thematic analysis depends on the orientation and approach of the study. Braun et al., (2019) propose that there are various orientations to thematic analysis. Firstly, an inductive orientation which is a type of theme development, where the content of the data influences the coding process in the development of themes. The second approach is a deductive orientation where the researcher intends using existing theories, ideas or concepts. A further orientation is the systematic way of thematic analysis which represents cases where the researcher intends providing explicit content of the information. In addition, the fourth approach is a latent orientation, which uses the assumptions and concepts in research to help in breaking down the existing data. Finally, the constructionist orientation is an approach that can be used to focus on the method of creating reality from the given data (Braun et al., 2019). Using all the orientations of thematic analysis is not mandatory however using a combination of different orientations would be useful for the researcher to get the most out of the research.

Thematic analysis is not a single step process but involves the use of different stages to get the most out of data. Expanding on the Collis and Hassey methodology of conducting content analysis; Braun et al., (2019) present a framework that is specifically designed for the application of content analysis. Thus, the step by step process assists researchers in interacting more with the data and facilitates in answering the research questions out of the data (Braun et al., 2019).

The process of thematic analysis has different phases. Successful analysis of the data requires a familiarisation process. Braun, Clarke, Hayfield, and Terry (2019) offer a six-step process in the process of thematic development. Firstly, the researcher should interact with the data and have an immense understanding of its content. The second phase of thematic analysis would be to identify key points in the data that would have a significant purpose in answering the research questions. Subsequently these key points must be labelled in a way that gives meaning to the data establishing the coding. Giving meaning to the data after it has been coded assist in the process of generating initial themes. The researcher would classify each data into relevant candidate themes to get the viable data useful in developing primary themes. Finally, through identifying the relationships between primary themes the researcher will be able to formulate the main theme (Braun et al., 2019). Through the development of the main theme, primary themes and sub-themes, the researcher should always be cognisant of the research questions.

3.7 Thematic protocol

Applying the Braun et al., (2019) framework to both the literature review and the main study allowed the researcher to develop an array of sub-themes and primary themes in pursuit of the main themes. The pathway from sub-theme to the development of the main theme was established through the use of codes/nodes. This was done by using qualitative analysis software in form of Atlasti and Nvivo. For the literature review the researcher used Atlasti as the analysis tool to develop nodes and find themes. On the other hand, when it came to the main study/questionnaire the researcher used Nvivo for the analysis.

The motion of formulating themes and their relationships with each other provided the researcher with a framework to structure the synthesis of the report and findings. To find the relationships between themes, nodes and text the researcher used a number

of integration tools offered by Nvivo. These are namely word clouds, cluster analysis, tree maps, word trees, and hierarchy charts. The researcher provides below the definition of each tool and the value it added to the analysis.

3.7.1 Word clouds

World clouds are a graphical representation of the frequency of words in document, quotations, codes, or any other form of text. In the case of this study it was applied to the response from the questionnaire. Seen in figure 3.2 is the word cloud representing the entire the entire study/collection of responses. The more dominant or frequent a word was in the study the larger the text appears in the word cloud. By means of utilizing word clouds the researcher was able to single out important themes and key areas.

Figure 3.2

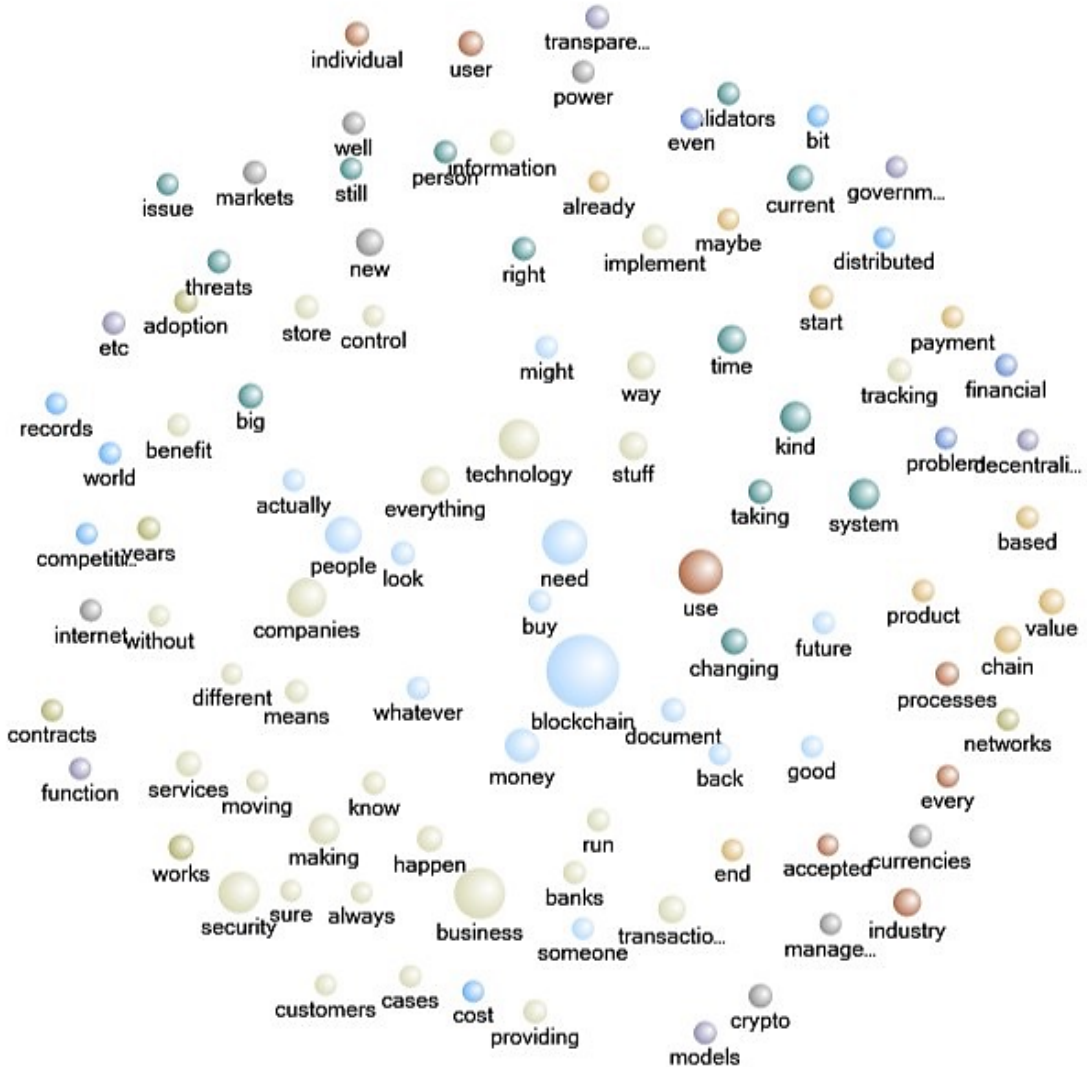
Word cloud representing all words from all respondents

3.7.2 Cluster analysis

Cluster analysis is a bubble diagram graphical representation of text highlighting a number of different facets. Firstly, the larger the bubble, the more frequent the utilization of the word. Secondly, the colour of the bubble depicts which words are related to each other, while the clustering or closeness of the bubbles illustrates the extent of the relationship between the words. Figure 3.3 represents the cluster analysis of the entire study.

Figure 3.3

Cluster analysis presenting the words of the entire study



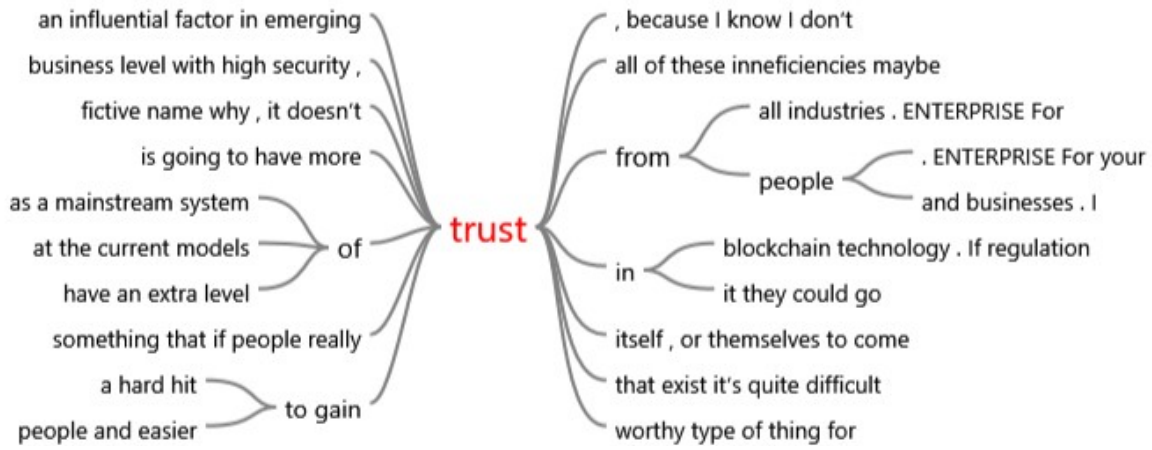
3.7.3 Tree maps

Tree maps are similar to word clouds and cluster analysis in that their foundation is based on the frequency of words, however, its relative advantage is that the frequency of the words are presented by block size and arranged by order of size, giving an idea of the flow of themes.

3.7.4 Word trees

Word trees are an illustration of how certain words are used in the context of other words or sentences. It shows their connections and highlights recurrent themes and sentences surrounding the word of concern. This helped develop new paths in the formulation of the primary themes. The word trees of more prominent words such as blockchain and security to are too large to provide as an examples, however figure 3.4 provides an illustration of a word tree focused on the word “trust”, showing all the reoccurring phrases surrounding it.

Figure 3.4 Word tree of the word “trust” and related phrases



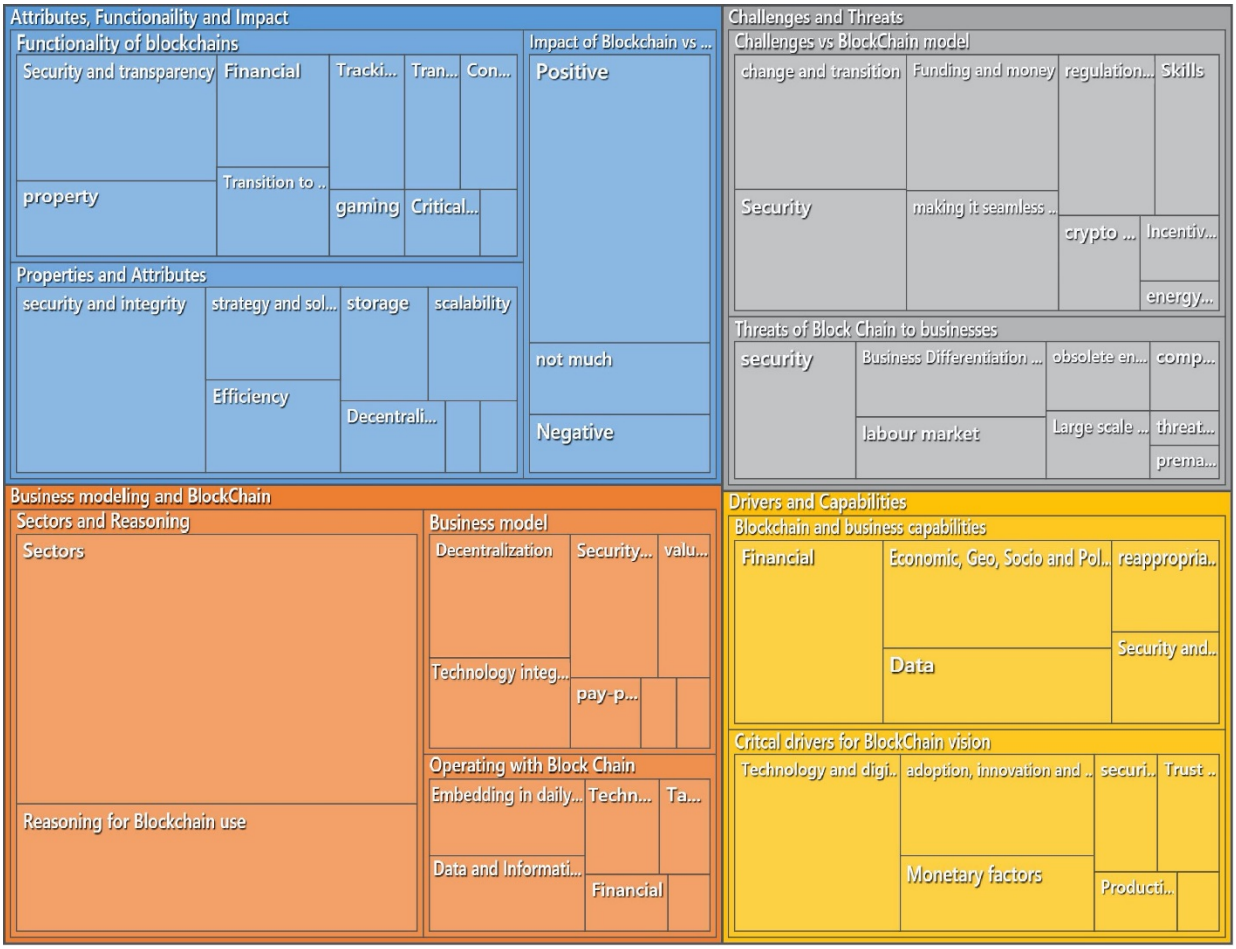
3.7.5 Hierarchy Chart

Hierarchy charts are similar to tree maps, however they are based on how heavily a node is weighted based on volume references to that node rather than the frequency of words. The larger the size of the block, the more referenced that node, with greater

response concentration in that block. Blocks are arranged from largest at the top left to smallest at the bottom right of the chart. Figure 3.5 shows the combined hierarchical charts for each of the studies' primary themes.

Figure 3.5

Combined hierarchy charts of primary themes



3.8 Method of reporting and synthesis

Through use of the various tools outlined above the researcher is able to synthesise the report. While the tools provided guidance on what relates to what, the researcher needs to pay focus on and which area/themes need to be further developed, the researcher then needs to establish a roadmap to put it all together (variables, nodes, subthemes and themes) and define a route to developing the primary themes. As a result the researcher created a node reference chart that shows the different levels of

analysis leading up the primary themes; see figure 4.1. In the literature review the researcher only goes as far as 3 levels deep. However for the questionnaire the researcher goes to 5 levels, which essentially shows the depth of information that the researcher was able to extract from the interviews. Moreover by collating the variables and themes to create a roadmap the researcher was able categorise and assign the questionnaire dialog to each theme, providing a significant benefit to referencing dialogs.

Going to the process of formulating the report was dependent on the coordinative utilization of every tool mentioned herewith. Firstly, the word clouds facilitated in the identification of keywords. The next notion of interest for the researcher was to understand how these keywords compared with each other. To develop this comparison between words the researcher used the tree maps to show which the big themes were and how significantly high or low they ranked. For instance looking at the challenges and threats tree map in figure 3.6, it can be seen that blockchain, security, business and money rank the highest. These are then linked to companies, need, technology and people. As a result, the researcher was able to identify the patterns developing between themes. The researcher generally focused on the first 5 columns of the tree maps.

Upon identifying the developed patterns the researcher used cluster analysis as a forensic tool to identify the words related to each other. The specific cluster analysis used was bubble diagrams which allowed the researcher to identify the closeness in relation of variables. Referring back to figure 3.3 it can be seen that blockchain is the largest bubble as it is the most prominent of the variables, with money, buy and document the closet bubbles to blockchain; this indicates the closeness in relation to blockchain of blockchain to money, buy and document. Through identifying the clustering of variables the researcher was able to formulate additional themes and structure the report in a way that synthesises heading for each cluster/theme, under which the researcher detailed the relationships of the variables.

With a multitude of analyses conducted there tends to be a notion of information overload. For the research to get a compressive view of all the analyses a dashboard is needed. In this instance the researcher chose the hierarchy chart as the dashboard. The hierarchy charts helped the researcher determine what were the most heavily

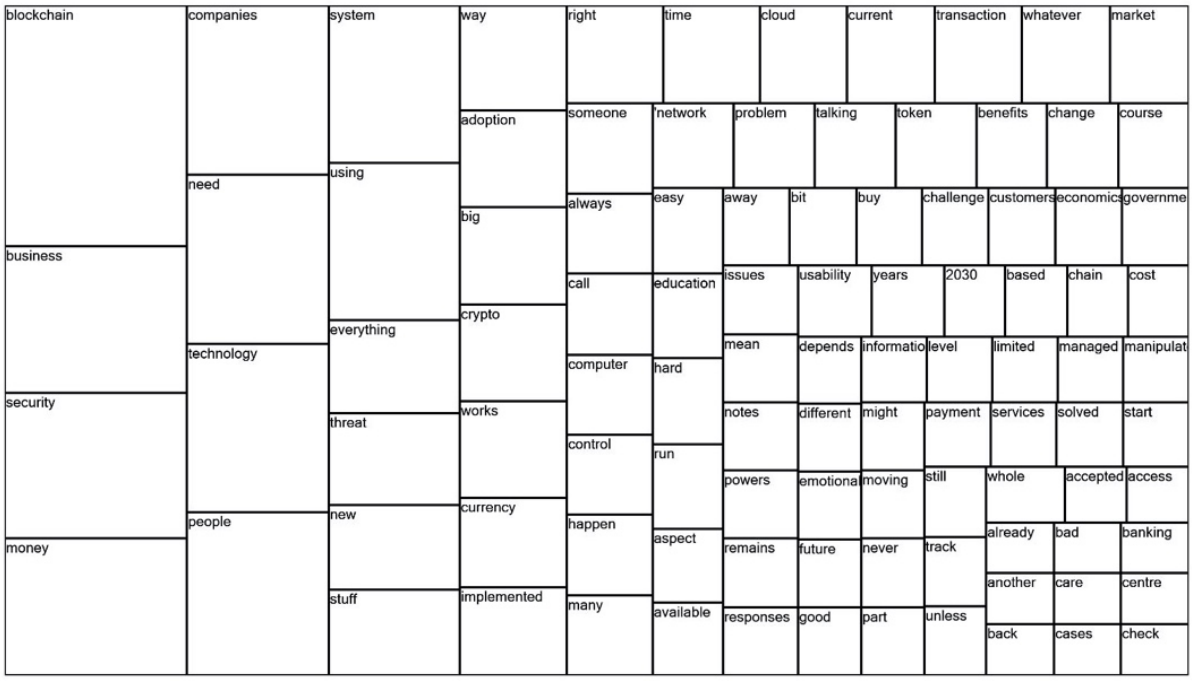
weighted themes and most important in the development of the primary themes. For instance, referring to figure 3.4, within primary theme of challenges and threats, challenges have a higher weighting with the theme of change and transition having the highest weighting within challenges.

The hierarchy charts gave the researcher a holistic view of what themes to keep, and what themes to exclude from the report.

Finally, to help understand the data more comprehensively the researcher used the keywords from each of the analyses to develop word trees. Word trees helped the researcher understand what the key words were connected to the keywords, especially the number of sentences that were attached to the keywords. By doing this it helped formulate how these keywords functioned particularly in relation to the dominant themes, and thereby giving further meaning in the structure and development of the report. The report was compiled not only in view of the analysis, but also the questionnaire dialog and research question.

Figure 3.6

Tree map of Challenges and threats



3.9 Conclusion

This chapter provided an in-depth view of the research methodology and illustrated practical examples of the data collection methods and the toolsets used in data analysis. As working with a small sample size, and dealing with open-ended, expansive opinions of respondent, this study followed the structure of qualitative research design. This allowed the researcher reflexibility to adapt the methodology to use multiple tools sets to induce meaning from the research data. The methodology called for the use of both primary and secondary data. Secondary data for the literature review, which identified the outlined points for further research and primary data for conducting further research. The primary data was acquired by means of an online questionnaire, however, as a result of the scarcity in knowledge and skills in blockchain, recruiting an adequate sample size was a challenge, and so an international audience was considered.

At the forefront of recruiting international participants, the researcher needed to understand what mechanisms could be used to reach them and collect the data. For this the researcher considered web-based platforms as an insight of social media and online survey platforms. In understanding what data needed to be collected and who the researcher was collecting it from, it become important to develop an ethics protocol that would ensure there are reduced ethical risks, and the study and methodology complies with global legal and ethical standards.

By the using a number of text query tools such as word clouds, word trees, cluster analysis, hierarchy charts and tree maps the researcher is able to bring meaning to the research data by identifying patterns, detecting relationships between variables and formulating themes. This facilitated in forming a structure to report on the study findings. Moreover, through the methodology and the development of themes it presented the researcher with a pathway to solving the research objective.

4 CHAPTER 4- ANALYSIS AND DISCUSSION

4.1 Introduction

Through the guidance of the methodological framework, and the tools described in chapter 3 the researcher was able to acquire a platform to present the empirical results in this chapter. The purpose of the empirical result was to identify patterns and relationships between variables. To achieve this, the foremost analysis instrument used was thematic analysis. Chapter 4 is divided into 4 sections.

In section 1 the researcher outlines the mechanisms that were used to ensure that the conclusions/interpretations that were drawn from the empirical evidence were distinct in a way that was trustworthy. Following section 1, section 2 presents the biographical details of the sample.

The third section of the chapter depicts the empirical results from the thematic analysis. The flow of activity in establishing the empirical results involved 3 steps. Firstly, the reduction of data. This was achieved by using the tools discussed in chapter 3, in addition to nodes being established. Secondly, the displaying of the data and mapping of the themes from the relationships identified between nodes. In this instance the researcher used concept mapping, an example of which can be seen in figure 4.1. Thirdly, the interpretations and conclusion of the data. This can be found under the headings and subheadings, with evidence to support the interpretations through the use of quotations from respondents, which are represented by italics, and in certain cases subsequent to the quotations supporting evidence was provided from literature.

The 4 key themes that were generated proved to be interesting and are unpacked in section 3. These were namely:

- Business modelling and Blockchain
- Properties, Functionality and Impact
- Challenges and Threats
- Drivers and Capabilities

The last section of the chapter draws conclusion to the chapter by providing a roadmap/summary of the key concepts extracted from the analysis that were most pertinent in achieving the research objectives and developing answers to the research questions.

4.2 Trustworthiness

Quality research is determined by various factors that are characterized differently between qualitative data and quantitative data. In the case of a quantitative study it is mostly characterized by reliability and validity of the study. On the other hand, qualitative studies are characterized by trustworthiness. This surmounts to whether the findings of the study can be trusted, and if so through what criteria was the trust established. In qualitative studies the trustworthiness of the study's findings is established through credibility, transferability, dependability and confirmability (Korstjens & Moser, 2018). In the section below the researcher unpacks each of these criteria in the way that was applied to the findings of this study to establish trustworthiness.

4.2.1 Creditability

To understand credibility, the most appropriate analogy would be to reference it to validity in a qualitative study. It deals with how consistent the research findings are with social reality, and whether a reader will find the results of the study believable (Korstjens & Moser, 2018). To underpin creditability in the study the researcher adopted particular strategies which are detailed below.

Firstly, the researcher used purposive sampling to recruit experts in the field, which was the most appropriate sampling method that aligned with the methodology and solving the research question. Secondly, the researcher used triangulation as a means to enhance the credibility. These were namely; methodical triangulation and data triangulation. In the case of methodical triangulation, the two data collection methods that were used were online questionnaires and textual analysis in the form journal articles. When it came to data triangulation both primary and secondary data were used. Finally, the researcher used persistent observation in which the researcher made use of codes, categories and themes to consistently study the data in depth until a final theme emerged for achieving the research objectives.

4.2.2 Transferability

This characteristic of trustworthiness is concerned with how applicable the study appears to the reader. Aforementioned in terms of the reader being able to relate the findings in a way that is applicable to their setting (Korstjens & Moser, 2018). To ensure transferability the researcher used rich data in chapter 3 and chapter 4 to describe; what strategy was used to acquire the sample, the demographic of the sample, the socio-economic conditions of the study and the sample, and the methodology. These transferability measures confirmed the participants of the study appreciated the subject matter of blockchain. Moreover, the broad nature of the research objective defines appreciated the finding to be applicable across all business sectors.

4.2.3 Dependability

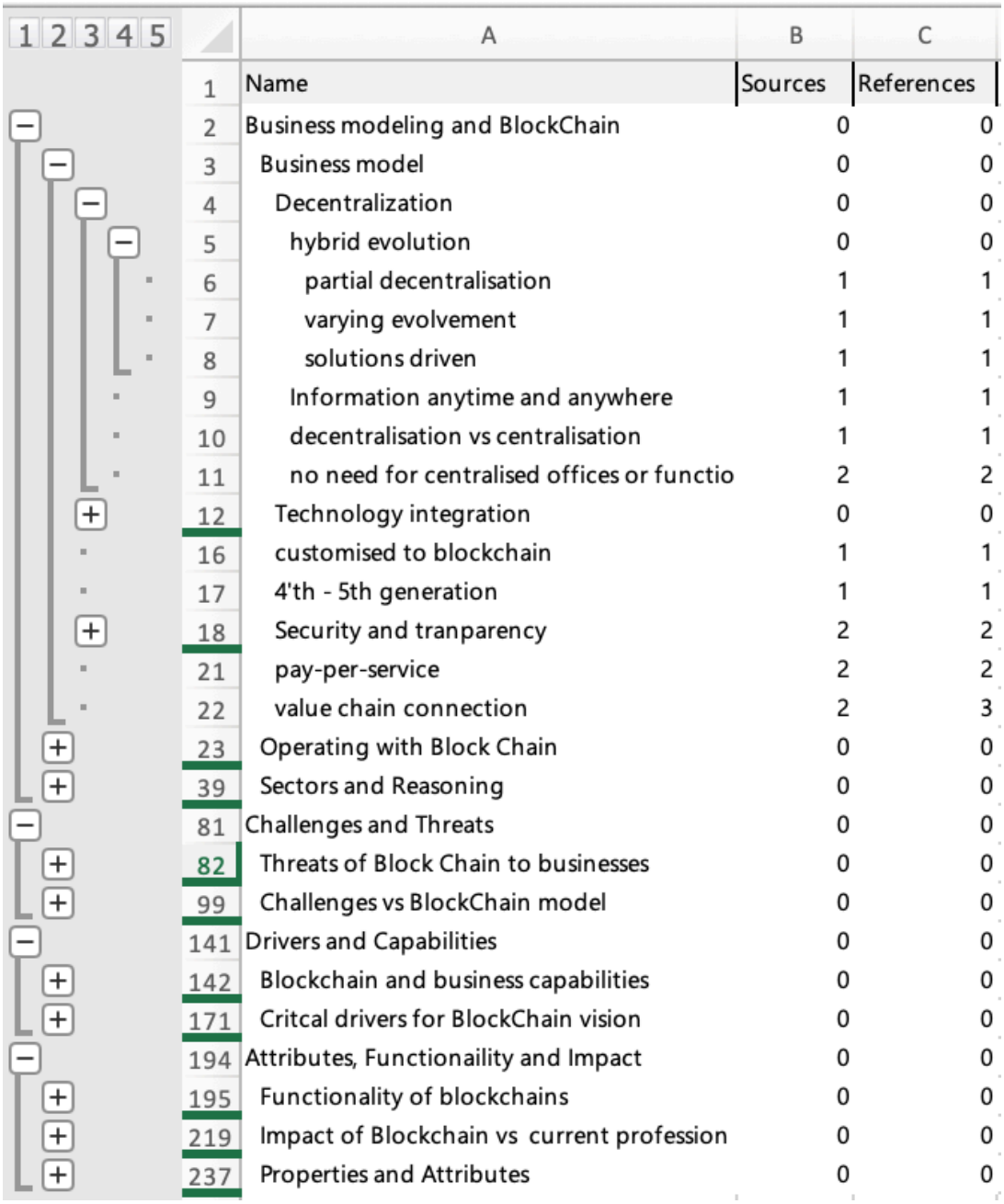
Dependability is a characteristic of trustworthiness that pertains to the establishment of an audit trail. It depicts the decisions made during the study and how developments were made leading up to the outcome of the study. It provides a reflective overview through the use of a memo detailing concepts and assumptions of the study. This process is most notable during the data collection and analysis stages(Maree, 2016). One of the tools the researcher used to establish an audit trail in this study was a node tracking chart. The chart depicts all the nodes leading up to the primary themes of the study, from a depth of level 5 to a depth of level 1 when applicable. A segment of the node tracking chart can be seen in figure 4.1.

4.2.4 Confirmability

In this characteristic trustworthiness the researcher needs to provide support for the interpretation of the data. It is similar to dependability in that it establishes an audit trail (Maree, 2016). For affirming confirmability of the study the researcher quoted the words of participants in context of the points being interpreted. These in text quotations depicted in italics essentially illustrate examples that the participants were aiming to convey pertaining to a particular point.

Figure 4.1

Audit trail-node tracking chart/concept map



	A	B	C
1	Name	Sources	References
2	Business modeling and BlockChain	0	0
3	Business model	0	0
4	Decentralization	0	0
5	hybrid evolution	0	0
6	partial decentralisation	1	1
7	varying evolvement	1	1
8	solutions driven	1	1
9	Information anytime and anywhere	1	1
10	decentralisation vs centralisation	1	1
11	no need for centralised offices or functio	2	2
12	Technology integration	0	0
16	customised to blockchain	1	1
17	4'th - 5th generation	1	1
18	Security and tranparency	2	2
21	pay-per-service	2	2
22	value chain connection	2	3
23	Operating with Block Chain	0	0
39	Sectors and Reasoning	0	0
81	Challenges and Threats	0	0
82	Threats of Block Chain to businesses	0	0
99	Challenges vs BlockChain model	0	0
141	Drivers and Capabilities	0	0
142	Blockchain and business capabilities	0	0
171	Critcal drivers for BlockChain vision	0	0
194	Attributes, Functionaility and Impact	0	0
195	Functionality of blockchains	0	0
219	Impact of Blockchain vs current profession	0	0
237	Properties and Attributes	0	0

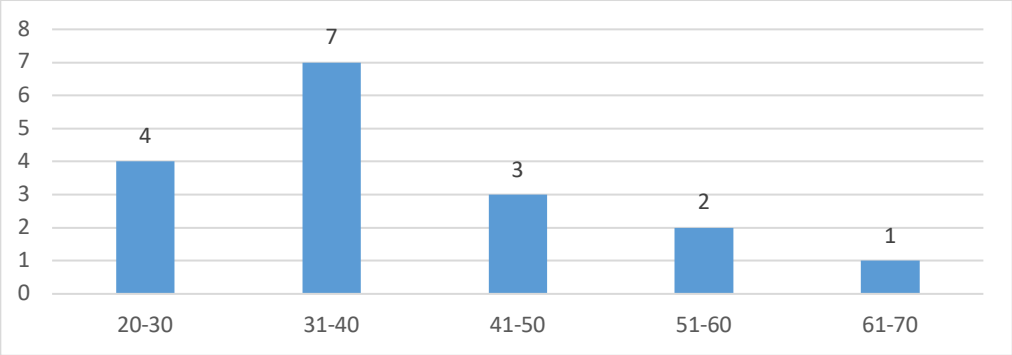
4.3 Biographical

The biographical data of the respondents are presented in graphs. There were 17 respondents in total.

4.3.1 Age

Figure 4.2

Ages of respondents

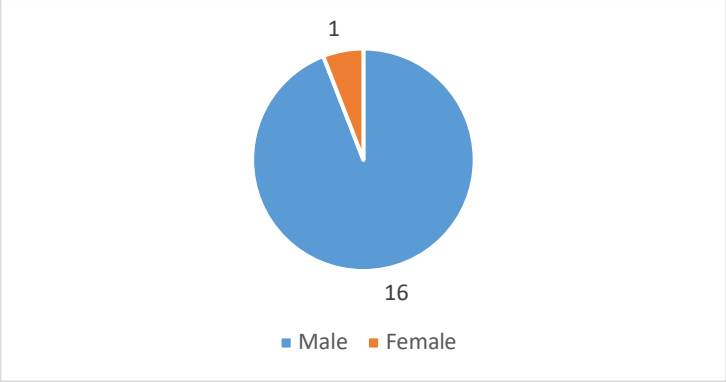


Most of the respondents were below the age of 40. This shows that majority of the respondents could be more technology inclined.

4.3.2 Gender

Figure 4.3

% Gender of respondents

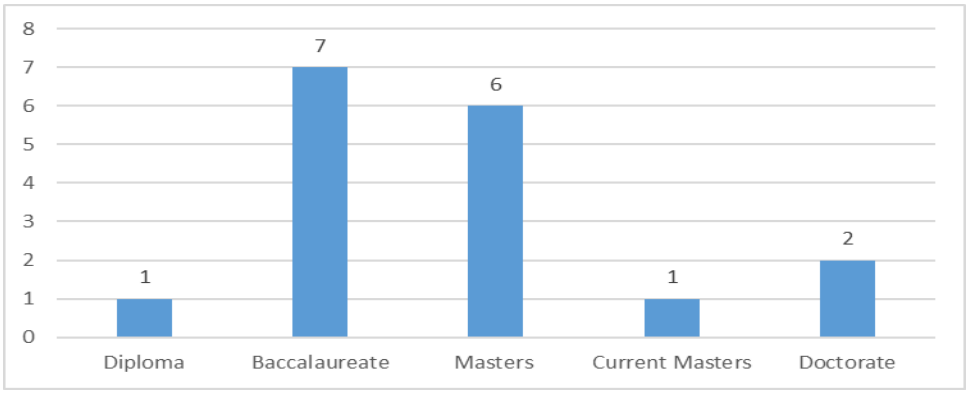


There were clearly more males than female. This can imply male dominance in the field/sector.

4.3.3 Education level

Figure 4.4

Education level of respondents

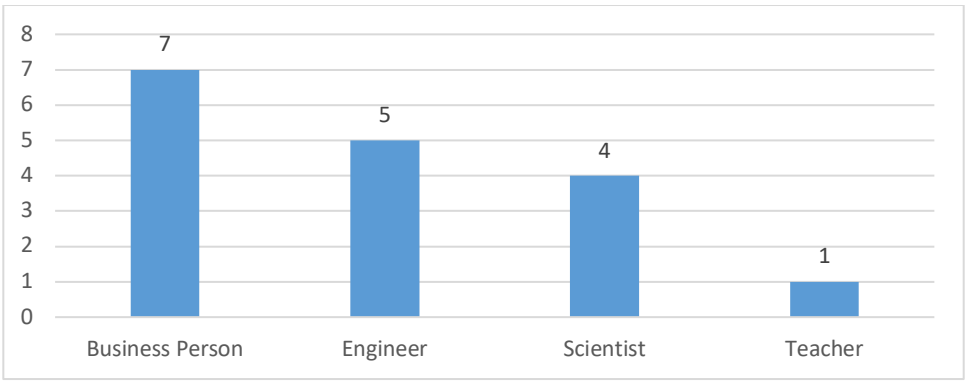


Almost all the respondents had a degree qualification. Majority had postgraduate education- (Maters and Doctorates). This implies that respondents were very educated and knowledgeable.

4.3.4 Occupation

Figure 4.5

Occupation of respondents

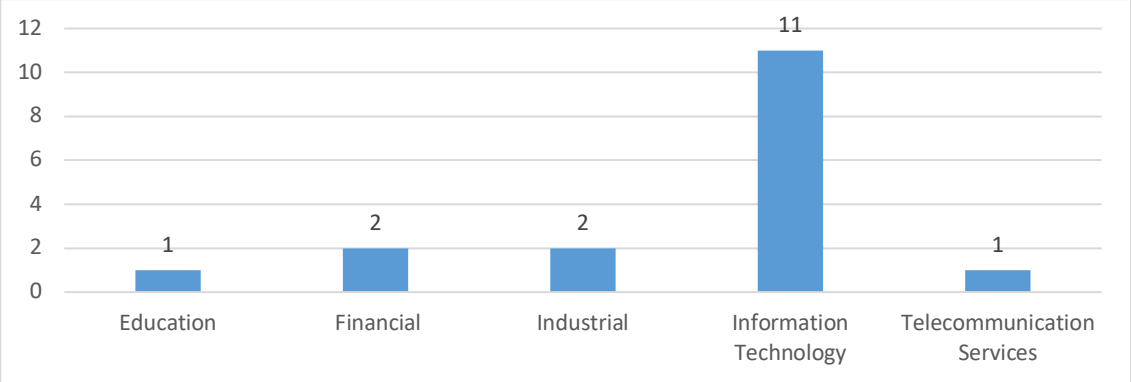


The majority of respondents were business people. This is logical as the study was examined in a business setting. However, there was also a significant amount of respondents with technical expertise such as engineers and scientists. Overall, the respondents were fairly well balanced and could provide a holistic view of blockchain.

4.3.5 Sector

Figure 4.6

Sector of occupation of respondents

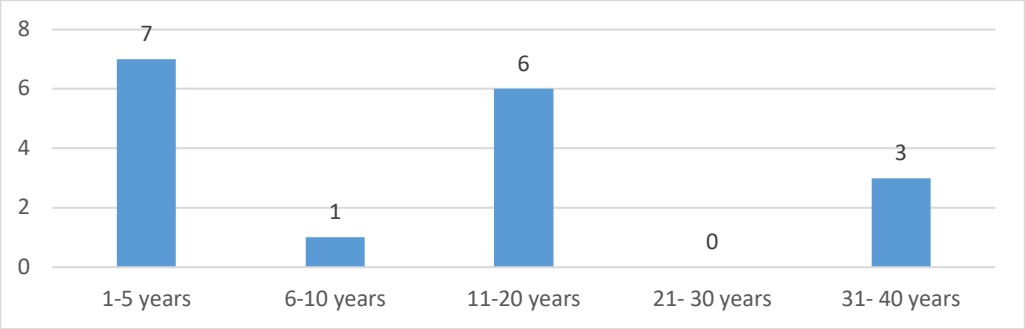


The primary sector of respondent was Information Technology (IT). This is logical as IT is the epitome of blockchain.

4.3.6 Years of Experience

Figure 4.7

Work experience of respondents

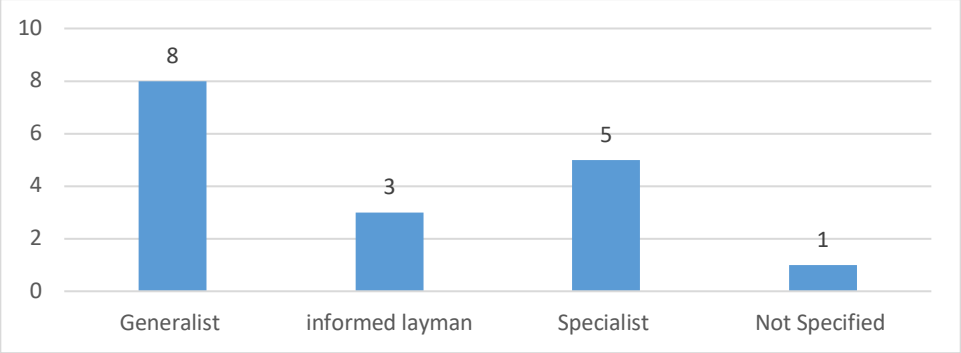


There seemed to be rich experience in terms of years. There were 9 respondents that had over 10 years of experience in their field.

4.3.7 Blockchain Expert

Figure 4.8

Blockchain expertise of respondent

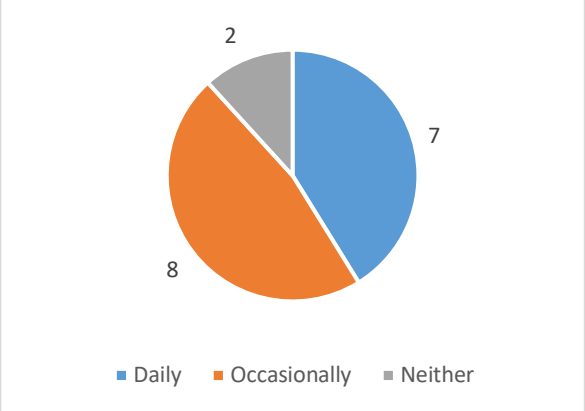


Respondents were knowledgeable of blockchain. The majority being generalist and specialist in the field.

4.3.8 Exposure

Figure 4.9

Respondents level of exposure to blockchain



Similar to previous, respondents were knowledgeable as they had some degree of exposure. There were +- 40% of respondents that were exposed to blockchain on a daily basis.

4.4 Themes

Each theme is numbers and unpacked in sections to follow.

4.4.1 Business modelling and blockchain

This was one of the main themes and covered the areas of business operation and modelling, along with sectors that can benefits from blockchain and reasons thereof.

4.4.1.1 Operating with blockchain

Businesses will have their operations integrated into blockchain. The following will inform such integration. These are listed in hierarchical order.

4.4.1.1.1 Technological

Technology integration into operations though the following ways as seen by two respondents.

4.4.1.1.1.1 Deep digital technologies

Deep digital technologies such as AI, neural networks and IOT among others will become the epitome of blockchain integration into business operation. These will need to be integrated via the development of necessary frameworks that can guide the process.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 2 references coded [1.79% Coverage]

During the coming decade(s) you also have to look at the convergence of various 'deep' digital technologies (IoT, machine learning, neural networks, A.I., misc. robotics, etc) and how crypto economics (in particular the M2M machine to machine component) act as the glue for all this.

But money & technology are also first and foremost social, cultural, political, etc. We still need to develop frameworks that help us to tackle the issues of convergence & adoption of various 'deep' digital technologies as well as satisfactory crypto economics acceleration & maturation.

4.4.1.1.1.2 Linking with AI and IOT

Relating to the above, blockchain will be intricately linked to technologies such as AI, IOT and others. Integration with these will differentiate businesses and give them a distinct advantage as these technologies each play a unique role in business processes as outlined by one respondent.

<Internals\\CI-QuestionPro-Response-23996868-09-22-2019-T140906> - § 1 reference coded [8.60% Coverage]

The organisation which will be able to integrate these technologies I think it'll be the one which will win the market. Let's take Amazon or Alibaba for example, these companies may offer to sponsor free public transportation which in that time will be dominated by autonomies vehicles in exchange of personal data of passengers. Through application of data science and big data these companies may deliver personal ads to the passengers. Passengers will be forced to buy from the ads they receive because the personalized just for the on their journey and pay instantly using crypto currency. All other steps which follows will be automated by AI, IoT and blockchain. Packaging will be done my robot through the help of artificial intelligence; supply chain will be automated also with help of blockchain technology to remove all the friction in between. And the delivery of the goods will be done by drones from nearby warehouse to the address required in this is help off Internet of Things.

4.4.1.1.2 Data and Information

Building on the above, Data and information will inevitable be a derivative and driver of operations. This is because of the following.

4.4.1.1.2.1 Strong reliance on data and trends

Businesses will be heavily dependent on data and trends formed thereof.

4.4.1.1.2.2 Sensitive information

Sensitive information critical to certain organisational functions will be written to blockchains.

4.4.1.1.2.3 Seamless communication

Information sharing and distribution will make communication seamless.

4.4.1.1.2.4 Information verification

All information will be verifiable. Business will know the authenticity of products and be able to verify it through blockchains.

<Internals\\Af-QuestionPro-Response-23143381-09-22-2019-T140622> - § 1 reference coded [0.35% Coverage]

All information verified

<Internals\\Sr-QuestionPro-Response-44563895-09-24-2019-T111634> - § 1 reference coded [1.07% Coverage]

So what happens with the blockchain for some companies is you will exactly know when this product has authenticity, now I think companies especially in the second world and third world countries, let's say if you go to Barcelona you will get a NIKE shoe for 30USD and you will never know whether it's authentic or not, and also this happens with real products.

4.4.1.1.3 Financial

Financial operations in itself will be reintegrated into blockchain. The following informed such integration.

4.4.1.1.3.1 Move to crypto-currency

There will be a strong move to cryptocurrency with businesses/people creating their own currency.

4.4.1.1.3.2 Financial backbone

Blockchain will become the financial backbone of businesses.

4.4.1.1.4 Embedding in daily functions

Blockchains can be literally and pragmatically embedded into daily functions, not just of business, but in many other sectors and even individual lives. It can becomes embedded in the fabric of things.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [0.73% Coverage]
Back to ordinary daily lives of citizens, adoption is an issue since all of this will need to be embedded in the fabrics of things, otherwise usage will be limited to folks with a higher computer science & cryptocurrencies education.

<Internals\\Jonty-QuestionPro-Response-24312271-09-22-2019-T140919> - § 1 reference coded [1.74% Coverage]
As time and businesses progress, blockchain will start to become embedded in a business' daily function. Any organisation that sees it fit to maintain a secure database will have the ability to build their own blockchain with greater ease; making the technology much more accepted and user friendly.

4.4.1.1.4.1 Base Layer

Relating to the above, the Blockchain will form the ‘base’ layer, which is the most important layer governing economic aspects of the multi-layered business transaction process.

<Internals\\Rn-QuestionPro-Response-44463397-09-24-2019-T125411> - § 1 reference coded [2.35% Coverage]
The will be multiple layers involved in business transactions. Blockchain will operate as a base layer for economic activity with perhaps sidechains anchoring to it and reusing its inherent security.

4.4.1.1.5 Based on offerings

An interesting point was made by one respondent whereby it would depend on what a blockchain offers a business and this will determine how they will operate with

blockchain. Some businesses will keep their status or their current workload whilst some may try to determine how they can match themselves or their models against the new technologies. In addition, some businesses or business processes can/may become obsolete. It all depends on what the blockchain can offer or do for the business.

This was supported in the literature review. The motivation for blockchain is enhanced through the application of the FITS models. The more elements of the FITS model that are applicable to different facets in the business models the greater the incentive to implement blockchain (Mccullagh, 2017). Moreover, if the processes of an operation fulfils more elements within the FITS model, in combination with tasks being highly routine in nature, then there is a greater propensity to have the entire process/operation automated over the blockchain. Which can result in deferring the traditional process to obsolete (Woodside et al., 2017).

4.4.1.1.6 Tracking and Validation

Tracking and validation seems to be a key offering that can be integrated into operation especially for those businesses that specialise in movement of products or logistics.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [2.67% Coverage]

What it offers you among others, a way to study; it gives you a way to track data and a way to validate so at least those three you have from the technology. Most of the time it depends how its implemented, if its correctly implemented, for what purposes are you using it, there are already projects starting for example in some countries like Switzerland, Australia, Thailand and some others, the government themselves implement this so that the youth can start to use this kind of technology for example to tract some processes internally, moving stuff from here to there. They use this technology because it's easy to log everything and to have everything correctly in a central data base or in a central way that you can validate against, so you cannot cheat, you cannot falsify information very easily in this kind of technology that's why it can have success in this area of businesses. A way of tracking stuff, a way of saving information and ensuring the validity.

This is notably in coherence with the literature, where White, (2017) states that not only is tracking and validation the key offering for integration in sectors like supply chain and logistics, but also in industries like digital identity management, manufacturing, bill management and auditing.

4.4.1.2 Business model

Relating to the above, blockchain integration into operation, business models will be subject to change. The following subthemes are unpacked which inform how business models will change. These are ranked in hierarchical order based on respondents.

4.4.1.2.1 Decentralisation

This was the largest subtheme when it came to Business model as confirmed by 8 respondents. This implies that most business will follow a decentralised model. Blockchain promotes this in the following ways.

4.4.1.2.1.1 No need for centralised offices or functions

There will be minimal to no need for centralised offices and/or even intermediaries. Businesses, operating even at different branches will be able to make decisions and approvals through blockchain. Smart contracts will be integrated into business processes.

<Internals\\GM-QuestionPro-Response-23293201-09-22-2019-T140731> - § 1 reference coded [4.28% Coverage]

The world is moving towards decentralization meaning everything including business may not operate the same conventional way there will be no need for centralized offices etc different branches of the same business will be able to make decisions without the need of the central office approving anything as smart contracts for instance will be embedded with business rules

<Internals\\Na-QuestionPro-Response-24390942-09-22-2019-T140939> - § 1 reference coded [2.87% Coverage]

Decentralization will become embedded in most operations. The end user may not realize it but a lot of what we do will be replaced by blockchain. It will have an impact

on future business models as centralized parties will now need to maintain the blockchain technology rather than perform an intermediary function.

It's worth noting that this aligns with Antonopoulos, (2019) notion that blockchain is borderless, and governed by mathematics rather than limited by the boundaries of national regulation. For instance, organisations have legal teams in different multinational branches to cater to compliance of the local legislation. Blockchain can disintermediate legal teams though self-enforcing smart contracts that are inclusive of the local law and rules of the multinational branch (Conte de Leon et al., 2017). This could be taken a step further by "management rules" being incorporate into the smart contract and therefore there will be no need to contact "headquarters" for approval.

4.4.1.2.1.2 Information anytime and anywhere

Decentralisation will ensure that information will be available at anytime and anywhere. This can promote global workforce for businesses.

The literature ties up with the sentient. Where by the nature of blockchain's decentralization allows employees to access data from anywhere around the world. Thereby giving organisations a competitive edge to hire talent from around the world without having to relocate them (Bridgers, 2017). Although it can argued that technologies such as VPN have the same offering, but the blockchain has a number of advantages of VPN such as the elimination of a single point of failure (Lisk, 2019). This gives companies greater confidence to operate remotely.

4.4.1.2.1.3 Decentralisation vs centralisation

Business will have to decide on their model, however they cannot claim decentralization if business process/validation is still going to be within a certain degree of control by the business. This for now remains a grey area.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [2.30% Coverage]

This is a big leak in the current or most of the blockchain connotations because they have this possibility because they are decentralised they were sold from the beginning to be like that, and they say there are already some checking or demonstrations that this can be very costly for someone to implement such a thing, it could be almost

impossible, it's not 100% concept proof, its shielded against that. No one can say its 100% clear; you can do it only if you control everything. Then that's not decentralisation anymore. I don't see the need of having decentralised blockchain if you are doing commodities or other stuff, that infrastructure is an environment in your control as a company or as a state or something like that, you do need to have that each year to let the consensus or correctness of the network to handle your users.

This reverts to the argument identified in the literature about public blockchains verses private blockchains. Some of the special features of blockchain since its inception has been its authority to decentralize and evoke trust viz the system. The cornerstone of these two elements takes trust away from human intervention and puts it in the consensus algorithm of blockchain. This has become the essence of the operational performance of the public blockchain. However, in the case of private blockchains these features are lost because trust is evoked to centralised agencies in the form of organisations to ensue transaction validation (A. M. Antonopoulos, 2019). On the other hand, as outlined one of the respondents if all infrastructure is absolutely necessary to be within the control of the organisation, there is no need for a public decentralized blockchain.

4.4.1.2.1.4 Hybrid evolution

In light of the preceding point, business can adopt a hybrid approach whereby they can keep certain things centralised and some decentralised.

4.4.1.2.1.4.1 Partial decentralisation

A key point was made whereby the evolution to blockchain and decentralisation will be a 'state of evolution' rather than a revolution. This will be where business will start by adopting decentralisation to a certain degree only.

This is assimilated through Lansiti et al., (2017) study on blockchain that discusses blockchain being a foundational technology rather than a disrupter/ revolution. Lansiti et al., (2017) goes on to state that blockchain has the potential to establish new foundations for economic benefit but not necessarily replace every aspect of the conventional business model.

4.4.1.2.1.4.2 Varying evolvement

There will also be varying evolvement depending on size of businesses and economies.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [1.07% Coverage]

(Geo-) political institutions are slow to evolve, except for very small countries that carve a niche for themselves in this blockchain & cryptocurrencies ecosystem. However there is a chance for still under-banked & under-tech-ed economies, in particular in the South Hemisphere, to leapfrog & see faster evolution of their younger societies.

4.4.1.2.1.4.3 Solutions driven

However, solution driven institutions such as the financial and insurance sector will move faster towards decentralisation, even if they start from a partial model, as these businesses will rely on blockchain to solve problems.

4.4.1.2.2 Technology Integration

Technology will become constituent to the business model. Respondents took this further in the following ways.

4.4.1.2.2.1 Reliance on Technology

Business models will become heavily reliant on technology as they embrace blockchain, especially ecommerce. However, this can also affect jobs as some positions will become redundant due to this reliance.

<Internals\\CI-QuestionPro-Response-23996868-09-22-2019-T140906> - § 1 reference coded [1,67% Coverage]

This is one example of ecommerce organisation; the same thing can be done in other sectors. As you can see future business model will rely lie more and more in technology and blockchain technology will you facilitate that to happen.

<Internals\\Sr-QuestionPro-Response-44563895-09-24-2019-T111634> - § 1 reference coded [1,07% Coverage]

iif they came into blockchain then they could be a lot of things that could be solved, that is one aspect but I think what I wanted to say is that in terms of jobs, a lot of jobs will be lost because if you see the out purchase department it will become like almost non-existent., because division which will be doing it. I see it kind of the future of IT.

The literature agrees with this statement, however the literature goes on to say that the greater public will have accessibility to open blockchain and can also become reliant on technology in such a way that while jobs may become redundant within organisations, more of society will become self-employed and entrepreneurship activity will increase as a result of open technologies (A. M. Antonopoulos, 2019).

4.4.1.2.2.2 No middleman

Relating to the above, there will be no real need for 'middleman' but more 'validators' could be on the cards. These validators will be technology driven.

<Internals\\Sr-QuestionPro-Response-44563895-09-24-2019-T111634> - § 1 reference coded [2,24% Coverage]
So, let's say you are buying coffee from someone and there is a middleman who will buy coffee from someone else but there will be certification that you have taken it from the guy and given it to that guy. So that kind of certification are the validators, so those kinds of jobs will be created with blockchain, but this must be in really, we still don't know what will be

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 1 reference coded [0,81% Coverage]
I would definitely say hopefully by 2030 we can get rid of the middleman in some areas that's basically what the blockchain technology was supposed to be from the beginning. It should cut out the middle man and have transparency not to have double standards on record keeping and stuff like that.

4.4.1.2.2.3 Integrating the role of IOT

The IOT will become critical driver as it can/may replace traditional technology. Such technology of IOT will allow for more flexibility and agility. This is in the form of live data and tacking and validation etc. the IOT hence becomes a very important technology component.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [2,89% Coverage]

Another thing that I think will happen in these 10 years to see that those businesses that will emerge , I don't think technology itself will be enough, I think that there will be some other types involved like IOT for example that will be able to work with this technology to assist with the consistency of this, because in some cases you try to use this blockchain technology, you want for example not only have an amount of something or just our numbers, you also want to have live data for example if you want to implement a tracking system, using blockchain to track some goods or some commodities from one place to another. For that it will not be only enough to have place or due locations you might perhaps need to have goods that can be damaged by temperatures, we need to have seen if they are in the optimal temperature, is the transport ok, and you could have something like that if you could have an IOT network to work together with your blockchain staff to ensure everything is correctly logged and to signal some warnings and some other stuff

4.4.1.2.3 Security and transparency

4.4.1.2.3.1 Strategies and decisions

As asserted by one respondent that business models will have security and transparency in their core strategies and decisions.

4.4.1.2.3.2 Permission

Currently, in the digital world, individual's data is being accessed without user permission. Blockchain will provide added security by ensuring users have full control

of their own data, with visibility of it being actioned by third parties when permissioned. This will change the current business model of commerce especially.

<Internals\\La-QuestionPro-Response-23987261-09-22-2019-T140852> - § 1 reference coded [4,85% Coverage]

Similarly, targeted advertisements designed by access to individual data are driving the marketing and advertising businesses. Each are tightly integrated with corporate access to individual data (mostly without permission or informed consent). These trends will increasingly become drivers in the way organisations operate. Until the public pushes back. The individual awareness of their ability to refuse permission to use their data, will then transform into a new form of commerce. Organisations or businesses trading data for products or services.

The equivalent of what blockchain can offer in terms of user data control, Europe's GDPR currently offers. This make GDPR blockchain's greatest competitor. However, while regulation maybe in place in protect user data privacy, it firstly only available in Europe, and secondly it is only a regulation. Companies have found ways to work around being compliant while still retaining user data without the user's awareness (Ashford, 2019). It is for this reason that blockchain has a relative advantage of GDPR, and can offer better security to user private data than GDPR.

4.4.1.2.4 Customised to blockchain

Some businesses will customise blockchain to suit their business models.
<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 1 reference coded [1,08% Coverage]

Business models would have to be evaluated and tailor made to integrate with blockchain solutions. Essentially, and information that can be written to a database now, can be written to a blockchain.

The literature has shown that customized blockchains have already become a reality and are signified through projects such "R3" where the blockchain was built on private framework and customized and is still being customized by the financial conglomerates that initiated the project. Integration is achieved through

interoperability. However, in certain instances customising a chain can pose a challenge. In the event of originations trying to merge chains that are developed from different structural frameworks, the chains might not be table to integrate and talk to each other as a result of their customizability (Piscini et al., 2018).

4.4.1.2.5 Value chain connection

Business models will be directly linked to the value chain. Hence they will be more connected to key value chain segments that is relative/relevant to the business. This will suit organisations such as manufacturing etc, whereby they are built on value chains.

<Internals\\Ra-QuestionPro-Response-23353146-09-22-2019-T140820> - § 2 references coded [1,92% Coverage]

Businesses would be more connected with taxes, receipts, transactions etc operating over blockchain. A typical business model could include every segment of the value chain connected over blockchain.

<Internals\\Sr-QuestionPro-Response-44563895-09-24-2019-T111634> - § 1 reference coded [2,53% Coverage]

To manufacture any product there will be a value chain, it starts from its electronic components which is the fundamental part. Based on the sensor values you try to figure out if you are at a certain level maybe, if you had claimed 300 steps. Based on the sensor you will manufacture the product, for that you need a lot of suppliers, so that is one end of the value chain. The sensor is at the left hand of the value chain and a lot of it is that you do will finally make a product. Let's say clothes that will be an end pillar for your value chain. Let's say there is a crush that happened that has.. Analysis to find out maybe it was a mistake of the driver, some electronic components and all those things the value chain will be very long if you consider the supply chain, so the supply chain and value chain will do with these two things.

This statement can be supported by Piscini et al., (2018) to suggests that the blockchain offers a future in which seamless communication and data sharing is possible between business partners. Through the combination and integration of

multiple blockchains, an ecosystems can be created that is diverse and scalable across the value chain.

4.4.1.2.6 Pay-per-service

Organisations can have business models adapted to be able to generate revenue through blockchain, such as charging service fees and maintenance fees.

<Internals\\Jt-QuestionPro-Response-24312271-09-22-2019-T140919> - § 1 reference coded [3,39% Coverage]

A typical business model will see companies specialising in blockchain functionality, where they charge a price on a monthly basis for a service (much like your Netflix etc). This service will often be outsourced and become a

very affordable option for businesses no matter what size they are or what industry they are in. Blockchain will revolutionise the way that exchange takes place (consider Project Kokha with the South African Reserve Bank). Examples of this will become the norm by 2030. Smart contracts will become more and more popular with records maintained on the blockchain.

<Internals\\Na-QuestionPro-Response-24390942-09-22-2019-T140939> - § 1 reference coded [0,66% Coverage]

Charging maintenance fees on blockchain transactions as a business model.

4.4.1.2.7 4'th - 5th generation

The advent of 4'th - 5th generation blockchain can be integrated into business models as a means of cost saving in various avenues.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 1 reference coded [1,16% Coverage]

I do think more and more businesses will deploy 4th or 5th generation blockchain which uses less power because in business you need to have power consumption at the point where the blockchain reiteration will have lower costs of global implementation than the current model which they used since the 60's and the 70's

such as the VISA chain and the SWIFT money system transfers and I think they will be deployed quite soon.

Although the literature doesn't confer with an estimate on a timeline of deployment on 4th and 5th generation blockchain, it does highlight the various R&D projects that are investigating the development in efficiency of the blockchain to the point where it can compete on the level of VISA transaction in a cost effective manner (Gilad et al., 2017). By this it will become extremely effective and a cost reduction for business to conduct transactions over the blockchain.

4.4.1.3 Sectors and Reasoning

This subtheme examines the main sectors (based on respondents) and key reasoning behind the use of blockchain. The sectors are listed in hierarchal order (based on respondent numbers)

4.4.1.3.1 Sectors

Majority of the respondents described all businesses to be influenced by blockchain. The first section provides details on this, while the second section in table 4.1 is an overview of the frequency of respondents favouring each specific business, with respondents claims of what blockchain can be used for in the sector.

4.4.1.3.1.1 All business (11 respondents)

Majority of respondents indicated that all business will require blockchain due to their reliance on ICT as Technology increases by 2030. However, 4 respondents explained further, which related to:

4.4.1.3.1.1.1 *Financial and operational processes*

Any organisation that will sell something will require blockchain to handle its financial transactions and operations.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [1,24% Coverage]

Going back to the idea that blockchain will be used to document processes and transactions. I think almost every single industry could use blockchain. If you think

about it like any kind of industry, any industry where you are producing a good which you sell, or you are providing a service for which you will be reimbursed. There is money going around no one no one is running an industry for nothing and there is no money being exchanged anywhere. All of us need to do book keeping so blockchain in itself if accepted as a tool for book keeping for documenting of processes, supply chains or something like that could have a gigantic future if it is accepted because I think every single industry can use that.

4.4.1.3.1.1.2 *Mainly those that focus on money*

Building on the above, mainly organisations that focus on generating money will adapt faster and adopt blockchain.

<Internals\\Sr-QuestionPro-Response-44563895-09-24-2019-T111634> - § 2 references coded [1,21% Coverage]
Only industries which have more money, I think only those kinds will adapt faster, so you can't expect places like agriculture, farming, schools, education, fmcg's.
For example, in academics there can be hundreds of users of blockchain, but it will not generate money, only that which can generate money will work. It needs people who will give money not people who can use blockchain and take your money.

4.4.1.3.1.1.3 *Business that rely on individual data*

Furthermore, business that rely heavily on individual data such as any customer or client orientated organisation- Medical and pharmaceuticals etc.

<Internals\\La-QuestionPro-Response-23987261-09-22-2019-T140852> - § 1 reference coded [2,23% Coverage]

All related to access, processing and resale of individual data. Pharmaceuticals. medical services and insurance industries will morph to make better use of individual and aggregated health data.

4.4.1.3.1.1.4 *Suppliers and end-users*

Supplier type businesses whereby they supply a product or a service will utilises blockchain. Such include online businesses and even taxi services.

<Internals\\Na-QuestionPro-Response-24390942-09-22-2019-T140939> - § 1 reference coded [2,83% Coverage]

Any company now which facilitated a meeting or marketplace for supplier and end user. For example Amazon facilitates a meeting place for buyers and sellers, Uber for people who need a taxi service, and Airbnb for people who need a place to stay. All of these marketplaces will be replaced by decentralized models.

This point has deep iterations in the literature, and outlines an avenue of blockchain that may reshape the business landscape by disintermediating the virtual market and allowing sellers to connect directly with buyers. Similarly recourses can be easily be shared with no inventions by intermediaries (Bridgers, 2017). Likewise Antonopoulos, (2019) supports this outlook, and warns the likes of Airbnb and Uber that their business models will not be sustainable for long as blockchain has the ability to connect end-users directly to the source.

4.4.1.3.1.2 Specific business

Table 4.1 provides an overview of the number of respondents favouring specific business type for blockchain application, with respondents claims of what blockchain can be used for in the sector. Where there is no claim respondents did not provide any motivation to their answer.

Table.4.1

Frequency of respondents in favour of blockchain application in a specific business

Sector	Number of respondents	Claim
Financial	6	Back-end payment and settlement systems by blockchain in banks, insurance and FinTech
Medical	3	Tracking ingredients, authenticity, allergies and origin in medical and pharmaceuticals
Public - state sector	3	Recording profiles and histories in government, hospitals, infrastructure
Earth and environment	2	

Logistics	2	Tracking in logistic will be most beneficial
Legal	2	Self-executing contracts and transparency
Manufacturing	2	Value chain and logistical nature in manufacturing
News and Media	1	
Food	1	traceability of content, point of origin and journey of food as well as food safety
Technology	1	
Marketing-Advertising	1	
Stock exchange	1	Improve turnaround time in stock transfer
Supply Chain management	1	
Agriculture	1	Recording and tracking of germination in agriculture and fisheries

4.4.1.3.2 Reasoning for blockchain use

Reasoning listed in hierarchical order.

4.4.1.3.2.1 Security and transparency

This was the highest ranked factor. It was informed by the following.

4.4.1.3.2.1.1 Secure storage

This applies to storage of data and confidential records. This can mainly pertain to being safe from ransomware and other digital malware. An example of a hospital setting was made by a respondent.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [2.43% Coverage]

If you think about what you can actually store with blockchain I'm not 100 % sure with all the details so let's say for example if I'm a hospital and I'm storing my patient history as art of blockchain, who is the patient what were the treatments the patient received over the years what kind of sicknesses he had etc. If this is stored in a distributed manner wouldn't that protect me from some kind of ransomware attacks…

4.4.1.3.2.1.2 Trust

Trust can increase between people and businesses.
Society depended on intermediaries to establish trust between people and businesses. Through the literature it was identified that intermediaries put ahead their own agendas before the sovereignty of trust. As a result, society as evoked distrust towards intermediaries. Blockchain provides a solution by evoking the sovereignty of trust to a system which people can depend on, while connecting them directly to one another (Hayes, 2018).

4.4.1.3.2.1.3 Smart contracts

Smart contracts will be possible.
According to (WEF, 2018), smart contracts are autonomous algorithms that run on the blockchain that have the ability to enforce and monitor process/contracts.
The literature states that smart contracts will used to reduced operational costs, with self-enforcement and automated execution there will be little to no need for involvement of legal bodies to facilitate, action or establish of contracts (Conte de Leon et al., 2017).

4.4.1.3.2.1.4 Security in daily operations

At first this will be to ensure security within their own business and daily operations.

4.4.1.3.2.1.5 Transparency and privacy

More importantly, if they need transparency, privacy of information or total security.

It was found in the literature that being transparent is very much a key selling factor in acquiring the trust of consumers and greater society. People what to know where things are sourced from, how budgets are spent, etc. To establish trust in the public eye transparency is absolute and blockchain presents this opportunity to business while maintaining security, creating transparency through a trust machine (Sun et al., 2016).

4.4.1.3.2.1.6 Cyber Security

Cyber security will be a key focus for those industries that that support security and cryptography.

4.4.1.3.2.2 Monetary

This was also a high ranked factor. It was informed by the following

4.4.1.3.2.2.1 For money generating agencies

Such agencies that thrive on customers paying for convenience and safety of services will benefit from blockchain**.**

<Internals\\Sr-QuestionPro-Response-44563895-09-24-2019-T111634> - § 1 reference coded [3,29% Coverage]

only that which can generate money will work. It needs people who will give money not people who can use blockchain and take your money. For example there is something called convenience…When the involvement happens then he will see that it's for his safety, only then will he realise, and only then will it pick up. If you do everything in the background, I don't think it will work…

4.4.1.3.2.2.2 Money management and virtual money

In addition, such organisations that specialise in money management will also find strong reason to use blockchains. This will include Banking and financial industries for loan management, stock management, venture capital management etc. Virtual money and legal contracts will also become constituent to blockchain and reasoning for use.

4.4.1.3.2.2.3 Outsource services

Interestingly as time progresses, the more experience blockchain based industries can/will start outsourcing their services to the newer industries that adopt blockchain. This will be a pay-per service for revenue generation.

This statement aligns with the literature, where Hayes, (2018) describes blockchain as a nexus of contracts. The paradigm of this concept is based on establishing trust through smart contracts rather than company decree. This will allow companies to streamline their operations and focus on the avenues of business that they are good at, and outsource other components of the business through the trust in smart contracts. Furthermore Antonopoulos, (2019), describes a business model of the future that disintermediates and promotes a shared economy. This can easily be achieved through outsourcing by blockchain.

4.4.1.3.2.2.4 Early adopters create trajectory

Early adopters that use blockchain and benefit financially can create the pathway for other last starters, especially when these late starters realise that technology, internet, cryptocurrencies are here to stay.

4.4.1.3.2.3 Validation and verification and tracking

This was also a high ranked factor. It was informed by the following:

4.4.1.3.2.3.1 *Tracking*

Items and objects can be traced which can improve standards and accountability. This can include scenarios such as food traceability and even tracking people and organisations in terms of tax compliance and other forms of tracking.

<Internals\\BG-QuestionPro-Response-31719397-09-22-2019-T140955> - § 1 reference coded [0,71% Coverage]

like trackability of food, food safety as an entire journey from farm to fork,

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [1,24% Coverage]

For example Value added Tax (VAT) that the state wants to know for each contributor and want to track that everything has paid its tax they could do that also with the blockchain technology. That could be implemented, you can track every year that everyone paid their taxes correctly, the network will be close it's not something that

will be decentralised, it will be closer ideas. I'm not sure that everybody could implement that but it can be used.

At this point in time, tracking is the most prudent avenue of blockchain R&D, as outlined in the literature. In addition, elaborating on the above examples of respondents; the literature provides further reinforcement by detailing that trough blockchain tracking contaminated food can easily be detected and traced back to the source preventing a pandemic (White, 2017). In terms of tracking taxes a further example is identified in the literature describing tax evasion/ channelling. The incomes of 80 of the top 100 corporations shelter their income from tax by channelling, governments lose millions as a result of these practices (Henry, 2013). However these practices can be curbed through government using blockchain as a medium to track the movement of funds.

4.4.1.3.2.3.2 *Information verification*

Information can be verified and sent as verified to whomever/wherever.

4.4.1.3.2.3.3 *People identification*

Blockchain can assist in identifying people

4.4.1.3.2.3.4 *Mitigating counterfeits*

It can make a large impact on counterfeit objects and data such as fake news and fake profiles

4.4.1.3.2.4 Predictive

Manufacturing industries can use blockchains integrated with AI for predictability to improve efficiency, quality and costs.

4.4.1.3.2.5 Smart Cities

Government and states sector could use blockchain to build scarcities in relation to infrastructure and energy managements etc.

4.4.2 Attributes, Functionality and Impact

This large theme examines the properties, functionality and impact of Blockchain. Each are unpacked below.

4.4.2.1 Functionality of blockchains

Functions of blockchains by 2030 generated substantial subthemes as outlined below in hierarchical order.

4.4.2.1.1 Security and transparency

This was the highest ranked factor in terms of functionality.

4.4.2.1.1.1 Transparency and privacy

There will be transparency in almost all avenues. This includes transparency in transactions and processes inclusive of even public processes such as voting. Furthermore, internet transparency will finally be possible.

<Internals\\Cl-QuestionPro-Response-23996868-09-22-2019-T140906> - § 1 reference coded [1.51% Coverage]
Blockchain technology is like remaining piece of puzzle in the current ICT systems. In any domain where there is a chance of fraud, need of transparency, and need for privacy then blockchain technology is must.

<Internals\\Jt-QuestionPro-Response-24312271-09-22-2019-T140919> - § 1 reference coded [0.47% Coverage]
Transparent blockchain based voting (for a variety of things such as elections) –

<Internals\\Na-QuestionPro-Response-24390942-09-22-2019-T140939> - § 1 reference coded [0.34% Coverage]
To allow transparency of the internet

4.4.2.1.1.2 Safe data records

Data records will be safe and secure and this applies to any setting including confidential data records. Encryption and decryption of records will be possible. Blockchain can also play a role on how passwords are generated and stored.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [1.28% Coverage]

any kind of information, the government themselves they could also use this technology for example they could use for the health care system or where all the information in secure in the blockchain like database with your card you have the encryption key that the doctor can decrypt all of your history from when you were born till the current time, it even look at all of your illnesses and no one can see them, in this case the security needs to play a major role. T

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [1.64% Coverage]

Depending on how blockchain can be used, I mean right now you can document transactions and stuff like that but theoretically if it were possible to use blockchain to for example store access data, account information passwords and stuff like that, that might be something that might be important in the future because we have been dealing with leaks of passwords for so much time. There was one company stores the password you have no control over how it's been stored it might be clear text so on and so forth if it could be stored, distributed on the blockchain somewhere maybe then it will be something were we could benefit out of security however it takes us back to the first problem we had which was about understanding that your password is being distributed in 10 different places actually means a plus on security compared to having your password in one place. Security is an emotional topic and we will never get around that.

4.4.2.1.1.3 Identification and verification

Information verification will be seamless and can be verifiable by others. Information cannot be changed once on the blockchain. Furthermore, there will be many people (around the world) that can verify data through blockchain.

<Internals\\Jt-QuestionPro-Response-24312271-09-22-2019-T140919> - § 1 reference coded [0.53% Coverage]

Blockchain based identification (possibly replacing passports and other unique identifiers) -

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [1.00% Coverage]

If you think about blockchain and you think about blockchain as a tool to document transactions, exchanges, production chains and everything else, that's the big benefit of blockchain that you can really document something and you can't go back and change something in that line of documentation without influencing the rest. Unless you run the blockchain technology strictly within your own company which I don't really foresee happening unless of course blockchain technology is going to become really simple and you can run it just purely upon your own company systems.

<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 1 reference coded [0.79% Coverage]

the blockchain being immutable, and decentralized, the information in the blockchain will be transparent for the whole world to see and verify.

In the literature we find that there are many blockchain decentralized identity projects underway. Blockchain has even caught the interest that even large non-profit organisation such as the UN where it is being used in refugee camps giving proof of existence to many refugees who don't have any documentation of identity. It can become really cumbersome for agencies to track refugees and monitor the aid allocated to them especially in highly populated refugee camps. Furthermore, through these mechanism of decentralized identity recording governments can easily identity illegal immigrants entering countries under the pretences of being refugees (Elidrissi, 2018). Blockchain not only gives identity to people but also commodities such as diamonds. Diamonds are now digitised. Similarly these precious stones have been given an identify through digitation, whereby each stone is marked with a unique identifier that detailing its origins and tracing the history (Reedy, 2017).

4.4.2.1.1.4 Social media

When it comes to Social media, users can now be totally protected from ID theft.

4.4.2.1.2 Property

Data will become the new property

4.4.2.1.2.1 Data becomes property

Data will become equivalent to property. People data can be given monetary value and they can control its distribution and even derive income of dividends from it. People can finally own their own data and hence people's data will become their main real estate.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 2 references coded [1.92% Coverage]

Data privacy protection & individual non-attribution could become a big issue, as well as giving back to people the ownership, control, & monetization of the proprietary data they produce, rather than having their data being robbed & exploited by third parties, without even receiving a dividend. Therefore property rights are not just about rights of property of traditional assets (financial, commodities, real estate, art, etc). Property will perhaps first & foremost mean data, the data that every individual produces & uses every minute. People's data will become the new & true people's main real estate.

4.4.2.1.2.2 Usage value vs ownership

This was an interesting point where people's ownership of their assets, once on blockchain would be measured by 'usage value'. The value of such usage will become individual's new real estate.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [1.05% Coverage]

Conversely, what people used to invest in & 'own' for whatever reason (expected return on investment, financial collateral, social status, consumerism) will become 'rented' & the true value, rather asset ownership, will be the value of 'usage', a 'usage' which itself may produce the data that will be the new individual 'real estate'.

4.4.2.1.2.3 Building models of usage

Based on the above, models or frameworks of usage will need to be built. Due to lots of anticipates digital financial and crypto currency, there would need to be models and architectures built to accommodate this.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [1.24% Coverage]

Even if that may sound a bit theoretical, I would anticipate that, a decade from now, quite a lot of crypto economics activity may derive from this rather simple 'migration of value' to the blockchain (or whichever prevalent architectures & protocols) and that you're certainly not wasting your time if you start plotting new models & building new architectures of usage & data along these lines.

4.4.2.1.2.4 All property on Blockchain

Globally, all property will be on blockchain

4.4.2.1.3 Financial

Financial uses will be by default.

4.4.2.1.3.1 Payment

Automated payment systems without human intervention can be possible using blockchain technology.

4.4.2.1.3.2 Crypto currency

Cryptocurrency will become the dominant and this will be secure and usable in any part of the world. Businesses will accept cryptocurrency as payment and this can eventually replace physical monetary system.

<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 2 references coded [3.05% Coverage]

With the use of mobile technology and the rapid evolution of internet services, I expect the transition from current monetary system to one that is cryptographically secure to be seamless. Units of accounts will move rapidly between devices as we a presented

with the opportunity to move cryptographically secure digital objects across the internet that have a tangible value that can be converted to USD at any given time. Merchants will accept payments on crypto currencies at their till points. Organisations will pay salaries in currencies of their choice.

4.4.2.1.4 Control of data

Individuals will now have control over their data.

4.4.2.1.4.1 Individual power to give rights

Individual will finally have the power to give rights to any entity to use their data. At present data was just being taken without permission. Blockchain gives individuals such power.

<Internals\\Sr-QuestionPro-Response-44563895-09-24-2019-T111634> - § 1 reference coded [2.79% Coverage]

In future every private individual will become more accustomed to all these upcoming technologies I think the honours will be on the user to give rights and everything with aspects to his data. Without user date see google is doing athletics with your data by taking your date, Apple is doing it, Amazon is doing it everybody have taken your data and it cannot happen that way, nobody cares because no one has touched your money buy bank, once banking and all those transactions get into blockchain know it's completely... and client model. A lot of banks are merging and demerging, a lot of things are happening, it's pretty much in the future, talking about ten years from now so we don't know, maybe the financial structures will change, so if you see in India even in Germany its happening because Indonesian banks are not able to sustain ... like last year they merged all the standard banks together.

<Internals\\Sr-QuestionPro-Response-44563895-09-24-2019-T111634> - § 1 reference coded [2.98% Coverage]

Property transfer, in India has already started and is coming to other things. I see blockchain maybe currently people are thinking more about using blockchain in individual to person environment not individual to enterprise kind of environment. So,

user data dead I think people will be more privacy conscious and the world will start going toward user accrual only when the user themselves becomes the validator only then will it stabilise more, so for companies on behalf of companies the employee might give you that right, so something is sold. So, let's say lit leaves a track record or something. So if I have a user's ... then everything will be stored, and if it needs to be transferred maybe to an hospital, I don't think this hospital will have any rights to transfer to another hospital or they can manipulate that data and do some other use with it, so unless the user gives this hospital any rights then maybe anything to do with user data then that will gain the maximum prominence.

4.4.2.1.4.2 Digital format

People can control value of their data in a digital format.

4.4.2.1.5 Tracking and documentation

Tracking of everything will be possible via blockchain. This includes logistics, food, groceries, pharmaceuticals, and almost any other items. Relating to tracking, every process will now be documented inclusive of financial transactions and information about almost any product.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [0.68% Coverage]

It will not only be about property rights. I think the future of this technology will be more in this direction there will be other businesses that will come up that will offer you a much easier, secure way of monitoring stuff, of tracking stuff,

<Internals\\Jt-QuestionPro-Response-24312271-09-22-2019-T140919> - § 1 reference coded [1.40% Coverage]

Blockchain based shipping procedures (including the ability to track and monitor ethical/sustainable food production). This can also be extended to the pharmaceutical industry where it is necessary to track medication for potential tampering.

4.4.2.1.6 Transition to Virtualisation

Many current physical object can/will be digitised and tokenised to have value. Furthermore, even current databases will be written to Blockchain.

<Internals\\BG-QuestionPro-Response-31719397-09-22-2019-T140955> - § 2 references coded [1.89% Coverage]

There could be objects which could be virtualised. With the power of blockchain, these virtual objects are turned into tokenized assets which, similarly to physical assets, will have their unique power of blockchain

<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 2 references coded [1.01% Coverage]

Any application that writes user data to a database will now write their data to a blockchain instead. Anything a database can store, a blockchain can store, with added advantages.

4.4.2.1.7 Transfer

Digital transfer will open new opportunities for all. This can include transfer of both tangible and intangible items/property etc. This can be applied to almost any sector.
<Internals\\Ra-QuestionPro-Response-23353146-09-22-2019-T140820> - § 1 reference coded [3.91% Coverage]
As per me, the primary function of blockchain would include tangible and non-tangible property transfers from real estate to raw materials, from patents to copyrights, and from automotive to electronics everything involving transfer of an asset in return of a materials, from patents to copyrights, and from automotive to electronics everything involving transfer of an asset in return of a liability
<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 2 references coded [1.45% Coverage]
Apart from smart contracts being activated at the press of a button, the ability to transfer units of value across the internet presents a whole new industry of possibilities.
Autonomous digital objects will be used by most retailers to facilitate digital transfers.

4.4.2.1.8 Critical public record keeping

Blockchain will be able to benefit the public sector by promoting effective public record keeping Government records, Credit details, Medical Records, Tax Records etc. Blockchain based ancestral and heritage recording by ensuring that such data are recorded accurately)

4.4.2.1.9 Everyday activities

Blockchains can reinvent everyday activities such as banking and shopping and even normal human interaction

4.4.2.1.10 Gaming

Blockchain can be used in the gaming platform which is fast growing and including gaming rights.

4.4.2.2 Properties and Attributes

Block will have a variety of properties and attributes by 2030 as conveyed by respondents and these can facilitate businesses in achieving a competitive advantage. These are listed in hierarchical order.

4.4.2.2.1 Security and integrity

This was the most highly ranked factor based on 14 responses. This was unpacked further.

4.4.2.2.1.1 Total security and compliance

Blockchain has the potential to provide total security for businesses thus making clients feel safe and confidential and this can be a competitive advantage. Those business that are more compliant to security needs will be seen as more competitive.

<Internals\\CI-QuestionPro-Response-23996868-09-22-2019-T140906> - § 1 reference coded [2.20% Coverage]
Total Security: Security is an issue today especially to the cloud services. The companies which will be able to take full advantage of blockchain security features will

have competitive advantage. For example choosing IPFS over HTTP/HTTPS as early as possible will have more competitive advantage by 2030.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [1.28% Coverage]

The competitive advantage I think is going to be security. We are moving towards a society and a world where security is more and more of a competitive advantage. Years ago when I was on the phone talking to US clients we always had questions about HIPAA & PCI compliance, so they were concerned about security, are we compliant with those ... now last year in Europe we got the GDPR , this being something important and something which companies are realising more and more is that if you have all these different regulations, they put more stress on your company because you have to follow those regulations, but of those regulations are out there and you can prove that you are following them that means a competitive advantage.

4.4.2.2.1.2 Anti-fraud and corruption

Relating to security, there will be an effective on mitigation of fraud and counterfeit goods as blockchain will track everything. Therefore those businesses that use blockchain will attract customers who are interested in genuine products.

<Internals\\Af-QuestionPro-Response-23143381-09-22-2019-T140622> - § 1 reference coded [0.59% Coverage]

Plagiarism and fraud will be of the past

<Internals\\BG-QuestionPro-Response-31719397-09-22-2019-T140955> - § 1 reference coded [3.97% Coverage]

With the advent of advanced features, we would see examples like Counterfeit medicines in the pharmaceutical industry Food supply chain in China (the tragic case of adulterated infant formula) Fake Louis Vuitton handbags and other fashion apparel in Asia Counterfeit auto parts in North America Grey market or counterfeit electronic equipment, including medical devices (World Health Organisation (WHO) estimates that 8% are fake) Enterprise IT equipment

The literature supports these sentiments, and highlights especially how fraud and corruption can be eradicated from government spending by tracking contracts

(Peterson & Wrighton, 1998). Furthermore, and intellectual property rights can be reinforced through digitalising products with unique digital fingerprints in a way they can be easily identified, tracked and authenticated (White, 2017).

4.4.2.2.1.3 Privacy

Organisations that protect individual privacy will gain more business and clientele.

<Internals\\CI-QuestionPro-Response-23996868-09-22-2019-T140906> - § 1 reference coded [2.03% Coverage]

Privacy: The more the organisation protects its users' information the more the attractions. For example, currently there exist protocols zero-knowledge proof. The companies which will ensure proper zero knowledge proof in the future will have competitive advantages

4.4.2.2.1.4 Quality and compliance

Companies that use blockchain will be able to improve on quality as everything will have 'digital' stamp of all processes. This will give customers peace of mind and furthermore, customer will 'pay' for such standards of compliance.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [1.22% Coverage]

There essentially have to be scenes of quality, if there is going to be a transnational institution maybe it can me national institutions but transnational is always better, if you have an authority that can really say if blockchain is used in methods x,y,z to store data to store transaction, in ways a,b,c then you will get a seal of approval which proves that everything you store for customers cannot be altered , cannot be deleted and so on and so forth because then that is going to be a competitive advantage for me. For that blockchain really needs to have practical appliances in day to day business and it has to be accepted as a secure way of storing data, that's the most important thing.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [0.58% Coverage]

So, I can say to all my customers I have the badge for being compliant and your company does not so if the customers pay with me you get the highest security standards, I am certified for that the others are not. If we take this to the blockchain and the blockchain is really recognised as a very secure way of storing information.

4.4.2.2.1.5 Transparency

The more a business performs its activities transparently, the more people will be attracted to invest and conduct business with such an entity.

This statement is synonymous with the literature, in that identifies a direct relationship between transparency and trust. A willingness of a business to be open about its activities in a way that would otherwise be hidden by competitors, displays the organisations values and responsibility to society especially in the avenues of environment, social and economic sustainability (A. M. Antonopoulos, 2019). This display of transparency evokes a sense of trust to the business from consumers, ultimately consumers putting their cash in something that they trust. As a result, this acquires the sights of investors.

4.4.2.2.1.6 Mash networks in space

A very innovative point was made whereby having mash networks in space, this would provide an innovative method to ensure that financial records are not tampered with if they are kept up in 'space'

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 2 references coded [2.59% Coverage]

To explain more about the distribution outside earth: There are still projects out there still in the start-up mode that are waiting for the price of pay load per kilogram to go down to send it in lower off orbit, basically the whole idea is that if it's in space, the ledger is kept in space no one could go physically and temper with it. It will take kind of a chain mash around more like the consolation satellites which they are trying to do now with the weather satellites, the imaging satellites and the communication satellites, once you have mash network no one can manipulate that.

4.4.2.2.2 Strategy and solutions

This was the second highly ranked subtheme in terms of blockchain attributes. It was informed by the following.

4.4.2.2.2.1 AI and decision making

Artificial intelligence will be able to provide the best logical advice and solutions without the need for human intervention and this will be recorded on blockchain.
<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 1 reference coded [1.64% Coverage]

Artificial intelligence will play a massive role in scaling human consensus and deducing logical decisions. This will start with businesses, as machines will be able to provide the best advice regarding the most strategically correct way forward. This information will all be recorded on blockchains.

4.4.2.2.2.2 Provide solutions

Relating to above, blockchain will be able to provide solutions to not just business but everyday problems.

<Internals\\Jt-QuestionPro-Response-24312271-09-22-2019-T140919> - § 1 reference coded [0.75% Coverage]

Blockchain will be more customer centric and focus on providing solutions to everyday problems that were not previously available.

<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 1 reference coded [0.37% Coverage]

Segwit and the lightning network will provide intelligent solutions.

4.4.2.2.2.3 Validation time and resources

There has to be a reduction in time and resources for blockchain. If one can succeed in this, then they will have competitive advantage.

<Internals\\Sr-QuestionPro-Response-44563895-09-24-2019-T111634> - § 1 reference coded [2.79% Coverage]

We need to reduce this anchor competition on the other hand we need to see that the person still holds the security that he can add that block. If you try and reduce this in seconds, when you start adapting the blockchain how much power will you need? How much heat it will produce, how much electricity it will use, it will not be that easy, there has to be one person who will always be looking to do it also. There are companies in China who do that it's still a mathematical issue, the time has to reduce and on the other hand also technologies will mix, maybe or the robotic process automation. Some will go into it to form one single system and we need to see how this concurrency issue will be solved, there needs to be a concurrency, two people will get an OTP and they will try to add it or there will be one person who will get it, those kind of systems I think will come in the future. It's a bit mathematically intensive

4.4.2.2.2.4 Simplicity

Simplicity trough ease of access and ease of use will be added competitive advantage as individuals will take up blockchain more if it's easy to use.

<Internals\\Jonty-QuestionPro-Response-24312271-09-22-2019-T140919> - § 1 reference coded [1.14% Coverage]

Ease of access and ease of use are two key priorities. While it is tough to say what will come about, it is clear that it will be in a manner that makes the lives easier of individuals and companies.

4.4.2.2.3 Efficiency

Efficiency has historically been connected to competitive advantage. Hence, Blockchain will provide this in the following ways.

4.4.2.2.3.1 Efficiency of validation

Validation times must be improved and the faster validation can occur, the quicker business transactions will be done. This can lead to competitive advantage. For example, if a customer wants a full validation/tracking of the product they are buying, it should not take long. It should be done in a few minutes at most. This will keep customers happy.

<Internals\\Sr-QuestionPro-Response-44563895-09-24-2019-T111634> - § 1 reference coded [3.71% Coverage]

What is happening is that everyone put a block in blockchain so there needs to be billions and billions of competition, but that can be customised. So, let's say if it's between a company and a company it will not take as long as it takes currently for example 10 mins that blockchain takes. It all depends on the level of validation that you want, if it's a successful validation it still take more than that time, like when I was talking about the coffee bean, you buy coffee from an estate agent and you collect it and give it to some other marketing person or something, so what's the proof that this person has brought it from that person himself? So, if you need some kind of physical validation, you need more time otherwise it is a software kind of validation and must be improved it can be improved. Some other kind of validation maybe an OTP or something, it might not necessarily use the competition for what they are using currently to put that value in that block, there might be some other validators that can come and, I think some systems will merge to form a better kind of application system. Essentially validation to reduce the completion time to confirm a block. That is the only time, otherwise it's just a battle of status

4.4.2.2.3.2 Real time business transactions

Transaction turnover rates will improves due to real time business transactions and this will be the solution to overdue business transactions

4.4.2.2.3.3 Business speed and agility

Relating to the above, business agility will hence improve due to easy and efficient transactions.

4.4.2.2.4 Decentralisation

Decentralisation is seen as competitive advantage.

4.4.2.2.4.1 Cryptocurrencies

Relating to decentralisation, crypto currencies will contribute to this as they are borderless and hence not confined to geographical regions. Businesses and

individuals will have the ability to send funds without a middleman through contracts bound by software between organisations. This can lead to faster and cost effective transactions.

4.4.2.2.4.2 Individualisation

Individual currencies will be used to control individual data.

4.4.2.2.4.3 Power and control

Blockchain will serve to decentralise power and control by its very nature.
Disintermediation has been a theme that has been echoing throughout the literature. According to A. Antonopoulos, (2019) disintermediation will be driven by decentralisation, which hand power and control back to an individual from intermediary. Antonopoulos describes a scenario of two economies, the old economy which centralized by intermediaries that are in control of individual's information and resources, and the new economy that is decentralized. When an individual choses to move to the decentralised economy, they not only take power and control of their own assets into their own hands, but also move their productivity and creativity out of the old economy and into the new economy (A. Antonopoulos, 2019b).

4.4.2.2.5 Storage

Storage opportunities will be abundant with blockchain.

4.4.2.2.5.1 Cost effectiveness

Storage would have to be cost effective and affordable as all businesses (large or small) and from any country (developed or developing) can afford it. Affordability of storage can lead to competitive advantage as then storage problems will be solved.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [1.11% Coverage]

If it's something that scales easily and is cheap that of course would be very interesting for companies in emerging markets. For our countries here in middle Europe if they had to buy more storage for data, they don't care they just buy more storage problem solved. Small upcoming companies are more open to changes and they are open to

new technologies. If the services which are powered by blockchain can become very cost effective that would allow small companies, start-ups or whatever from emerging markets, 3rd world countries etc it would give them more access essentially to technology and to being available all over the world.

4.4.2.2.5.2 Distribution in space

An innovative method was proposed by one respondent whereby blockchain distribution is space will mean that it can be accommodated despite how much it grows (without impacting on physical earthy space). It will also be more trustworthy in such a realm.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 1 reference coded [1.81% Coverage]

but on the technology side I think if the blockchain is distributed but not distributed with people but distributed somewhere in space with satellites or micro satellites or whatever then the size of the blockchain can somehow become smaller than it currently grows all the time so you need to take into account if you deploy something how much space you need how much memory you would need in the future. I could totally see it if the blockchain ledger is encoded smaller or the technology comes which makes it little bit smaller the approval rates on the blockchain, on the ledger and distribution which is not on earth that could actually be very trustworthy

4.4.2.2.5.3 More platforms

Overall, more platforms can/will emerge as time goes and this will allow for more users to securely store their tokens and data.

4.4.2.2.6 Scalability

Blockchain will provide scalability for businesses which will make them bigger and more profitable.

<Internals\\Jt-QuestionPro-Response-24312271-09-22-2019-T140919> - § 1 reference coded [0.43% Coverage]

The companies that can scale quickly and adapt will be the most profitable.

<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 1 reference coded [0.25% Coverage]

Scalability issues will be addressed in time.

According to the literature, logistical and legal uncertainty is some of the reasons why small to medium size businesses have not been able to reach the international markets and operate on a global scale. As a result their scalability has only been limited to regional levels. The benefit of blockchain to these type of companies that are looking to scale to an international or national level but are uncertain, and especially concerned about the costs involved, blockchain smart contract provide seamless mechanisms for them to achieve scalability. Through smart contracts these sort of companies can scale with trust and confidence that they are operating legally in the correct jurisdiction, transporting efficiently within their legal boundaries, and reaching out to the best customers and suppliers globally that will allow them to grow their business (Stambolija, 2019).

4.4.2.2.7 Data management

Data will be more manageable and available.

4.4.2.2.8 Inter Blockchain Communication

With so many different chains in existence, standardisation is a issue at present. However, with wide spread adoption some sort of standardization is inevitable. As result blockchains that previous could not be integrated or combined will be able to communicate with each other.

4.4.2.3 Impact of blockchain vs current profession

This subtheme examined the impact of blockchain on current profession of respondents. It is divided in to positive, negative and not much impact. However Positive impact seemed to rank the highest.

4.4.2.3.1 Positive

The following was seen as the positive impact.

4.4.2.3.1.1 Security, Transparency and records

This was the highest ranked positive impact and was informed by the following.

4.4.2.3.1.1.1 Simplify cyber security

Cyber security will be impacted in terms of implication and also via provision of traceable and secure platforms. However, some new threats can/could emerge.

<Internals\\CI-QuestionPro-Response-23996868-09-22-2019-T140906> - § 1 reference coded [0.91% Coverage]

For cybersecurity profession, blockchain will help in simplifying things but at the same time introducing new security threats.

<Internals\\Jt-QuestionPro-Response-24312271-09-22-2019-T140919> - § 1 reference coded [0.63% Coverage]

Presently (in cybersecurity) this will have a large impact in terms of providing traceable, secure platforms.

4.4.2.3.1.1.2 Transparency

Transparency will be inherently improved in terms of advertising and other processes. Furthermore, user profile rights will also be transparent but will also have some restrictions.

<Internals\\ANO-QuestionPro-Response-23156731-09-22-2019-T140656> - § 1 reference coded [0.40% Coverage]

Advertising will be more transparent

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [0.31% Coverage]

I think changes could be in how certain processes could work it could be that some processes are more transparent,

4.4.2.3.1.1.3 Record keeping

Record keeping will improve considerably, as records will remain forever on blockchain without getting lost or become obsolete.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 1 reference coded [1.01% Coverage]

I could say the record keeping can benefit the most, the reporting of what we do at the moment where we generate a bunch of notifications which are important for a while and they become obsolete at the same time after a year or two if something happens and you want to make an audit you can pull the data out so blockchain makes it a little bit easy to do it that way.

4.4.2.3.1.1.4 License keeping

Similarly, license keeping will also seem to benefit as licences issues and dates can be accurately recorded including when it was purchased.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 4 references coded [1.42% Coverage]

On the products I use, definitely it could help in the licensing, I think the licensing can benefit the most. I don't expect it to impact that much but definitely the licencing models can benefit out of blockchain, like licensing itself from which date to which date, when it was purchased all of that stuff is very easy to do however an excel database makes it the same,

It should have outside connections otherwise its worthless. I don't see a much bigger impact, but on the licensing, it can have a beneficial impact.

4.4.2.3.1.2 Professional growth

Professional growth will increase for respondents in their respective fields.

4.4.2.3.1.2.1 *Positive change*

There will be a positive change for most professions, as it will bring about new opportunities for development, innovation and learning.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [0.88% Coverage]

Since I'm on the proactive side of massive implementation of not only blockchain but other converging 'deep' technologies, I no doubt shall continue to contribute to the (revolution in the most active manner at both local & global stages. We've only scratched the surface so far :)

<Internals\\GM-QuestionPro-Response-23293201-09-22-2019-T140731> - § 1 reference coded [0.80% Coverage]

I develop for blockchain so it would make my profession even better

<Internals\\PI-QuestionPro-Response-44526570-09-24-2019-T111850> - § 1 reference coded [1.31% Coverage]

For me as a consultant it is good as new technology brings about change and I get paid to bring about change to save money.

<Internals\\Rn-QuestionPro-Response-44463397-09-24-2019-T125411> - § 1 reference coded [1.70% Coverage]

It will change the landscape of the industry that I work in. As an auditor many process in my job scope can be substituted by smart contracts.

<Internals\\Jt-QuestionPro-Response-24312271-09-22-2019-T140919> - § 2 references coded [0.48% Coverage]

Greatly. Previously (in finance) this would be the core functioning of the business.

4.4.2.3.1.2.2 Skills adaptation

People will have to adapt to blockchain irrespective of their fields. This can include lawyers learning about blockchain as well even IT personnel adapting their skills to newer technology.

<Internals\\Na-QuestionPro-Response-24390942-09-22-2019-T140939> - § 1 reference coded [1.37% Coverage]
Lawyers need to be able to advice on blockchain disputes, regulations and smart contracts in order to stay relevant. It touched on every area of law.

<Internals\\Ra-QuestionPro-Response-23353146-09-22-2019-T140820> - § 1 reference coded [1.36% Coverage]
Assuming if the workers council allows a BC network, i will have to develop new BC related capabilities to continue my work in manufacturing.

4.4.2.3.1.3 Improved validation

Simplification and improved validation would be possible for those involved in smart contracts.
<Internals\\BG-QuestionPro-Response-31719397-09-22-2019-T140955> - § 1 reference coded [2.40% Coverage]
For my current profession of business development - it would make life simple for me and for my customers who don't need multiple iterations of reading the contract (with the advent of smart contracts), or to validate T&C and payment modes as the contract is being executed.

4.4.2.3.1.4 Decision making

Decision-making can/will improve.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [0.38% Coverage]

some decision making some other stuff it could be but other than that I don't think it could change too much. It could be that I am wrong.

4.4.2.3.2 Negative

However, 4 respondent asserted that there could be negative impact of blockchain on certain professions.

4.4.2.3.2.1 Financial and legal

Finance and legal can be threatened due to the advent of pre-agreed and pre-decided consensus based rules that are already present for transactions.

<Internals\\BG-QuestionPro-Response-31719397-09-22-2019-T140955> - § 1 reference coded [2.11% Coverage]

The level of automation is a threat to many professions - and definitely blockchain would have an effect on finance and legal professions as there would be pre-agreed, pre-decided consensus based rules pre-set for execution of a transaction.

4.4.2.3.2.2 Security threats

There will be new security threats that will be created in relation to blockchain by 2030.

<Internals\\CI-QuestionPro-Response-23996868-09-22-2019-T140906> - § 1 reference coded [1.12% Coverage]

The cybersecurity profession will still be needed by 2030 to fight against new security threats introduced by blockchain and other new and old technologies.

4.4.2.3.2.3 Blockchain with AI - replace industry

Blockchain will become even greater with the aid of AI and together, such a combination can threaten to replace industry.

<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 1 reference coded [0.89% Coverage]

Blockchain in particular poses minimal threat to most industries, but blockchain in conjunction with artificial intelligence with threaten to replace any industry.

4.4.2.3.2.4 No option to delete

Currently there is no option to 'delete' blockchain records and one respondent saw this as a negative. Sometimes, in certain, instances, a delete function is needed. This can be governed by a policy.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [2.29% Coverage]

In the end what we want to do is really delete, someone left the company, they don't come back after one year we want to have everything and I think that's going to be special enough from a GDPR point of view were we have to have a deletion system or a deletion policy in place, what is that going to do for the blockchain. The blockchain, the idea around it is that you can't change something online because then it doesn't match to the rest, but what about the data that you have to delete, from a legal point

of view. In those cases, you would be actively deleting things, we could be deliberately making changes somewhere earlier in the blockchain, but in that case it's a good thing because you have to delete it, but all of a sudden, the rest doesn't add up anymore. So, what is that going to be for the blockchain actually? I don't know, I'm not that much into the technical part, if you can make it in a way that deletion is ok, editing is ok or whatever in the end especially from a GDPR point of view we are moving in a direction were data has to be deleted you can't store data indefinitely anymore, you can't store it if the purpose of the data has already been fulfilled, so we need to delete things. We need to back things and delete them. What kind of effect is that going to have on blockchain?

4.4.2.3.3 Not much

There were another 4 respondents that felt that there would be not much impact of blockchain and reasons included, it will just mean a new technology which will involve training and uptake as the same as for any new technology. Hence, the blockchain does not really provide change or benefit. Another respondent felt that they had given up on the idea of blockchain whilst another felt that human intervention would always be need in critical processes. a further respondent felt that blockchain in the same company would not make sense and should have outside connections or else it would be worthless.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [1.31% Coverage]

I'm not sure it would have much of an impact because if you look at it from a training perspective like for us changing data is something, we do all the time because we have to keep trading stuff to date so we are changing data all the time. We want to document who changed what where? But we don't need like a chain were we all suddenly get notified because there was a change somewhere, so it doesn't really provide much of a benefit for us. The same goes for example if you think about the results of college, you are given a test or something and there is results. It would be terrible if one of them had admin rights and could change their own results in the system or something like that, but they don't have any rights so that's not an issue.

<Internals\\Sr-QuestionPro-Response-44563895-09-24-2019-T111634> - § 1 reference coded [2.11% Coverage]

If it is a purely operational role, a validator role then I think it's a threat, but otherwise there are human and motion decisions so let's say I'm doing performance analysis you cannot automate performance analysis if I finish and one person has filing defects and the other person has sold two. You cannot tell the person that has finished fixed.... is better than this other guy, you cannot say the two that he has sold is much more complexity than the file that he has solved. Whenever there is human interaction, I think ..... so those kinds of jobs will still remain, it cannot do sales for you, so only those kinds of jobs which are not .... Essentially it won't affect me in my current profession.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 2 references coded [1.63% Coverage]

In my product position I would say it doesn't change anything at least it shouldn't because if they start implementing blockchain that would be a strange situation. It's a private thing and blockchain is meant to be used in a public domain.

I said blockchain is mostly meant for public domain or at least private where it goes on a world domain it doesn't stay in the same company so I think blockchain in the same company doesn't make any sense. It should have outside connections otherwise its worthless. I don't see a much bigger impact, but on the licensing, it can have a beneficial impact.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [0.68% Coverage]

I don't think it will influence me too much since I gave up on that idea, I managed to almost burn my graphic card and I have noticed that for example it doesn't matter I cannot compete with the computing power that the Chinese market has right now

4.4.3 Challenges and Threats

This Theme clearly focuses on challenges to the 2030 blockchain vision that people should be cognisant of. It also examines threats in terms of how application of blockchain can pose a threat to businesses.

4.4.3.1 Challenges

Challenges are here unpacked in hierarchical order.

4.4.3.1.1 Change and transition

This was the largest factor as supported by 9 respondents. It was informed by the following factors.

4.4.3.1.1.1 Understanding and adoption of BC

Everyone will need to understand blockchain and how it operates. This has to be filtered right down to ordinary people and not just technical experts. People will need to understand it and emotionally connect with it for it to work. However herein lies the challenges of how this will be done.

<Internals\\Jt-QuestionPro-Response-24312271-09-22-2019-T140919> - § 1 reference coded [1,25% Coverage]

Core understanding - the technology is still not completely understood by the man on the street. For blockchain to be used in daily life it will take time for individuals to learn and understand what the benefits are.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [1,36% Coverage]

The acceptance is going to be on a technical level because you will always have people who will worry about the technical aspects of it and who are the experts who will say yes this is secure, but also its going to be on a emotional level because in large companies you do have those expert, hopefully unless if your staff is 60 years old or something and they will never go away from the old ways of doing things but you will have those experts. If you really want to spread blockchain as a worldwide tool by 2030 it has to be something which is expected by the masses. That of course depends on how easy it is to implement, how easy how the emotional feel towards it is. Do we really feel this is secure I can invest into that? Which in the cloud in 20 years we still don't have?

4.4.3.1.1.2 Technology conversion

Business will also have the challenges of converting their technology to that of blockchain and this will involve newer and other 'deep' digital technologies.

4.4.3.1.1.3 Reluctance of giving control

One respondent asserted that there can be a reluctance of granting control. Despite current cloud technologies generating lots of revenue, some companies are still reluctant to place their data into the cloud as they feel they are giving away control of their data. Similarly, they will have the same reservations about blockchain, and it is compounded by the fact that once data is on blockchain, it cannot be changed.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [3.51% Coverage]
People are reluctant to give control over their data to a cloud provider if we now think of blockchain as a distributer of cloud data were your data is in different parts of the cloud which is from a security point of view is the benefit but from a motional point of view you are not giving the data to someone else you are giving the data to God knows how many people and the question is will this actually be something that companies do. Considering how reluctant some businesses are with moving to the cloud, I'm not sure that blockchain is going to be anywhere near the standard in 2030.

4.4.3.1.1.4 Management and leadership

This is important as integration must be driven from the top. Hence obtaining the attention of management is necessary but can be a challenge.

A study by Clohessy & Acton, (2019) supports this notion by stating that the attitudes and behaviours of management towards a technology is what drives adoption.

4.4.3.1.1.5 Transition of older companies

Companies in existence for a long time e.g. over 20 years may have a hard time getting to transition. This is because they are too accustomed to traditional operations. They will be overwhelmed by such technology due to their lack of understanding and even

concerns of costings. Hence, resistance will increase. Start-ups will have quicker adoption.

4.4.3.1.1.6 Time change

An interesting point was made by one respondent whereby this entailed an inherited technical issue from the previous millennium (Y2K). Currently, the global digital clock was set at 2033. This needed to be changed as well or it will pose a key challenge.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 1 reference coded [1,51% Coverage]

I also think that time is ticking for the current system because in 2033 they will run out of clock for transactions, all the Y2K flow for computers which they changed a little bit but for those computers it will run out in 2030, 30-35, I think you can get a good explanation about that from a British channel called computer file, there is a professor there who explains the situation. so, on transaction systems they will have to change, they would have to change 1) the transparency of the system and 2) the scalability and efficiency of blockchain.

4.4.3.1.2 Funding and money

This was the second largest subtheme when it came to challenges and was supported by 8 respondents.

4.4.3.1.2.1 Dependant of affordability and money

Some business just don't have enough money to invest in blockchain. Hence, only those that have money will consider the benefits of blockchain and its facilities of tracking etc.. However, those that cannot afford it won't care as such. See example below.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [1,09% Coverage]

This only works if people actually have the time and money for it. I mean right now Germany is really doing very well so you will get those initiatives for green power or you go to the supermarket and you have different labelling on your food were you can

see how was that pig, how happy was that pig so on and so forth it's all nice and dandy if the people actually have the money for it. If you don't have the money for it, you buy the cheapest thing and you don't give a damn where it came from and you are not interested in this information that the blockchain as a tool of tracking something can really provide you with.

4.4.3.1.2.2 Resistance to Centralised financials

Another respondent felt that some sectors such as government will not want their financial functions to be decentralised, as then they would lose control of it. Blockchain works on a decentralised model, hence this will cause a challenge.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [1,40% Coverage]

On this part or area I personally think it could help for the financial staff that's a different part of the discussion because I don't think the centralised system would work, or any of the current government would like that someone else is responsible for their own currency evolution, I don't think they would like that. That would mean a complete change in the way people think, and I don't think that will happen in this century, that is something way in the future if you want to have something like that.

These sentiments are supported by Antonopoulos, (2019), who argues that intermediaries that have large controlling power over the population don't support a decentralized system. Antonopoulos, states that the reason for this is because the dynamics under which these intermederies operate dependends on centrality as a means of control.

4.4.3.1.2.3 Offerings

Blockchain would have to make unique but affordable offerings. It would have to be affordable especially to smaller markets. Larger markets or business won't care about prices as such when it comes to obtaining more storage space etc. hence emerging markets stand to gain, but it will have to be affordable offerings.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [1,77% Coverage]

Properties besides storage from my limited knowledge of blockchain, the understanding of it, what it can do I don't really see much more than that right now. I mean its storing of information, what kind of information is of course always going to be different other than that I don't see any benefits the question of course is what's the cost in it, is it going to be a factor? If it's something that scales easily and is cheap that of course would be very interesting for companies in emerging markets. For our countries here in middle Europe if they had to buy more storage for data, they don't care they just buy more…

At present the cost of doing a transaction or executing a smart contract is substantially more over blockchain as opposed to AWS. It is for this reason that the literature compliments these sentiments by highlighting the growing concern that the technology not cost effective at this point to run business process competitively (Rimba et al., 2017)

4.4.3.1.2.4 Availability

Blockchain would need to always be readily available and not just something that would disappear eventually, as companies will be outlaying cash and investment into it.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [1,51% Coverage]

If I as a company see that using blockchain will be very beneficial to me, but I also see that it's also going to be a development effort internally for two years costing me 10 million or something like that I will not do that, so how readily available are blockchain systems...So, we want something for companies, for, storing the supply chain data, documenting things it would need to be first of all readily available second of all it would need to have implementation.

Blockchain's availability is reinforced in the literature thorough it's perpetual decentralization and openness in the case of open blockchains (Berberich & Steiner, 2016). However in terms of user interface, integration and readily available plug and play systems, solutions are still in the development stages. Providing a solution like this a solution that is on the level of integration to the point where it is just plug and play will overcome a significant adoption barrier (Piscini et al., 2017).

4.4.3.1.2.5 Benefit vs time

Some businesses cannot see long term benefits of blockchain technology. They will want to see immediate financial benefits.

Although this maybe the case, the literature on diffusion of innovation reinforces that the outcome of adaption does not happen instantaneously but over a period (Rogers, 2003).

4.4.3.1.2.6 Pricing

One respondent asserted that a challenge could be the actual pricing incorporation into the business model.

4.4.3.1.3 Cryptocurrency

Cryptocurrency was also a challenge for the following reasons.

4.4.3.1.3.1 Black market

There seems to be an emergence of black market and other corruption from cryptocurrency.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 1 reference coded [1,04% Coverage]

One disadvantage of the blockchain education is the crypto currency market at the moment, which is a big disadvantage for the current technology because crypto currency started from being a fun hobby type of thing then it moved directly to the black market then now its directly to the fintech guys which are trying to catch every 10 cents per hour or whatever on transactions.

4.4.3.1.3.2 Network value

Cryptocurrency is still undefined. Hence its value is subjective or relative. Perhaps it needs to be linked to a 'network value' based on the network it operates on.
<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [1,25% Coverage]

Or perhaps if they are configured in a way that effectively reflects the 'network value' related to the network with which the token is associated, and that itself needs to be rigorously defined. There is much PhD work that remains to be conducted in the field of crypto economics, and sadly a lot of blockchain-based models whose crypto economics are mostly hot air, so let's remain mindful of that.

4.4.3.1.3.3 Will not last

One respondent believed that cryptocurrency will not last as it has literally come out of nothing with no physical measurement etc.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [2,17% Coverage]

While a certain degree of disintermediation & decentralization can give new businesses a 'disruptive' edge against perhaps soon-to-be obsolete systems, one big unclear question remain the crypto economics & the monetization of token-based incomes. I don't believe that 'Frankenstein' multi-function tokens will last long…

4.4.3.1.4 Making it seamless and simple

There would be challenges in making blockchain seamless and simple for all to understand and adopt. This is for the following reasons.

4.4.3.1.4.1 Making it easy to use

This was one of the highly ranked factors. Blockchain needed to be easy to use for everyone and not just skilled or technical people. Hence, this would be challenging to do while maintain security. If it only became easier, then only there would be growth and reach. Furthermore, ensuring that everything works in a systematic way, whereby all conditions must be met for actions to happen.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 2 references coded [2,15% Coverage]

I would say usability and blockchain education, education of the concept itself. If you provide usability for people I would say as a con, it's very hard to do proper usability against security at the moment. That's a big no-no at the moment because people

cannot still make it work in a way that IOS or Android operating system user works because on one hand you want security on the other hand you want usability…

While the literature does not indulge into the catch22 between the technical aspects of security and usability, it does state that usability is a result of skills and a knowledge gap (Clohessy & Acton, 2019). However the respondent poses an interesting notion that is instead of there being a drive for organisation to upskill people to work with blockchain, the user interface and experience should improve to the point where anyone can use the technology even without being upskilled.

4.4.3.1.4.2 Standardisation

If blockchain is to be established across eg. 190 + countries, then there would be global standardisation of blockchain or else it just might end up becoming too cumbersome with each having their own standards.

While this may be the case for customizable private blockchains. The literature supports the POW algorithm as the gold standard in the public blockchain space in terms of a consensus algorithm. While companies have the opportunity to use the POW standard, they are swayed against its characteristics of being open and censorship resistance (A. M. Antonopoulos, 2019).

4.4.3.1.4.3 Embedding and compatibility

This relates to how compatibility and embedding of blockchain technology in everything (fabric of things). There will be much/different tokens and other aspects that would need to be compatible on all architectures. This will require significant efforts and can pose challenges.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [1,58% Coverage]

Right now I'm concerned with issues of scalability, inter-operability, flawless operability, UI/UX interfaces etc. I'm not sure when the issues of so many clunky protocols can be solved, by having the plumbing sufficiently embedded in the fabrics of things, so that everyone individual, corporate & government may use applications as easily as they use email or an App. How do you make so many tokens compatible

when you have architectures with one function / one blockchain/sidechain / one token, etc.

Embedding blockchain in existing infrastructure is key to widespread adoption. However as the literature points out and supports the above statement, having the ability to integrate chains that are coded to different protocols is challenging as the chains don't speak the same language (Piscini et al., 2018).

4.4.3.1.4.4 Responsiveness

Efficiency and responsiveness of the system would be pivotal. Transfers and payment would need to be seamless and quick (within minutes and not days)

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [4.34% Coverage]
The second I think is also very important since we talked about banking and stuff that can derive from the responsiveness you could use such a system to implement some kind of transaction mechanism for example if you are to send money from A to B to ensure that you receive money at that B spot. Right now there is a problem, sometimes there is a huge delay…

The literature backs this sentiment through studies conducted my Gilad et al., (2017) that illustrate that throughput efficiency of current blockchain system are nowhere near VISA's current capacity. For blockchain to scale and become commercially viable transaction speed needs to be as competitive as VISA (Mccullagh, 2017).

4.4.3.1.5 Security

Security was a highly ranked challenge.

4.4.3.1.5.1 Hacking

Hacking could become a key reality. This can affect records.

4.4.3.1.5.1.1 *Access to records*
If someone gain access to records, they would have access to the entire 'history' of records

In this instance the literature does support this state to a certain extent. Gaining access to records might be possible to advanced cryptographic techniques(Wirth & Kolain,

2018). However it will not be possible for the perpetrator/ malicious actor to alter the data that is visible (Zheng et al., 2017).

4.4.3.1.5.1.2 Rewriting records

Furthermore, someone could ‘rewrite’ a record along with its history or create new false data.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [1,74% Coverage]

The problem with centralised blockchain is that it can be hacked. It’s hard but it can be hacked, there are some will see the flaws in the design of the blockchain, the blockchain is only valid if it has more than 50% of the notes, if someone took over that, it can re- write the whole chain. So you will get a new history or a new data that can be false, and we cannot prevent that if you don’t put some constraints, or our cannot control your network, that’s why I say a decentralised blockchain will not work at least from government or big company’s point of view., they like to have control of their architectural and all database,

4.4.3.1.5.2 Security flaws

There were also security flaws that could be present where someone could be able to trace your activity for their own benefit. An example of Bitcoin was made.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [1,27% Coverage]

Right now if you look at some blockchains you will see some huge leaks in security for instance at one time bitcoin is secure it can be untraceable, you can send from one side to another and you will be complete..... These are false claims, this is not true in the blockchain itself in the bitcoin blockchain, you still have traces of IP addresses and everyone can use this information to build graphs, your money workflow and eventually they could track you.

The literature support this statement and highlights it as a flaw in the security protocol. According to Wirth & Kolain, (2018) blockchain is not completely anonymous, and a

user's private key/IP address can be identified the advanced through advanced cryptographic techniques. Although Wirth & Kolain, (2018) further suggests that this issue can be resolved by adding an additional layer of security to elude traceability. Nevertheless FATF's new legislation makes it mandatory for authoritative entities to track and report transactions over 1000USD (Linver, 2019).

4.4.3.1.5.3 Maintaining anonymity

The system would have to ensure that there is a fair degree of anonymity and not everything is exposed.

4.4.3.1.5.4 Control over notes

The 'notes' system was critical and if anyone was able to take over (eg. Even 50%) of the blockchain notes, then they would have a carte blanch over the system and use notes for their own purposes etc.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [4,12% Coverage]
Right now the creator of the bit coin it's not the public future it's a fictive name why, it doesn't trust itself, or themselves to come to public because the technology itself is not meant to be reliable. It's based in each and every one that is using the network to find that currency or to buy it, it is the competing power but it cannot guarantee that you are rewarded for your time spent in there, it's never a guarantee. Taking over 50% of the notes depends on the technology itself, some of them are very hard to have this 50% takeover and it also depends on who is initiating the attack because it could be that there are some state factors that would want to do some destabilisation, some areas and some services they could sponsor such stuff, there also bad guys, they want to do stuff for money or other purposes. If they could use that floor for example to hack every note in that system and they could turn that in time into their favour, they could switch to the new chain and take more than 50% of the notes and they could rewrite everything. For example if you have a banking system well controlled and someone managed to sneak in it and take over your internal network of notes that are monitoring and managing this blockchain, what they will do or can do is just generate

fake currency associate it to their account , every transaction they do can be accepted because they have enough notes to make consensus that each transaction we make we trigger even if its false the system itself

4.4.3.1.5.5 Investment in security

Security investment will be very high in terms of time and money.
Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [3.42% Coverage]
If you talk to any IT security experts in companies, everyone will complain about the budget not being high enough and not having enough people, there being too many projects; you will always hear that because there is always so much more you can do when it comes to security. You really have to work with this and have the budget to do this. I think this is going to be one of the main challenges.

4.4.3.1.6 Regulations and legality

Relating to security, this was also a key subtheme and was informed by the following.

4.4.3.1.6.1 Affects implementation and adoption

Adoption to blockchain can be faster if it is engrained into regulation. However, getting it into regulations could be challenging.

<Internals\\Jt-QuestionPro-Response-24312271-09-22-2019-T140919> - § 1 reference coded [1,57% Coverage]
Regulation - If regulation spurs innovation then the adoption will be much faster. It could also mean that individuals would have an extra level of trust in blockchain technology. If regulation does not come into play, then you may find that many industries may lag behind.

<Internals\\Pl-QuestionPro-Response-44526570-09-24-2019-T111850> - § 1 reference coded [1,18% Coverage]
Regulation/ legislation is also an issue for the length at which the technology can be implemented and applied.

4.4.3.1.6.2 Convergence of technologies

The convergence of a plethora of technologies that will become the crux of blockchain could pose a problem from a regulatory protectionism aspect.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [1,84% Coverage]
During the coming decade(s) you also have to look at the convergence of various 'deep' digital technologies (IoT, machine learning, neural networks,
A.I., misc. robotics, etc) and how crypto economics (in particular the M2M machine to machine component) act as the glue for all this.' The use is to outsource not just the periphery but the center away too. That could create some serious frictions & brakes to adoption in addition to regulatory protectionism of powers-that-be & established profit centers & hierarchies, therefore so that political outcome too remains up in the air.

4.4.3.1.6.3 Physical vs digital representation

On blockchain, data cannot be removed which goes against data protection legislation and hence this presents a divide between physical and digital representation which there is no solution to yet.

4.4.3.1.6.4 Authorisation rights

Companies were facing digitisation problems when it came to authorisation.

4.4.3.1.6.5 Awareness

There would need to be individual awareness of the use and value of their data, and a mechanism to control and release one's own data to buyers.

4.4.3.1.7 Skills

Blockchain would requires substantial skills development and investment. Currently there was a lack of skills thereof, and as it grow, so will skills need to grow as well. this could takes lots of time and money.

<Internals\\ANO-QuestionPro-Response-23156731-09-22-2019-T140656> - § 1 reference coded [1,01% Coverage]

The problem with new technology is, the skills upgrade of workers, this cost a lot of money.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 2 references coded [1,88% Coverage]

back to ordinary daily lives of citizens, adoption is an issue since all of this will need to be embedded in the fabrics of things, otherwise usage will be limited to folks with a higher computer science & cryptocurrencies education

Finally, if someone needs a M.Sc. in cryptocurrencies & blockchain technology as well as a PhD in crypto economics to be able to manipulate & use these things, then adoption will not work, at least not at the required scale among various societies in the whole World. So it has to be embedded in the fabric of things and be usable by anyone who is 'basically' educated.

<Internals\\PI-QuestionPro-Response-44526570-09-24-2019-T111850> - § 1 reference coded [0,49% Coverage]

Lack of skills in blockchain-technical skills.

4.4.3.1.8 Incentives and Reach

For people to adopt or consider blockchain, there would have to be meaningful incentives in place. Only then will mass reach occur.

4.4.3.1.9 Energy consumption

Decentralised system do have high-energy consumption levels.

4.4.3.2 Threats

This subtheme examines threats in terms of how the application of blockchain can pose a threat to businesses.

4.4.3.2.1 Security

Security threats ranked the highest of business whereby:

4.4.3.2.1.1 Hackers

Hackers could use scams or steal funds or steal identities

4.4.3.2.1.2 Cyber attacks

Cyber-attacks can lead to identity thefts and financial loss.

4.4.3.2.1.3 Manipulation

Manipulation of data in isolation can compromise the validity of the chain path.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 1 reference coded [2,58% Coverage]
From a security perspective definitely the blockchain itself has a very idealist security feature which is everything has to be public nothing can be manipulated if it not accepted by the communities or other computers to hold a ledger which is a distributed one, but we all saw with the crypto currency market which can be reflected in the logistics market or in other markets it can be the same but definitely there will be a need to create more security but the security itself won't be necessarily on the blockchain it will be more or less on how to make sure the wallets cannot be manipulated…

4.4.3.2.1.4 Network control and data

If someone managed gain control over the blockchain network, then they would have access to lots of data. In addition, Destabilisation can occur if someone were to feed false data into the system.

4.4.3.2.2 Business differentiation and re-position

There will threats to business differentiation in terms of pricing as well as physical threat to their processes/existence if they do not reposition themselves.

4.4.3.2.2.1 Price

Businesses will be forced to charge a common price and this will make it hard to differentiate one business from another based on price.

4.4.3.2.2.2 Reinvent - reposition

Business will definitely have to reposition themselves and/or even reinvent themselves and their model. If they do not, then they run the risk of losing customers and losing their existence.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [0,51% Coverage]

However that may force many people & businesses right now to reconsider their ways of doing things, and embrace innovation before innovation steamroll all over us.

<Internals\\Na-QuestionPro-Response-24390942-09-22-2019-T140939> - § 1 reference coded [2,56% Coverage]

Any business serving an intermediary function is at risk. Businesses may not disappear but they will need to reinvent themselves in order to survive. For example, Strate may be replaced by blockchain technology, but it may in the future be the maintenance managers of the new system.

<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 1 reference coded [0,65% Coverage]

Any business who does not technologically evolve will have a limited customer base, and ultimately hamper their growth.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 2 references coded [2,69% Coverage]

The implementation of blockchain will be a threat for businesses, it depends on what business for some businesses it will be very simple and easy, and for others it will be very hard to cope. I could think that some small payment providers would not like that or maybe they don't want to adapt themselves, for the big business maybe they do not have a CFO who saw this and it was already too late, then they would have to look at

other companies the same as us, spending millions of EURO's just to digitalise because we didn't do it at the proper time.

Its either you are not in the market and you are kind of slowly dying at the worst end of the company or you become a later doctor and you spend a lot of money to be on par with the technology which is current, or you innovate so threats, I would say they would be a lot of lobbying against that, but this is happening now so in 2030 I think we could have solved that already by 2025, 2028 I think we would have solved it already.

4.4.3.2.3 Large scale damage

Some large-scale damages can entail:

4.4.3.2.3.1 Need for Damage assessment

There is always a possibility of damage. Hence businesses need to do a damage assessment before implementation else they can be severely threatened should damages occur and they are not prepared.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [1,37% Coverage]

there could be many threats, but it depends on how they are implementing and for what they are being used for. I do think when a company or state pursue such a project, they should be aware of the benefits and, they should ask themselves what happened if someone outside has access to that, with everything what damage can be done? Damage assessments needs to be correctly implemented because it can lead to very nasty solutions, so each technology or new technology can have the good and the bad side.

4.4.3.2.3.2 Potential crash of monetary system

Crypto currency adoption at a fast and uncalculated pace could spell the crash of the physical economic system.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [0,86% Coverage]

We should not exclude major global financial crisis & other major geo-political shocks, as the responses to a deep crisis & even collapse of an entire established system may be found in potentially accelerated adoption & implementation of (partially) decentralized solutions.

<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 1 reference coded [1,07% Coverage]

This who do not integrate will be left behind on the old monetary system. If users massively adopt cryptocurrencies, then that will result in a huge financial crash of our current monetary system.

4.4.3.2.4 Labour market

The labour market would definitely be threatened as many jobs and roles will become redundant and also organisations will not have the necessary skillsets for blockchain.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 3 references coded [1,99% Coverage]

People will see it as a threat because it can automate certain things, for which you right now need people. For example of you say with the blockchain its 100% impossible to cook your books which means whatever right now it says for revenue the final number that you have, if you can 100% say these are correct then you don't need anyone doing your auditing, no one to actually look through your books to see if everything matches up and stuff like that. In the end if you have that what happens to all those auditors, you don't need them anymore?

References 2-3 - 1,03% Coverage

It's similar to the discussions we have with AI's chat box and stuff like that , I think it was Google who did the whole phone call with a computer which sounded like a human being or whatever, of course people are afraid of that because if we can do these things properly, like you don't need any agents who do the check , you don't need any call centres and stuff like that so it's a threat to that person , it's a threat to that company which offers call centre services to some big company. It's not going to be a threat to the actual big company; it will be probably a way of saving money

<Internals\\Pl-QuestionPro-Response-44526570-09-24-2019-T111850> - § 1 reference coded [1,54% Coverage]
A new technology can be a threat your core business. The threat will be most inflicted on the labour of the business as jobs may become redundant.

<Internals\\Rahul-QuestionPro-Response-23353146-09-22-2019-T140820> - § 1 reference coded [0,92% Coverage]
Organisations might run out of people with competencies to handle the situation/crises. Chaos!!

4.4.3.2.5 Obsolete entities or extinction

There is a direct threat of businesses becoming obsoletes either holistically or even certain aspects of business. Some sectors, and businesses will no longer be needed inclusive of financial sectors and related.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [1,49% Coverage]
This remains partially valid in Fintech & Insurance, however since you threaten established powers & interests, you may expect some serious obstruction & regulatory friction. If one does not exclude the 'massive extinction' scenario following a major crisis & systemic collapse, and the replacement of dinosaurs by mammals, then obviously the transition might be hard and there could be some serious geopolitical implications as well for dominant & aspiring financial powers.

The literature reinforces these sentiments stating that at least 30% of jobs in the banking industry will be lost in the short-term as a result of redundancy due to blockchain (Grover et al., 2018). Moreover the companies and jobs specifically that blockchain will jeopardise are those involving reconciliation, verification, processing and transactions. However, the literature also states that there will be a keen interest in job creation for a new class of professionals specializing in encryption and industry 4.0 data security (Murray, 2016).

4.4.3.2.6 Threat to vulnerable processes

Businesses that may have processes that are vulnerable to manipulation or influence etc, will be threatened (however, this can be seen as good thing).

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [0,76% Coverage]

It's going to be a threat to businesses that essentially are relying on bad processes or processes which can be manipulated, processes which can be attacked. If all those vulnerabilities go away due to the use of blockchain then the businesses will make money with those vulnerabilities, protecting your business from being vulnerable in those parts, for them it's going to be a problem because we take in a way their business morals.

According to the literature, a tool used when identifying if blockchain is permissible to a use case or business is the FITS model. The identifier in the model is *Fraud*, therefore business where there is a known history on ongoing fraud are best suited for blockchain (Mccullagh, 2017). Based on the literature it can be conferred that a business operating with such challenges using traditional operational mechanisms will be threaten by a competitor who has switch their operating platform from the traditional to blockchain.

The first element of the FITS model is fraud. The fraud element defines an environment where there is an excessive degree of compliance requirements, due to a high frequency of fraud cases (Mccullagh, 2017). Blockchain features like immutability, trackability and secure cryptography will facilitate with this sort of environment support

4.4.3.2.7 Complexity and resources

Blockchain can become complex as it grows and also storage and resource constrains can arise.

4.4.3.2.8 Prematurity

Blockchain is new and hence subject to have new protocols that are unproven or not fully applied. Hence this can causes problem when applied to business for the first time or too early.

4.4.4 Drivers and Capabilities

This primary theme examined the critical drivers of blockchain 2030 vision as well as new capabilities that businesses will via blockchain.

4.4.4.1 Critical drivers for blockchain vision

This subtheme generated a variety of factors that can drive the blockchain vision. These are listed in hierarchical order.

4.4.4.1.1 Technology and digitisation

This was seen as the biggest driver of blockchain. It was informed by the following.

4.4.4.1.1.1 Infrastructure

This entailed building of adequate infrastructure including different layers supported by very fast internet, cloud storage, IoT and AI etc.

4.4.4.1.1.2 Data, IOT and AI

Big data and IOT as well as AI will be seen as drivers. The internet will change considerably granting new ways of operations through blockchain. AI will bring self-learning bots.

<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 1 reference coded [2.01% Coverage]
Artificial intelligence - the emergence of AI int grated with blockchain will prove to be a game changer. Not only will platforms be decentralized, but they will also have bots to maintain codebases based on user input. Internet of things - a new generation of devices hooked up the internet will present new possibilities of passing around units of value on devices.

4.4.4.1.1.3 Computing power and networks

Computing power will be much need to keep up with the pace. Furthermore, side-chains and the lightning network will address scalability issues.

4.4.4.1.1.4 Applicable automation

Automation will have to be done on all applicable process to integrate with blockchain and gain deep visibility. This will also mitigate manual systems whereby the traditional pen and paper as well as outdated databases will become redundant.

4.4.4.1.1.5 Autonomous digital objects

This entails moving digital objects between devices that have units of value assigned to them.

4.4.4.1.2 Adoption, innovation and understanding

There will have to be a high degree of business adoption, innovation and understanding of the technology. The absence of these could result in blockchain not being understood and this can negatively influence its potential.

4.4.4.1.2.1 Phased adoption

There should be a phased adoption whereby one aspect should be tackled at a time. This will ease transition.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 2 references coded [1.56% Coverage]

We have to learn to walk before we run. So first and foremost let's build use cases that actually work on the required scale, and then scale up. One aspect strikes me in dealing with adoption: even if everything started with the ethos of peer-to-peer transactions, social media marketing & crowd funding / public sales, in the end you're often dealing with B2B2C situations ('Government' may also be inserted where relevant).Which means that first & foremost you have to deal with the B2B segment.

4.4.4.1.2.2 Knowledge

There needs to be defined and physical recognition of knowledge such as badges to depict competency and knowledge.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 1 reference coded [1.19% Coverage]

So people will want to have those badges, the same as you want to have a badge for truth south or truth north because your equipment is good, the same as you want the badges for data protection a badge for how you handle medical data a bunch of acronyms and stuff like that. I do think that this will be the big drive, that the population will want a bit more transparency. Its either businesses start revolutionising or they follow up.

4.4.4.1.2.3 Adapt to change

There will have to be some adaptation to change for businesses. This will be inevitable in order for them to survive. However, adapting to change may be varied but some sort of structure as to how businesses adapt should be considered*.*

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019 T140838> - § 1 reference coded [1.41% Coverage]

There is no doubt in my mind that 'traditional' business process will transform, and management actors and consultancies may get involved with catalysts to get new (partially) decentralised systems to be embedded in the fabric of everything. Simply because in order to survive, they need to provide new approaches & new solutions to their client. Of course, new competitive actors may emerge as well in this B2B implementation & adoption process

Although the literature does not indulge too much on the process of adaption and the integration of blockchain with traditional legacy systems, it does outline the adoption process. It is worth noting that it might be possible to use a similar concept to the 5 stages of adoption and apply is to an adaption case. Therefore while certain aspects of business might be more well equipped to complete integrate with blockchain and

reach the confirmation stage very quickly, other areas of the business may spend more time at the knowledge stage (Grover et al., 2019).

4.4.4.1.2.4 Identification of proper use

Proper use cases must be identified.

4.4.4.1.3 Monetary factors

These factors play a big role as asserted by 5 respondents.

4.4.4.1.3.1 Affordability

Blockchain will have to affordable.

4.4.4.1.3.2 Charging and rewarding

Charging for blockchain services and maintenance can be business model whilst also being rewarded by virtual currency and intangible benefits such as ensuring ethical handling of blockchain data to benefit users.

<Internals\\Na-QuestionPro-Response-24390942-09-22-2019-T140939> - § 1 reference coded [3,79% Coverage]

Charging maintenance fees on blockchain transactions as a business model. Or community driven maintenance without a central company in charge of maintenance…

4.4.4.1.3.3 Crypto cash registers

Allowing businesses and people to use cryptocurrency.

4.4.4.1.3.4 Individual data management

Collection and aggregation and resale of individual data.

4.4.4.1.4 Security

Security, by default remains a driver. This entails ensuring that data cannot be breached, hacked and stolen etc. this also includes financial transactions and all other valuable data. Security should be become a core value.

<Internals\\Mt-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [2,14% Coverage]

I think on the one hand how important security is going to be, this is something where you know it's going to come from a business interest where you show that 'I am secure' …It's not just that you have to buy one more firewall for our server you need to get something that will keep you ahead of everyone on the dark side so to speak. I think to really drive this as a tool is blockchain…

4.4.4.1.5 Trust and transparency

Relating to security, trust and transparency will be key. Both businesses and individuals need to trust blockchain technology. Without this, implementation and adoption can falter.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 1 reference coded [2,03% Coverage]

People want more transparency in general, once people want something businesses kind of have to make it otherwise, they will not survive. My thinking behind it is that society wants more transparency because we already used to transparency…

4.4.4.1.6 Globalisation

Globalization is drives not only competition but also innovation. Innovation is what brought blockchain into being and the more innovative society can be through globalization the more the technology will evolve, especially in aspects that support a new form of business that is boundaryless and that is a DAO that operates on smart contracts.

4.4.4.1.7 Productivity

Performance and productivity is seen as drivers as blockchain will need to contribute to productivity and performance in any business willing to adopt it.

4.4.4.2 Blockchain and business capabilities

This main subtheme examined the capabilities blockchain can give to business. These are ranked hierarchically below.

4.4.4.2.1 Financial

This was the main capability as supported by 12 respondents.

4.4.4.2.1.1 Financial savings

4.4.4.2.1.1.1 *Decreased Overheads*

This could mean decreased overheads and savings thereof.

4.4.4.2.1.1.2 Cutting out middleman

Blockchain will eliminate the need for a middleman which will save businesses money.

4.4.4.2.1.1.3 Outsourcing

Blockchain will allow for some services to become outsourced, allowing companies to focus on their key competencies. In turn this will allow companies to become true specialist in their sectors as they will be able to render more resources towards the development of their speciality.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 1 reference coded [2,04% Coverage]
Definitely cost cutting some I would say what can appear would be companies with direct strategy and goals to cater to those businesses, first it will start as a small business the same as we have the manage service provider, in the 90's everyone had to the 90 administrator, in the 2000's everyone saw that maybe a whole team, maybe you can just out source it and it's the same as the current payment solution…

4.4.4.2.1.2 Business guarantees via subscription and contracts

Businesses and companies can now have longer relationships with clients as blockchain will present newer ways in conducting business in smart contracts and subscriptions. This will ensure business continuity.

<Internals\\MT-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [3,24% Coverage]

We have been transforming into a subscription business many companies are moving towards subscription as a service, which is becoming more and more common… Now if we have a contract with each other you are providing a service to me, this service might be vital to my business operations. How can I be sure that your company will be a long-term partner for me? How can I make sure that I can keep my business running because you are not around? If I get something as a service from you and you are not around anymore then my own operations run into a halt and that's bad. I need to find a way of making sure that you are staying in business, that there are no stupid accidents stupid things happening, again this is where blockchain, can be a chance, can be a business driver…

4.4.4.2.1.3 Automated - instant payments

Automated and instant payment would be possible through blockchain and this could lead to more efficiency in operations and cash flow.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 2 references coded [1,50% Coverage]

One would be instant payment which we don't have at the moment this would mean that businesses will be able to make cash flow more efficient.

Because once you have instant payments, it's nothing new, the Chinese already have instant payment on We Chat but generally having it on business level with high security, trust worthy type of thing for the world well at least some variations for the world will definitely improve the cash flow a little bit. For instant payments companies can make better provisions, better statistics they can react faster…

4.4.4.2.1.4 Improve investment process

Blockchain can speed up investment processes for added benefit.

4.4.4.2.1.5 Funding acquisition

Blockchain can present funding opportunities for businesses.

4.4.4.2.2 Economic, Geo, Socio and Political

This was the second highest ranked subtheme when it came to capabilities and spanned over the following variables.

4.4.4.2.2.1 Business growth and development

Blockchain can inevitable lead to the growth and expansion of almost any business irrespective of size. Many business will want to be at the forefront of such change, and business will then operate irrespective of borders. They will inherently become global with also the advent of cryptocurrency.

<Internals\\Jt-QuestionPro-Response-24312271-09-22-2019-T140919> - § 2 references coded [3,74% Coverage]

As cryptography advances, more businesses will migrate toward securing transaction records in this manner. Again, this will be by large companies as well as innovative ones that are eager to be at the forefront of change…

<Internals\\Na-QuestionPro-Response-24390942-09-22-2019-T140939> - § 1 reference coded [0,91% Coverage]

Businesses will inherently be global not local. Larger markets will be accessible to all businesses.

4.4.4.2.2.2 Southern hemisphere growth

An important point was made whereby, the newer or younger businesses, even those from developing contexts will have the opportunity to grow with blockchain and catch up (leap frog) to its bigger counterparts.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 3 references coded [3,62% Coverage]

However there is a chance for still under-banked & under-tech-ed economies, in particular in the South Hemisphere, to leapfrog & see faster evolution of their younger societies. I have a lot of 'hope' for that. Applications in supply chain & energy management, healthcare look promising…

4.4.4.2.2.3 Predictive economies

Blockchain will allow for a key concept of Predictability especially in terms of consumer and global economics.

4.4.4.2.2.4 Fluidification of currently establish geo-political & geo-economic order

Blockchain can lead to development in other economies of scale creating market leaders all over the world.

<Internals\\Crypto-QuestionPro-Response-23968494-09-22-2019-T140838> - § 1 reference coded [1,30% Coverage]

A second one is further fluidification of currently establish geo-political & geo-economic order: while North-America clearly remains a market leader in this field, the activity in East-Asia (where I have lived most of the past 30 years & keep returning regularly) is enormous & extremely aggressive in this field, and Europe, who as usual is only moderately engaged, needs to seriously wake up as well to that fact...

4.4.4.2.2.5 Local business advantage

Local business a better platform of competition for local customers.

4.4.4.2.3 Data

Data capabilities also rank highly.

4.4.4.2.3.1 Data monitoring and tracking

This is seen as one of the core competencies of blockchain.

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [0,71% Coverage]

They will have a better opportunity to monitor or track data, I think this is the main use of blockchain you need to monitor or track some kind of data it doesn't matter what, if its financial, if it's of any other form, this is what the system will give you.

4.4.4.2.3.2 Transparency

Information and data will be transparent. Visibility will be increased across all processes. Anyone can identify the movements in a process or transaction, and this can serve to mitigate wrong-doings and fraud, especially in government spending

<Internals\\CIP-QuestionPro-Response-44555860-09-24-2019-T111742> - § 1 reference coded [1,26% Coverage]

If some of your people ask how was the budget spent the state can say you have the database here are the costs we built those roads etc everything is there you can have a look so transparency will also be something that could function a little bit better in the future…

4.4.4.2.3.3 Trustworthiness

Relating to transparency, blockchain allows for data to be untampered or illegally changed, this promotes trust in the system.

<Internals\\Sr-QuestionPro-Response-44563895-09-24-2019-T111634> - § 1 reference coded [0,62% Coverage]

Apart from that they have the regular ones like the uses of blockchain that you cannot temper with it, so you can see the whole chain like what transfers will happen or there is something missing or anything.

4.4.4.2.3.4 Buying personal data

The ability to buy personal data from the individual.

4.4.4.2.4 Re- appropriation

There would new opportunities for individuals and businesses to appropriate themselves toward new ways of business.

4.4.4.2.4.1 Individual capacity

People will have skills on how to manage their own data after creating it and they can use it for their own purposes including monetary. Furthermore, individuals need to increase their capacity to develop IT and blockchain skills.

<Internals\\Si-QuestionPro-Response-44553085-09-24-2019-T111808> - § 1 reference coded [0.83% Coverage]

On the financial aspect I would see a lot of consultancy would happen, a lot of consultancy, a lot of specialisation would need to happen, the current finance guys who are working in finance would need to know a little bit more than just numbers, they would need to know a little bit of coding as well…

4.4.4.2.4.2 Transfer

Relating to the above, all users can learn to or have the ability to send and receive units of value to every other user.

4.4.4.2.4.3 Custom platforms for services

Businesses will be able to build their own custom platforms for blockchain use suitable to their needs/areas.

<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 1 reference coded [0.91% Coverage]

Each platform will form the foundation for users to integrate with this technology, and ultimately leverage the services provided and make their own custom platforms.

4.4.4.2.5 Security and regulations

Security and regulations by default was seen a core capability.

4.4.4.2.5.1 Framework of security and comfortability

Blockchain will provide such as effective framework for security and this will make business and people comfortable to do business transactions without fear of crime and corruption. Blockchain ensures that everything is documented and this cannot be change. A single change in something will show and everyone will know. Hence financials will not be able to be crooked and all transactions will be transparent and nothing will be hidden. Business will be more secure with lesser legal ramifications. The security framework hence becomes a key strength.

<Internals\\MT-QuestionPro-Response-44556841-09-24-2019-T111708> - § 1 reference coded [4.91% Coverage]

If you look at the business world there is always like in company XYZ they have been siphoning money out of the accounts, there is always some shady things happening in the background and that can bring a company down... This can be something like technology, it's not just about creating new possibilities to do more things, technology also about creating a framework for what we can do to make sure we only move within this framework and nothing happens that shouldn't happen…

4.4.4.2.5.2 AI creating laws

Artificial intelligence will have the potential to create new laws without human intervention and these can be used to govern blockchain processes, businesses and even groups and societies.

<Internals\\Sy-QuestionPro-Response-23332651-09-22-2019-T140808> - § 2 references coded [3.20% Coverage]

AI that is capable of running its own code and modifying the architecture of blockchains without human intervention, then this proposes the case of having a blockchain of self-amending laws, to govern and group, society, or possibly even a nation...

4.4.4.2.5.3 Ethics and accountability

Businesses will need to follow regulatory protocols and principles such as EU GDPR to do business globally. This will promote result in compliancy and promote the sustainability of those organisations that are ethical in practice.

4.5 Conclusion

In this chapter the framework of the trustworthiness of the study was presented. This was achieved through defining the credibility, transferability, dependability and confirmability of the study. In addition to the trustworthiness the bulk of the chapter focused on the empirical results of the study and the researcher's interpretations of the study data thereof.

Chapter 4 concluded the analytics of the study by developing four primary themes from which the researcher was able to extract key concepts that were most relevant to the study in answering the research questions. In table 4.2 a summary of the key findings can be seen; the most fitting concepts align at the intersections of main themes and the research questions. This presents the researcher with a roadmap to answer the research questions.

Table 4.2

Summary of findings

Research question	Primary themes			
	Business modelling and blockchain	Properties, Functionality and Impact	Challenges and Threats	Drivers and Capabilities
What businesses need to consider staying relevant in a widely adopted blockchain future?	4'th - 5th generation blockchains	Data will becomes property Trust and transparency Real time business transactions		
What industry specific factors lead to the success of a blockchain application by 2030?	Security and transparency Monetary Validation, verification and tracking	Strategy and solutions Skills adaptation		Infrastructure Computing power and networks Knowledge
What are the negative effects of not regulating blockchain by 2030?			Adoption rate	
What properties and functions will blockchain provide in 2030?		Security and transparency Data becomes property Real time business transactions		
What are the comparative advantages of blockchain over traditional business practice?	Decentralisation	Security and integrity		Data Re-appropriation Financial

What are the positive and negative effects associated blockchain implementation?		Power and control Security, Transparency and records	Time change Funding and money Making it easy to use Security	Economic, Geo, Socio and Political Re-appropriation
Is blockchain a disruptive technology?		Impact of blockchain vs current profession		

5 CHAPTER 5 DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Chapter 5 provides the concluding aspects to the study. The chapter is broken down into 4 sections. The first section discusses the outline of the study and what was set out to be achieved. Section 2 postulates detailed answers to the research questions, through the most heavily weighted topics detailed in table 4.2. Section 3 establishes the limitations of the study and provides recommendations for future studies, while the final section provides a concluding statement to the study.

5.2 Study overview

The study introduces blockchain as a megatrend with the potential to revolutionise the economy, globalism and society as a whole. To understand this megatrend the researcher proceeded to investigate the impact of the megatrend towards the year 2030 by firstly identifying the problem statement, the research questions and then the research objectives. Thereafter, the researcher proposed a qualitative research methodology as the most appropriate method of achieving the research objectives and providing solutions to the research questions.

The next objective for the researcher was to get a better understanding of the subject matter and establish some sort of direction towards solving the problem. This was achieved through a literature review, the researcher was able to identify key themes that paved the way for further research, which was needed to achieve the research objectives and answer the research questions.

The researcher then further defined the tools and instruments needed to achieve the research objective. These were namely; an online questionnaire which was formulated from the themes identified in the literature review, and thematic analysis of the response of the questionnaire.

In the thematic analysis the researcher identified nodes and the themes that led to the development of four primary questions that were needed to answer the research questions. Additionally, the researcher went about interpreting the thematic analysis by providing support from respondents' statements and literature. Finally the research was able to establish which key concepts were most pertinent to answering the

research questions from which the researcher used to formulate the answers and achieve the research objectives.

5.3 Answers to research questions

5.3.1 What businesses need to consider to stay relevant in a widely adopted blockchain future?

On route to the year 2030, it would be very difficult for businesses to compete on a global stage while still maintaining a traditional paradigm in conducting business.

The trend of businesses moving their business strategies towards industry 4.0 is more than just about digitizing business, it is about improving efficiencies, increasing competition and contributing to the global ecology of socio-economic development. In the case of Industry 4.0 specifically blockchain, businesses would need to consider the following factors to remain competitive and stay afloat.

Firstly instantaneous transactions, tracking and monitoring will be possible. Therefore, businesses would need to consider aligning themselves with this phenomenon, by implementing mechanisms and protocols that would promote both a responsible and agile response to live data.

Secondly, as more businesses prescribe to a customer orientated approach of doing business, customers are becoming more mindful about which brands they can truly trust. In the space of industry 4.0, where customers entrust their data to organisations the concept of trust plays a key role in businesses competing with each other. Transparency will be the benchmark of competition towards 2030, with fixation on trust through transparency. As a result, in order to be competitive, businesses would need to be more open and transparent about their business dealings.

The third consideration for business to stay relevant towards 2030 is for organisations to rethink the traditional organisational forms of business. By 2030 operational costs would have reduced significantly as a result of new business platforms and organisations forms. Examples of these can include DAOs, and other forms of decentralised entities that outsource everything that is not their speciality. These new organisational forms enhance the value chain by creating a distributed economic ecology.

The final major factor that businesses would need to consider is the role that data will play towards the year 2030. Information and data will be of the utmost value, it was said by one respondent that data would be like a commodity. Therefore businesses would need to consider what systems and protocols need to be in place to effectively manage, secure, and regulate data.

5.3.2 What industry specific factors lead to the success of a blockchain application by 2030?

As business approaches a new era, the traditional mechanisms of operations are becoming obsolete and inefficient. The megatrend in the business environment is directed to a migration towards adopting facets of Industry 4.0.As a result, there is a migration to linking different aspects of the business to the internet. The main reason for this is integration; the networking of operation, processes and business units. However, there are issues that are synonymous with the integration; these include issues with security, trust, skills, infrastructure and resources. These factors will ultimately provide support to mitigate these issues and lead to the success of a blockchain application by 2030. The details of how this will be achieved are outlined below.

Although integration has led to operations being performed seamlessly and effectively, there has been numerous breaches in the cybersecurity. As a result, it has led to the loss of crucial and sensitive data, the crippling of the operations, and a loss of income from businesses being held to ransom for their data or operating systems. Blockchain, by being decentralised, storing multiple copies of the data, and supporting strong cryptography makes it an ideal candidate to solve the security issues behind a single point of failure of centralised client server networks, such as ransomware attacks. Thus, blockchain is a mechanism that many businesses may need to secure their data while reducing the effects of attack.

The next factors that contribute towards the application of blockchain are trust and transparency. Both these elements are closely linked, in that they have somewhat of a direct inter-relationship. Businesses are moving away for a transactional based business approach and more towards a partnership approach through building meaningful relationships with customers. The more trust a customer has in a business,

the greater the propensity to create confidence in a sustained long-term relationship. Blockchain can offer trust to the customer, not only in terms of the system securing their privacy but also but also in terms of transparency. Customers are becoming more mindful and conscious about their buying decisions, especially in terms of a product's impact on the environmental and social ecology. To make buying decisions easier for customers, there needs to be a mechanism that supports visibility towards enabling a transparent purchase. Blockchain provides this mechanism to business in a way that reinforces trust with customers by enabling businesses to be transparent about their activities and their operations.

The third contribution towards the application of blockchain towards 2030 is related to the drive for a cashless society. It is becoming more prominent for business to offer tokens/vouchers that direct and circulate "cash" within the limits of their business parameters. This reinforces the need and preference to conduct business over the platform rather than customers spending their "cash" elsewhere. Blockchain offers the most secure mechanism to business to support them in creating their own tokens, digitizing money and virtual money management. Through blockchain the tracking and reconciliation of digital money is possible, making it easy to track the history and circulation of tokens. Blockchain's immutability allows business to easily track the movement of "funds" infinitely unlike traditional banking systems that are finite, especially at the point of cash exchange. This innovation will be a driving factor particularly in the space of finance where assets can easily be tracked, identified, and reconciled.

Tracking with blockchain is a feature that is immutable and cannot be tempered with. This is what gives it a relative advantage over other traditional tracking systems. There are many businesses in this day and age that have a multitude of suppliers, however, when failure occurs at the end user its normally the end product brand that takes accountability. Business are becoming vigilant of this, and have become wary of suppliers using products that are either counterfeit or not within standards. As a result, it has become popular for supplier contracts to require the storage of relevant documents for at least 10 years for auditing purposes when the need arises. Businesses are becoming more accountable for their brands and what they are selling to society. Therefore, there is a need for a system that can not only track, but also validate and verify the authenticity of a transaction or product to enhance

accountability. This is envisaged by what blockchain offers, a system that can track and validate items to a point that businesses don't have to spend so much resources on auditing, thus saving costs while improving standards and accountability.

The fifth factor that will lead to the success of blockchain application pertains to the evolving strategies of companies to become more agile and responsive to market movements. The combination of blockchain with technologies such as IOT allows business the privilege of adopting such strategies through the development of live dashboards that facilitate their response to live data and enable them to track transactions in real-time. As a result decisions can be actioned with velocity with solutions that are the best fit in reference to live data.

The final two factors that will lead to the application of blockchain are more future orientated than the factors previously discussed. The first factor pertains to skills of the workforce, as business becomes more automated machines replace skilled personnel. The effect results in a shift of job orientated skills to being more positioned towards Industry 4.0. Therefore, educational systems and institutes need to act accordingly. The quicker these skills get incorporated into the educational systems the more rapid the blockchain knowledge gap will be filled.

The final factor is related to infrastructure and resources. As business points towards Industry 4.0 there is a need to build infrastructure to support technologies such as AI (Artificial Intelligence) and IOT (Internet of things). The primary layers of support are the web and computational power. Blockchain can additionally provide support to these technologies beyond the realms of storing and tracking data off the blockchain. As computer chips get more powerful and quantum computing becomes commercially viable, blockchain can support these AI and IOT through the establishment of an evolved new version of the internet, one that is a blockchain decentralised internet capable of lightning speeds.

By the year 2030, with the support of quantum computing, scalability and throughput will be enhanced to a point where transaction confirmations are instantaneous. This, combined with having the ability to monitor and track data live, presents a challenge to business. These factors will evolve the way business is conducted, making every decision by role players crucial. As a result, organisations would need to be reconsider their management strategies and style,

5.3.3 What are the negative effects of not regulating blockchain by 2030?

There were more vocal opinions against the regulation of blockchain than for its regulation. Nevertheless, the most prominent aspect highlighted as a result of not regulating blockchain was the influence of regulation on the technologies' adoption rate. Regulation of a phenomenon generally establishes trust in that phenomenon. Similarly, in the case of blockchain, not regulating the technology could result in a number of companies not having the confidence to trust in the technology and as a result adoption may lag.

5.3.4 What properties and functions will blockchain provide in 2030?

Blockchain already possess a number of properties and functions that have been highlighted in this study, however the study has also brought enlightenment to the evolving features that blockchain will bring to business towards 2030; Most notably, the role that data will play in the future; the study identified data to be almost like a commodity in the future, with individuals having full control of their data, and being able to sell and trade with it all through the facilitation of blockchain.

The second most notable feature of blockchain that is pre-existing but will evolve over time is security and transparency. In the case of the latter, it was identified that transparency is very much linked to the openness of the system. The characteristic of openness is synonymous with public blockchain, which has the ability to create a social reality where innovation thrives through opensource. The idea of opensource technology and culture supported by blockchain, will bring about unparalleled creativity and innovation to society, inertly promoting blockchain as an organisational form, through which society can connect to do business independently and securely. Expanding on security, cybersecurity will have multiple layers beyond just public and private keys, as individuals' assets will be directly linked to their identity to transact.

Thirdly, through the incorporation of smart contracts with IOT, towards the year 2030 there will be networks of DAO's operating. As a result, these organisations will need a more consistent form of support than human intervention to manage them. As a result, the development of a blockchain DAO management system operated by AI will cater for this need. This also sprouts the need for DAO management system to be rendered as a new business platform.

Lastly, by the tear 2030, with the support of quantum computing, scalability and throughput of blockchain will be enhanced to a point where transaction confirmations are instantaneous. This combined with having the ability to monitor and track data live presents a challenge to business. Business would need to evolve, as every business decision by role players would be crucial. Therefore, organisations are advised to reconsider both the management strategies and style, with the notion to develop a strategy that is more agile to cater to the stealth in information that would be broadcast from operations.

5.3.5 What are the comparative advantages of blockchain over traditional business practice?

The most apparent competitive advantage that blockchain has over traditional business is the practice of reconciliation. The process of reconciliation is in every business sector and influences a vast array of processes with an organisation. Blockchain eliminates the task of reconciling and reduces the resources that a company would otherwise allocate to reconciling. Similarly, the process of auditing, which is a check on the reconciliation process can also be illuminated. Blockchain can conduct both these processes automatically; improving the accuracy while reducing the costs and saving time.

The second competitive advantage that blockchain has over traditional business is in the security and integrity that it can offer. Blockchain can provide complete security to a business; this is in the way of every aspect of the business that is linked to blockchain is automatically secure. Moreover, blockchain's decentralisation feature further enhances its security features over traditional security measures such as firewall. When it comes to integrity; blockchains immutability feature ensures that ethical practice in business mitigates the chance of information being tampered with that would otherwise be present in a traditional business setting. Moreover, blockchains' immutability in combination with blockchains' tracking characteristic mitigates the introduction of counterfeit goods and reduces fraud from the business cycle.

The third competency of blockchain that has a relative advantage over traditional business platforms centres on data management. Blockchain has the ability to provide live data updates and tracking, as well as disintermediate transactions, giving business

the ability to acquire the data and transact directly rather than depending on third parties. Additionally, blockchain has the ability to support business in re-appropriating new business platforms. This can be built on their older substrate of the business architecture, with a fork creating the new substrate. The notion aforementioned provides transparency for a company's history as opposed to traditional business platforms where in some cases poor or corrupt business decisions are muted and untraceable. Thus, by documenting all extents of data in business dwelling blockchain assures ethical business practice.

Finally, the most notable competitive advantage blockchain has over traditional systems, is its ability to maximize financial savings through the illuminating premium transaction costs imposed my intermediaries, decreased overheads through decentralisation and dismantling of traditional brick and mortar organisational forms, and by outsourcing so that companies can maximize their returns from their specialties.

5.3.6 What are the positive and negative effects associated with blockchain implementation?

This study has highlighted both positive and negative effects of implementing blockchain in its current state. While there are more positive effects than negative, the researcher nevertheless outlines the most heavily weighted effects of implementing blockchain.

The result of implementing blockchain establishes a decentralised platform from which individuals can connect with each other and transact directly. This results in the effect of power and control being handed back to the individual rather than the individual being forced to transact through the intermediary. Similarly, re-appropriating business platforms are easily achievable through disintermediation, as a result of decentralisation. Businesses that used intermediaries to connect to clients can be liberated; they can connect with their clients directly and streamline their businesses. Not only is the cost savings on transaction but it also enhances the relationship between the client and supplier. Additionally, with all assets being in full control of the business, it can instill a layer trust and confidence in the system.

The negative aspect about decentralisation is in the propensity of being unregulated, resulting in many forms and versions of the technology being developed. Different versions of the technology are preferred and act well in promoting ingenuity, however, with variation versions it is unlikely that there is a standard architecture that is acceptable for the integration of different chains. This makes it difficult to combine chains.

The next effect that results from blockchain implementation is focused on security, transparency and records. While in most instances blockchains will have a positive effect as it will ultimately be the security systems. However, as long as human interaction is possible, chains will be prone to some level of corruption, maybe not through a direct attack on the security mechanism of the chain, but through collusions of controlling the majority of computing power of the chain or by the false input data (Konfidio, 2018). Therefore, the effect on security on the implementation of blockchain will result in the further enhancements of security to illuminate any human interaction with the chain. One respondent even suggested nodes could be based in outer space. With regards to transparency and records, blockchain implementation mostly provides a positive effect by illuminating fraud and corruption and establishing trust in society. However, the downside at this point in time is being able to securely confirm the level of transparency and anonymity

From a technical viewpoint a negative effect associated with the implementation of blockchain has got to do with blockchain's key feature of being decentralised. As a decentralised network is dependent on the resources of individual nodes which puts network at risk in terms of the clock for transactions running out by the year 2030 as outlined by one respondent. An additional challenge associated with the implementation of blockchain is its affordability. Blockchain needs to be affordable for use especially to the lower market segment as this is where it will have the greatest effect and most rapid rate of adoption. This is the intersection where liberation for the intermediaries occurs.

With a general knowledge gap in the field of blockchain, implementation into a business environment can either lead to its failure from resistance to adoption, or its success by adoption which would enable personnel to become more technically astute in the field. This will result in further widespread knowledge of the technology finding

traction in educational systems. However, it's worth noting as pointed out by one of the respondents, instead of having everyone upskilled to suit the technology, the technology should be made in such way that it is easy enough to suit everyone's use.

The final effect associated with the implementation of blockchain is positive however it is the most controversial. It is focused on the economic, geographical, sociological and political influence of blockchain.

Currently about 70% of internet searches go through websites that are controlled or owned by either Facebook or Google. This inertly means that searches are encoded to direct users of products and services that will maximize the profit of these large conglomerates (Warren, 2019). Additionally, these large conglomerates hold vast profits that have hardly had any tax imposed on them (Henry, 2013). With this in mind and taking note of Marx's Labour Theory of Value (1865), which states that capitalists exploit in order to stay competitive. It can be identified that these large conglomerates are capitalist in a way that they are only concerned with profit strategies and not societies' best interests.

Blockchain has the ability to change this; through implementation of blockchain, the internet can be liberated and profits can move from large conglomerates to be distributed amongst smaller to medium size businesses (Konfidio, 2018). Buying decisions and the internet will not be controlled or manipulated by these large conglomerates but, rather a blockchain system will disintermediate these conglomerates to connect people directly with each other. As a result, this ideology will establish more entrepreneurs, ensure appropriate taxation and give people the freedom to making buying decisions that are best for them. This effectively reshapes society and redefines capitalism.

5.3.7 Is blockchain a disruptive technology?

Through the majority of the respondents confirming that blockchain will have a huge on their professions in addition to the literature detailing revolutionizing the internet and shared economy, it can be assumed that blockchain is a disruptive technology

5.4 Limitations of the study and recommendations of future research

Some drawbacks of this study and areas that may be useful for future research are unpacked in this section. The first part highlights the limitations of the study accompanied by recommendation for further research to remedy the limitations. The second part identifies additional areas for future research.

Firstly, as detailed in the methodology in chapter three, the study had a broad focus in the arena of business management and the impact of blockchain in a generalist approach. It's worth noting that future studies having focus on the impact of blockchain in specific sector will add significant value to the knowledge and application of the technology in that sector. Worthy mentions of sectors that would be viable candidates are the government sector and healthcare.

The study was further limited by the methodology that resulted in a sub-minimal sample being recruited. There were two main contributing factors that caused this which effected the narrow response rate of the questionnaire. Firstly, it was difficult to recruit candidates that were well-balanced in knowledge of both business process management and blockchain. Secondly due to the complexity of the open-ended questions in the questionnaire, it required a significant amount of time to complete. This made it difficult for possible candidates to participate. Hence the study had a high dropout rate.

Additionally, the study's focus was directed more towards the mechanisms of public blockchains. An interesting outlook for future research would be investigating the dynamics of private blockchains and whether it can surmount as a competing technology to public blockchains.

Although not defined by the limitations of this study, other worthy mentions for future research identified in this study are as follows. Firstly, to investigate blockchain as a new version of the internet. Similarly, future studies can investigate blockchain's role in the evolution of the new version of the shared economy. Finally, a study of notable interest would be for researchers to pursue investigations into quantum computing's impact on blockchain's cryptographic framework and the overall performance of the blockchain.

5.5 Concluding statement

Blockchain is more than just a tool to facilitate a new way of storing and tracking data. It is a mechanism that can liberate the internet, liberate business and society at large by giving power and control of what rightfully belongs to an individual back to them. Through blockchain social equality can become a reality, if, in the correct hands, it can reshape society to reduce the gap between the rich and poor and redefine capitalism.

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7 Annexure 1: Covering letter

26 August 2018

Dear Respondent

I am studying towards my MBA (Master's in Business Administration) degree at the Nelson Mandela University Business School. I am conducting research on blockchains. I believe that my study will make an important contribution to the practical application of blockchains and identify the areas of business that will best suit blockchain implementation.

You are part of our selected sample of respondents whose views we seek on the abovementioned matter.

We would therefore appreciate it if you could answer a few questions. It should not take more than 40 minutes of your time, and we want to thank you in advance for your co-operation.

There are no correct or incorrect answers. Please answer the questions as accurately as possible. Please note also that your participation in this study is entirely voluntary and that you have the right to withdraw from the study at any stage. The cover letter/term of the questionnaire can be seen in appendix 2. Should you be interested in the study feedback/outcome, I will provide you with a PDF copy of the study results upon your request. There are no known risks involved with your participation in this study. We also guarantee your anonymity and the confidentiality of information acquired by this questionnaire. Neither your name nor the name of your firm will be mentioned in the study.

Thank you very much.

Contact details:

Mr Dev Moonsamy

Email: moonsamyd@gmail.com

Telephone: +27790367333

To verify the authenticity of the study, please contact Prof Chris Adendorff at telephone number: +27836516789 or e-mail address: powerhouse@alfresco.co.za

8 Annexure 2: Data collection tool/ instruments

8.1 Questionnaire

Q1 BUSINESSMODEL

In the year 2030, the way organisations operate will be significantly different, and perhaps unconventional. How do you see businesses operating with blockchain in the year 2030? What is your vision of a typical business model? Elaborate especially on the manner in which exchange/transactions would take place?

Q2. FUNCTIONS

Blockchains are gaining facets in many arenas. At present one can allege blockchain's primary function as being that to transfer property rights. Describe what you envisage the functions of blockchains to be in the year 2030? Be as innovative as possible; try not to extrapolate from existing the trends.

Q3 PROPERTIES

What new advances in the properties of blockchain will surface by the year 2030? As a result, how will these properties facilitate businesses in achieving a competitive advantage?

Q4 SECTORS

In the year 2030, which industries would use blockchain as a core feature in the way they do business? Furthermore what will they use it for?

Q5 ENTERPRISE

For your blockchain vision of the 2030 business model, what are some critical drivers that construct or reinforce the image?

Q6 CHALLENGES

For your blockchain vision of the 2030 business model, what are the challenges/weights that must be met in order to bring it into fruition? Discuss the relative strengths and weaknesses of each challenge.

Q7 OPPORTUNITIES

The advancement of technologies has lead businesses to capabilities beyond the realm of traditional performance. In the year 2030 and beyond, what new capabilities will businesses have as a result of blockchain? Furthermore how would these capabilities drive the creation of new business platforms?

Q8 THREATS

How could the application of blockchain be a threat to businesses in the year 2030? Please elaborate on your answer.

Q9 IMPACT

How could the blockchain of 2030 affect you in your current profession?

Q11 What is your gender?

1. Female
2. Male

Q12 What is your age range?

1. Under 20
2. 20-30
3. 31-40
4. 41-50
5. 51-60
6. 61-70
7. Above 71

Q13 What is your highest level of education?

1. High school diploma
2. College Diploma
3. Baccalaureate Degree
4. Masters Degree
5. Doctoral Degree
6. Other _____

Q14 Which option describes your sector of employment?

1. Materials
2. Industrials
3. Consumer Discretionary
4. Consumer Staples
5. Health Care
6. Financials
7. Information Technology
8. Telecommunication Services
9. Real Estate
10. Education
11. Energy

Q15 Which term best describes your occupation?

1. Scientist
2. Business person
3. Engineer
4. Teacher
5. Politician
6. Cleric
7. Artist
8. Publisher
9. Health worker
10. Service worker
11. Manufacturer
12. Retailer
13. Distributor

Q16 How many years experience do you have in this role?

Q17 Are you an expert in the field of blockchain, working with it daily?

1. Yes
2. No

Q18 Do you work with blockchains occasionally?

1. Yes
2. No

Q19 Would you consider yourself a:

1. Generalist
2. Specialist

Q20 With regards to blockchain, would you classify yourself as an informed layman?

1. Yes
2. No

9 Annexure 3: Ethics clearance

NELSON MANDELA UNIVERSITY

FORM E

ETHICS CLEARANCE FOR TREATISES/DISSERTATIONS/THESES

Please type or complete in black ink

FACULTY: Business and economic sciences

SCHOOL/DEPARTMENT: NMU Business School

I, (surname and initials of supervisor) Prof CM Adendoff

the supervisor for (surname and initials of candidate) Moonsamy D

_____ (student number) 217062237

a candidate for the degree of MBA

with a treatise/dissertation/thesis entitled (full title of treatise/dissertation/thesis):

BLOCKCHAIN READINESS FOR COUNTRIES TOWARDS 2030-
THE BARRIERS AND BENEFITS OF ADOPTING BLOCKCHAIN TECHNOLOGY

considered the following ethics criteria *(please tick the appropriate block):*

	YES	NO
1. Is there any risk of harm, embarrassment of offence, however slight or temporary, to the participant, third parties or to the communities at large?		X
2. Is the study based on a research population defined as 'vulnerable' in terms of age, physical characteristics and/or disease status?		X
2.1 Are subjects/participants/respondents of your study:		X
(a) Children under the age of 18?		X
(b) NMMU staff?		X
(c) NMMU students?		X
(d) The elderly/persons over the age of 60?		X

(e) A sample from an institution (e.g. hospital/school)?		X
(f) Handicapped (e.g. mentally or physically)?		X
3. Does the data that will be collected require consent of an institutional authority for this study? (An institutional authority refers to an organisation that is established by government to protect vulnerable people)		X
3.1 Are you intending to access participant data from an existing, stored repository (e.g. school, institutional or university records)?		X
4. Will the participant's privacy, anonymity or confidentiality be compromised?		X
4.1 Are you administering a questionnaire/survey that:		
(a) Collects sensitive/identifiable data from participants?		X
(b) Does not guarantee the anonymity of the participant?		X
(c) Does not guarantee the confidentiality of the participant and the data?		X
(d) Will offer an incentive to respondents to participate, i.e. a lucky draw or any other prize?		X
(e) Will create doubt whether sample control measures are in place?		X
(f) Will be distributed electronically via email (and requesting an email response)?		X

Note:

- If your questionnaire **DOES NOT** request respondents' identification, is distributed electronically and you request respondents to return it *manually* (print out and deliver/mail); **AND** respondent anonymity can be guaranteed, your answer will be NO.
- If your questionnaire **DOES NOT** request respondents' identification, is *distributed via an email link and works through a web response system (e.g. the university survey system); **AND*** respondent anonymity can be guaranteed, your answer will be NO.

*Please note that if **ANY** of the questions above have been answered in the affirmative **(YES)** the student will need to complete the full ethics clearance form (REC-H application) and submit it with the relevant documentation to the Faculty RECH (Ethics) representative.*

and hereby certify that the student has given his/her research ethical consideration and full ethics approval is not required.

SUPERVISOR(S) — 25 May 2018 **DATE**

p.p. **HEAD OF DEPARTMENT** — 05 June 2018 **DATE**

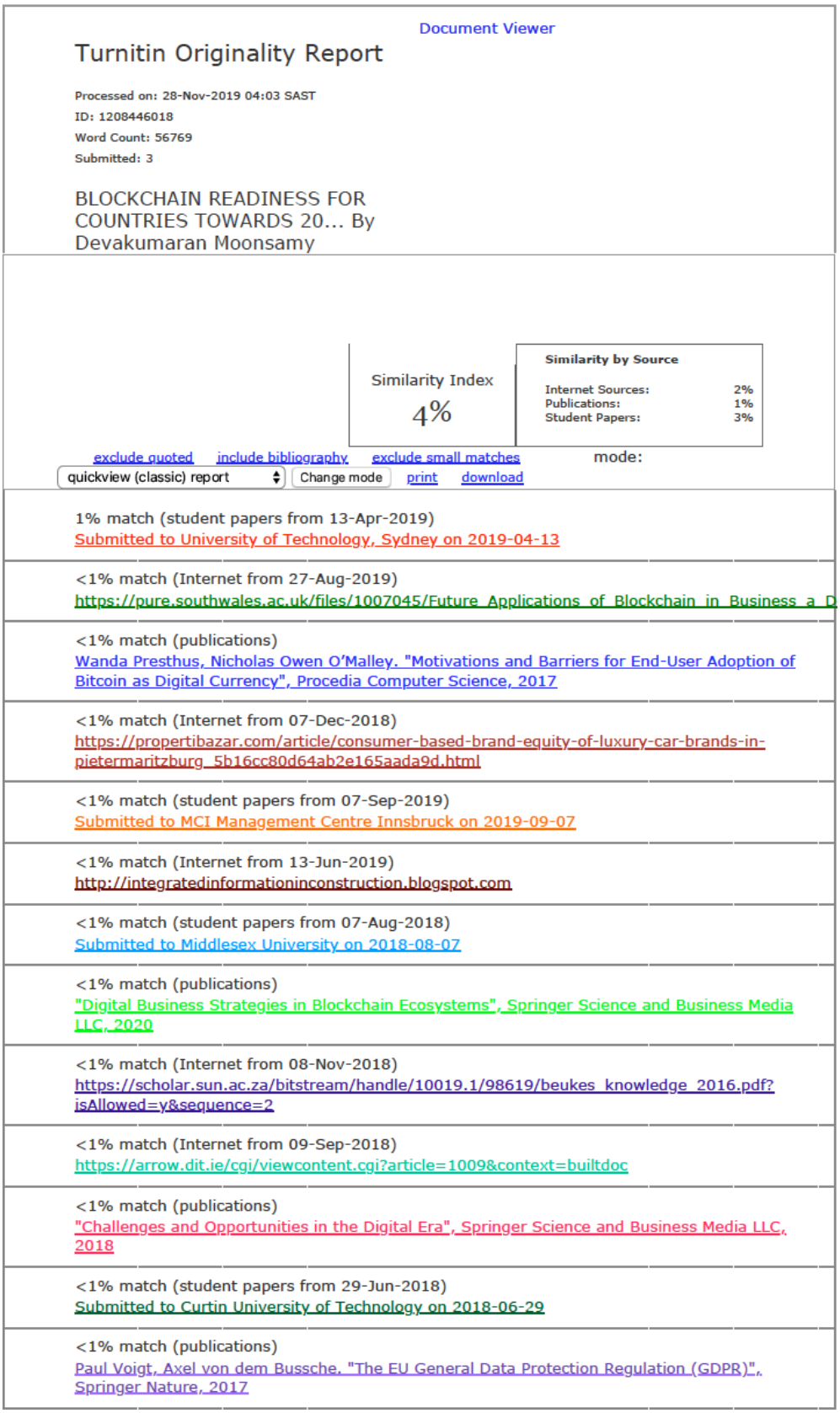
STUDENT(S) — 24 May 2018 **DATE**

Student(s) contact details (e.g. telephone number and email address):

Mobile Number: 073 036 7333 Email: moonsamyd@gmail.com

Please ensure that the research methodology section from the proposal is attached to this form.

10 Annexure 4: Turnitin Report



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