

***The impact of BlockChain on a South African top-tier
Bank's operational efficiencies***

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Plagiarism Declaration:

I, Thihe Khaole, declare that this research article is my own work except as indicated in the references section. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at Wits Business School, University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.



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_____29th May 2019_____

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Abstract:

Traditionally, banking transactions have been maintained within ledgers with different parties maintaining copies of their own ledgers, resulting in inevitable disputes. These disputes are minimised by utilising intermediaries, such as banks that are able to assist but at a cost, added on to overall business costs. BlockChain has become one of the most exponential and disruptive technologies of the last decade, and as a result, its adoption within financial services, specifically commercial banking, has grown in this period. The purpose of this study is to analyse the impact of BlockChain enabled solutions in their ability to enable operational efficiencies within a South African bank. This impact then assessed based on respondent groups that were surveyed separately and analysed in parallel. The last few years have seen the growth of distributed ledger technologies, least of all through multiple digital currencies and adoption for transacting in them across service providers. With the advent of technologies like BlockChain that seek to minimise the involvement of third parties and intermediaries such as banks, how banks embrace the technology to remain relevant and necessary is crucial to the commercial banking sector. It is proposed that there are benefits that can be achieved from resultant operational efficiencies as a result of embracing the technology within the South African commercial banking sector. This is primarily through the possibility of enabled efficiencies through banking use case adoption, including but not limited to use cases such as regulatory reporting process automation and asset loan provisioning through simplified KYC (know your customer) processes.

Keywords: BlockChain; operational efficiency; exponential technologies; smart contracts; streamlined processes; digital currency; distributed ledger technology; commercial banking

Acknowledgements:

I would like to thank my supervisor, Dr Johnny Manamela Matshabaphala, for his continued guidance, support and patience with me as I found myself through this advanced research project process. It is through the leadership of individuals like you that I believe more than ever that “I am not lucky, but rather blessed” to have been afforded the honour of your mentorship on this journey.

I would also like to thank close friends and family such as Edison Mazibuko, Christopher Kistasamy, Nkosana Roda and Benedict Mathebula for their support through the most challenging stages of the process and for playing a significant role in enabling me to achieve my research targets. Your support has not gone unnoticed, and I am grateful to you for your enduring support.

I would like to give a special thanks to my wife, Siyabulela Ntombentsha Khaole, for her unwavering emotional, spiritual and psychological support, as well as her guidance through this entire process. She is indeed my pillar of strength and the most authentic leader I have ever encountered in my life. This entire journey would not have been the same without the blessings that are Amogelang and Arabile, my daughters whom I love dearly. Through them, I am learning more and more every day how to be the best that I can be, and I look forward to additional vital lessons in the future. This has been an incredible journey in which we have all grown as a family together, enabling us to be stronger and undoubtedly successful in the future.

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1 Introduction

Within South Africa (SA), commercial banks are adopting BlockChain teams to create solutions that can improve operational efficiencies, streamline processes, deliver products and services cost-effectively and generate returns for their shareholders. This is achieved by development of in-house BlockChain teams as well as through securing the services of financial technology (FinTech) companies to design innovative solutions that disrupt the traditional banking system, and in the process bring some standardisation to back-office functions (Sharma, 2016).

The detailed analysis of BlockChain as a concept was introduced in 2008 through the proposal of a digital currency called Bitcoin in an article by Satoshi Nakamoto, where he outlined how this peer-to-peer digital currency would work and how it would solve the problems of trust between two parties transacting in digital currency (Shuyan et al., 2017). This further culminated in additional research on the topic and years later in 2015, three phases of BlockChain were released through a Bretton Woods white paper that proposed how the technology would be developed. Firstly, BlockChain 1.0 would focus on encrypted digital currencies reflected in the application known as Bitcoin, but also in other crypto-currencies; BlockChain 2.0 would deal with smart or intelligent contracts utilised in financial and economic markets and the contracts within these markets (loans, intellectual property rights, stocks and bonds) and BlockChain 3.0 would focus on how the technology could improve public services as a whole (Shuyan et al., 2017).

Within banking, BlockChain 2.0 and BlockChain 3.0 would be most applicable, facilitating process enablement capabilities that are built on the backbone of BlockChain technology which has the potential of significant efficiency gains (Cocco et al., 2017). BlockChain 1.0 would potentially follow, dependent on the regulatory landscape around digital currencies and how these would then be adopted by the banking industry in South Africa and abroad. This will be achieved through reduced duplication in record keeping, eliminating the need for reconciliation (Cocco et al., 2017), as well as allowing for the banking organisation to revolutionise their operations once transformed by the benefits of incorporating BlockChain into their operations (Davidson et al., 2016).

Computerisation of transactional processes of the past that involved recording transactions has not necessarily eliminated problems with these processes but in some instances, has potentially made the problems worse, hence there is a prevalence of a constant requirement for security and risk management within the entire value chain.

South African commercial banks need to ensure that the teams in which they invest internally are incentivised to ensure long-term commitment through benefits and rewarding work experience. This is the only way to develop the capability for the long term while the short to mid-term allows for outsourcing of skills to skilled service providers who can assist in introducing the technology and its benefits in a steady but effective manner.

1.1 Research Problem

South African banks face the reality that BlockChain as a technology is revolutionising the commercial banking sector with exciting and promising use cases providing the prospect of transforming how financial transaction integrity is maintained, how essential financial sector information is shared and how financial technology innovation is embraced. Failing to adapt will potentially lead to disruption from FinTech companies embracing technology to deliver services cost effectively and more efficiently. To survive the disruption, a transformation in the industry is required, as the commercial banking industry seeks to maintain top-line growth and continued relevance as trusted intermediaries.

This has been achieved despite the lack of precise regulation of this decentralised technology and clarity on how certain use cases for the technology will be controlled, specifically in the case of crypto-currencies. The problem for South African banks is that failing to adapt to this changing landscape, will ultimately result in loss of market share across multiple banking services, and an inability to become more innovative in how they facilitate payment and settlements in a transparent, efficient, cost-effective and secure manner; all of this while increasing operational efficiencies and executing on evolving but relevant strategies that result in a positive impact on business drivers. Key to their analysis of the benefits of BlockChain to improve operational efficiencies will be driven by internal efforts across commercial banking and future engagement in the industry to evaluate the technology in live, time-bound testing conditions under regulatory oversight.

1.1.1 Environmental Analysis

For BlockChain to excel and grow in SA, there has to be careful consideration for the ailing economy and overall economic conditions (Davidson et al., 2016), as well as with the fit for purpose capability of this technology for solving business problems for the banks within South Africa. Understanding the business issues that banks experience is the only way to drive the value proposition that can be delivered to them that enables their processes (Cocco et al., 2017), through customised solutions that comprehensively solve these specific business problems. Banks are taking longer to adopt BlockChain significantly, but are exploring its opportunities incrementally with caution, understanding that to achieve operational efficiencies with this technology, digital innovations must be enabled and additional technologies, such as artificial intelligence and predictive analytics, better understood (BusinessTech, 2018).

BlockChain is not merely bitcoin or a crypto-currency but instead, a platform that can assist banks in automating processes, ensure that they are streamlined and simplify the tasks of their workforce to deliver better solutions for their customers (Cocco et al., 2017). With the competition increasing in the banking industry, this provides an opportunity for competitive advantage that can be leveraged (Powell, 1997). BlockChain provides the opportunity to transform how financial transactions are conducted and, in the process, challenge the status quo in how banks interface with other third parties and also with security exchanges (BusinessTech, 2018).

1.1.2 BlockChain - the Silver Bullet – Really?

Blockchain is multi-faceted and emerging at such a rapid pace that it is regularly confused as the next great technological solution to all business issues. The reality, however, is that there is not widespread comprehension of its full benefits to make such bold statements. There is also a perception that despite its base of cryptographic algorithms, it has security flaws (Xu, 2016), as was discovered in the Secure sockets layer protocol (Promodou, 2017) hence why its real impact is unknown, and there is some level of caution towards adoption. The aim should be instead to understand the scope of use cases and what these bring to the table in terms of improvements, new ways of working and efficiencies.

Mostly, the aim should be to understand how banking strategy is executed successfully as a result of technology adoption (Duygun-Fethi et al., 2009) in enabling essential business functions and overall strategy. Thus, this will enable an understanding of use cases that lower administration costs and introduce process efficiencies, taking away the time consuming and paper-based processes of the past and shortening long payment cycles within a remittance eco-system.

BlockChain is not the solution to all business problems, but it provides benefits that could lead to not just reducing operating costs and reconciliation errors but in the long term, assist in transforming the commercial banking industry.

1.1.3 Journey to operational efficiency enablement

The researcher explores to what extent BlockChain can influence digital transformation in a commercial bank and specifically introduce operational efficiencies through its capabilities while delivering on the bank's overall strategic imperatives. The purpose is to conduct an analysis of whether BlockChain technology and its application through innovative solutions to business problems, leads to more efficiently run operations that deliver services and products more efficiently in a top tier bank (Lakhani et al., 2017). With a wealth of use cases, the question at hand is can these use cases truly transform banking organisations into insight-driven organisations that utilise their benefits to drive operational efficiencies. "Unlike the internet alone, BlockChain's are distributed, not centralized; open, not hidden; inclusive, not exclusive; immutable, not alterable; and most importantly secure. BlockChain gives us unprecedented capabilities to create and trade value in society" (World Economic Forum, 2017).

BlockChain use in commercial banking will in all likelihood need to evolve into an enabler, working within existing banking systems and augmenting their effectiveness as opposed to replacing them. In this process, it will reduce the traditional reliance on intermediaries, replacing them with interconnected infrastructure that generates efficiency gains, eliminating recording of duplicate records and enabling faster bank to bank settlements (Cocco et al., 2017).

1.2 Research Scope

The core focus of the research is the opportunities, risks and challenges posed by BlockChain in enabling operational efficiencies in a South African commercial bank. Through this, how the different BlockChain technologies can be utilised for developing solutions to identified business problems in banking operations is outlined. This will take the form of understanding inside out (Top tier bank employees) and outside in (Industry specialists, enthusiasts and generalists) perspectives.

The commercial bank that will be the focus of the inside out analysis is a South African financial services group and is one of Africa's biggest lender by assets and has been in operation within South Africa and Africa for over a hundred years. The commercial bank will be referred to as ComBank to maintain the anonymity of the bank as well as the respondents who assisted with the research. ComBank employees, through experience working in the bank, can identify the recurring themes that they have and currently experience, how these themes form into solutions and what the reoccurring issues are that are being dealt with across the business (Cocco et al., 2017).

1.3 Underlying Structure and BlockChain Basics

The blockchain is the concept of a chain of data blocks being digitally connected and each block containing a store of transactions in a hierarchical format, a randomising number making keys more random and a time-stamp indicating the time transactions were committed (Pirlea, 2016). The blocks themselves are interlocked through hashes (data strings that are the result of encrypting clear text with a private cryptographic key), and each of the data blocks contains the hash of the previous block. This enables the integrity capabilities to be maintained for each and every block of data in the BlockChain (Pirlea, 2016).

The global trend is that communities of practice are being formalised within commercial banks and technical resources are being dedicated towards the cause of exploring the benefits of BlockChain technology and developing the use cases for these within these banks (Ernst & Young, 2018). There are companies architecting labs that will devote themselves to BlockChain research, and thorough analysis of the potential benefits with skilled resources made up of multiple disciplinary backgrounds (Deloitte.com, 2018) and they are sharing this

knowledge with banking clients to ensure that the outcomes of their research, can benefit the commercial banking industry as a whole.

BlockChain, due to its structure, can assist in simplifying administrative tasks, streamlining key business processes and ensuring that there is a structured way of providing trust for transactions between parties.

1.4 BlockChain – A Global View influencing SA adoption

To get the context of BlockChain effectiveness and adoption, the researcher analysed BlockChain global adoption, funnelled down to adoption within Africa and ultimately, adoption within the South African (SA) commercial banking sector. In certain African countries, as is a more significant problem globally, there is a need to combat terrorist actions and the mechanisms with which these networks are structured and financed. As a result, to avoid the situation where specific systems, such as the Hawala systems in Somalia, being shut down despite being a crucial way of transferring money for Africans to relatives in other countries, crypto-currencies could be utilised to bypass traditional banks (Scott, 2016), in the process, achieving the ability to enable small-scale international commerce by allowing African based merchants in poor rural communities to sell their services or goods in international locations (Scott, 2016).

As BlockChain adoption has increased globally, these global efforts are being utilised to guide continents, such as Africa, and countries, such as South Africa, to increase their adoption and explore use cases that deliver business value. Foundations such as the Linux Foundation Hyperledger project and cross-border funds moving distributed ledger solutions have been created specifically to focus on the operational efficiencies and cost savings that can be achieved from leveraging this technology in commercial banking environments and advance its use through value inducing initiatives (Cocco et al., 2017).

This will enable financial reporting savings, streamlined data governance and improved clearance and settlement processes along with other benefits to be surfaced and discussed with multiple parties globally. There are parts of Africa; however, which are looking beyond this to further use cases as technology communities within Africa are now finding other potential uses for the technology (Bizimungu, 2018).

As things stand, in many African countries, BlockChain based services are being introduced and utilised by a significant population of all adults across the continent (Lovells, Hogan, 2016). To convince more people to buy into its benefits will require a market being created, usage of the crypto-currencies being adopted widely in poor communities and the ability to trade the bitcoin or other crypto-currencies back into local currencies (Scott, 2016).

Therefore, for these countries that have significant percentages of their populations being poor and historically not included in the economies of their countries due to their limited resources, such systems present an opportunity to finally obtain financial inclusion (Jaag et al., 2016). How widely the technology will be adopted and whether any funding that is geared towards unlocking these benefits will be utilised appropriately still remains a concern and a key focus area.

1.5 Hypotheses

- 1) BlockChain solutions enable commercial banks to obtain a competitive advantage through their adoption and the proliferation of their complex business problem-solving use cases.
- 2) There is value being delivered through BlockChain solutions, and this can ultimately translate into increased efficiencies in how operations take place across multiple divisions and business units within a commercial bank.

1.6 Research Questions

- 1) Is there an impact on operational efficiencies of a Commercial Bank as a result of utilising BlockChain technology? (Survey A and Survey B)
- 2) What is the effect of BlockChain on the strategies of a commercial bank in the South African context? (Survey B)
- 3) Are the BlockChain banking use cases currently being developed and executed future proof considering the exponential nature of BlockChain Technology? (Survey A and Survey B)

2 Literature Review

2.1 Theoretical Framework - BlockChain provides a competitive advantage

The researcher analysed the theory of “information technology as a competitive advantage” (Powell, 1997), when this technology is BlockChain and whether its application results in operational efficiencies within a top-tier South African (SA) bank. In essence, the analysis looked at the linkages between BlockChain technology and a company’s strategy execution, as a result of operational efficiencies being attained (Duygun-Fethi et al., 2009). The theory outlines the risks and benefits of disruptive technology and how in making banking systems more efficient, they enable cost benefits (Tapscott , 2017) as well as operational efficiency benefits. Additional literature on the theory focusing on how these benefits or challenges lead to successful banking strategy execution, cost reductions and ultimately, firm performance is considered (Cocco et al., 2017).

Currently, there is the ability to execute a single transaction across traditional payment channels, permissioned and permissionless BlockChain’s as well as ledgers that are centralised (Del Castillo, 2017). This means that costs spent on streamlining processes separately across payment channels can be better utilised, achieving economies of scale and thus disrupting the traditional models (McDonald et al., 2016). There are multiple technologies that can be considered for banking use cases, such as forecasting when a lender will go into bankruptcy and through predictive analytics, analysing a BlockChain enabled dataset (Duygun-Fethi et al., 2009). The researcher explored literature pertaining to cryptocurrencies and BlockChain in banking with the purpose of understanding a bank’s exposure to BlockChain technologies and also to understand how the employees who use these technologies interact with them. Further to this, whether in these interactions, there are patterns being reused (Banker et al., 1990) and utilised to drive operational efficiencies. Whereas literature has explored economic efficiency and efficient service, this research focuses on operational efficiency, and whether in embracing the benefits of the technology, these efficiencies can be achieved (Cocco et al., 2017).

Top management within top SA banks are more than in the past, ensuring that programmes are in place and that these programmes involve vital parts of the organisation driving towards a common goal (Hawthorne, 2018). The research analyses whether these goals are achieved through cost-effective delivery of products and services which allow for operational efficiency in these banks, through technology solutions solving complex business problems (Powell, 1997). The theory further evaluates BlockChain technology, and whether in being able to process financial transactions in a very efficient way, its use case applications lead to operational efficiencies (Banker et al., 1990), savings and thus, a successful way of using technology to drive impactful strategic growth.

The theory is that technological innovations are critical to the banking industry in transforming the financial technology industry (Guo et al., 2016) and finding ways to achieve a strategic advantage that can be passed on to the customer in terms of savings. These downstream benefits are merely a result that, despite not being the key focal point, can materialise nevertheless and thus must be factored into the process despite not being the primary objective of the research. The specific impact of this technology (Fanning, 2016) is interrogated, and the drivers and metrics pertaining to this impact and how it can be measured and leveraged.

Through utilising BlockChain enabled solutions, there is the possibility of transforming clearance and settlements of payments faster than an automated clearing house (Guo et al., 2016) and in this process, the further possibility of lowering costs, and benchmarking such results against traditional payment systems. A compelling feature of a BlockChain based solution is that in the value it delivers, it enables collaboration and teamwork to solve complex business problems, and in this process, breaks down the tower structure of a hierarchical organisation (Powell, 1997). This can drive the strategic buy-in across all levels and avoid strategic drift within commercial banks, and through internal campaigns, can encourage employees to explore BlockChain enabled applications that allow the monitoring of efficiency metrics, presenting customised analytics as well as additional use cases (Cocco et al., 2017).

The use of BlockChain technology at the core of banking operations can guarantee that the financial transactions processed are reliable and genuine while not wavering from a strategy of cost reduction and other operational efficiencies (Guo et al., 2016). Within banking finance operations, BlockChain based systems can be utilised to potentially drive up to seventy percent (70%) cost savings that are realised through accurate reporting as a result of streamlined processes, increased data integrity and reliability and ultimately, an efficient execution of the bank's operational processes (Cocco et al., 2017). To ensure that the products or services that are delivered to customers as a bank are of immense quality, effective service delivery is vital because if services are delivered efficiently, then profitability will follow along with shareholder support (Harker, 2000).

This leads to transparency and auditability of financial transactions and compliance based cost savings as a result of utilising digital identities (Cocco et al., 2017) to group and better manage customer data and resultant personally identifiable information compliance (Davidson et al., 2016). Without centralisation, as is traditional with banking, a distributed architecture will alleviate the need for efficiency which is limited to a transaction or a centralised clearing and settlement house (Guo et al., 2016).

To conclude the theoretical framework focus area, the researcher is clear that with all considerations for the benefits and the possibilities of BlockChain, what the research components highlight, are that there is always a risk in adopting technologies without clear outcomes defined. In a banking environment, there are inherent banking specific risks operationally, credit risk from customers potentially defaulting and market risk factors that cannot be controlled by commercial banks. The critical element is that operational risks need to be managed as not doing so will result in an inverse relationship between economic efficiency and operational risk being highlighted to the bank through management reports (Cheng et al., 2018). Utilising information technology efficiently can lead to many strategic benefits which can be linked to direct operating cost savings and therefore are quantifiable (Banker et al., 1990).

2.1.1 Crypto-currency Review

The BlockChain system has evolved from once being only focused on financial transactions and crypto-currencies to a system that maintains its trust model, eliminating third parties and intermediaries (Pirlea, 2016). It was developed by Satoshi Nakamoto who envisioned a peer-to-peer electronic transaction and payment system that had no need for additional third parties (Pirlea, 2016). It has inherent weaknesses, such as lower transaction amounts being infeasible (increased transaction costs to mediate), no possibility of non-reversible transactions (mediation needed for disputes) and no anonymous transactions (therefore personal information to be collected by a third party) (Abu Bakar, 2017).

The research provides thought leadership on how the technology as a whole and not just as a crypto-currency use case can benefit the South African commercial banking sector and enable operational efficiencies which in turn, lead to business drivers being delivered on (Cocco et al., 2017). There is significant global adoption primarily from a crypto-currency perspective, through crypto-currencies such as Ethereum, Ripple and Bitcoin. Banks can allow write access to their networks to trace transactions and publicly verify and view them with a technically superior technology like BlockChain, but they require adoption (Francisco et al., 2018). This is because, without widespread adoption by users, the technology value is lost and thus not useful for delivering the strategic objectives of the organisation. Key to enabling the use of BlockChain within a commercial bank is to ensure to the maximum possible extent that it is easy to use in the use cases where it is adopted. Employees will not utilise it if it is deemed to add complexity and instead introduces additional effort than existing processes (Francisco et al., 2018).

To unlock value and operational efficiencies, an evolving banking strategy is required to ensure enablement of secure, seamless and scalable access to systems of record controlling who can view what, but allowing banking customers' simplified access to their transaction and investment balances and historical analysis (Mulligan et al., 2018). Banks can benefit from the lack of regulation with innovative solutions for quick settlements, collateral management with the utmost trust and restructuring banking such that the need for clearing houses is removed (Cermeno, 2016).

These benefits lead to competitive technological advantages (Powell, 1997) through customer centricity in enabling innovative banking and this enablement can be achieved through leveraging BlockChain capabilities (Guo et al., 2016). The crypto-currencies in themselves are merely a payment system facilitated through electronic transactions, and that is based on cryptographic algorithms working in a trust model. As transaction costs have fallen and the abilities within the data processing remit have grown significantly, there is a much better ability to provide innovative and technologically driven products and even services such as those provided by BlockChain technologies (Trautman, 2016).

There are some that still question BlockChain enthusiasm and why there is a hype around it as a technology and what it presents in terms of opportunities (Dawn, 2015), but there are frameworks for distributed ledger technologies such as R3 Corda that through better understanding, can change such perceptions (Ward, 2018). R3 Corda is specifically designed for the financial services industry, making it the candidate for banking strategy enablement through this technology, unlike Ethereum which can be utilised for multiple applications and transactions (Valenta, 2017). Operational efficiencies can be attained by allowing for new benefits (Okoye, 2017) such as more accurate risk profiling (that can be utilised to determine whether credit should be afforded to a banking client) and efficient information exchange (between banks and third parties to facilitate customer transactions and compliance). Payments made through crypto-currencies are entirely traceable (Gupta, 2017) and hence, the security benefits for allowing this traceability is of value to banking customers. Within banking operations, when one decides to purchase or lease a property, it is not merely the lenders and banking providers of those funds that can benefit from BlockChain technology, but also the potential buyers or those who wish to be leasing those properties (Tapscott, 2017).

In conclusion, banking strategy can have a far-reaching impact and can involve scenarios in which money transfers are made not only in traditional currencies but can also occur as crypto-currency transfers (Jaag et al., 2016). As these monies are transferred, the resulting efficiencies gained through using smart contracts for establishing settlement instructions, trigger the transaction commencement and pre-defined business contract terms that allow funds to move due to certain “if-then” conditions being met (Cermeno, 2016).

2.1.2 Banking Review

Conversations with senior executives in the top banks globally who have been introduced to BlockChain toolkits have shown that there is more and more dedication of resources and finances to this technology in some way or another (Mulligan et al., 2018). The research provides a contribution to management knowledge that outlines whether BlockChain solutions lead to a bank's strategic direction being influenced as there are tangible benefits derived in how the bank maintains operational efficiencies, delivery of products and creation of services for consumption by its customers in the most cost-effective manner possible while still ensuring the high quality of its products, service and support (Fanning, 2016).

In order to have a competitive advantage through BlockChain technology, commercial banks require a value proposition that enables them to utilise BlockChain technology to improve their operations to avoid being removed as intermediaries in such lending processes. The processes to achieve this can be streamlined through BlockChain adoption, simplifying how services are provided as well as the time in which they are provisioned. Real-time transaction processing can be achieved with increased trust and shared record keeping (IBM Corporation, 2016). Delivering banking services by spending less frees up funding for marketing and other expenditures which can then be passed on to customers showing value from BlockChain technology (Tapscott, 2017).

To conclude the banking review, the researcher has outlined that as BlockChain adoption grows, more and more commercial banks in South Africa are considering utilising the technology to enable transferring of remittances, leveraging the cryptographic and security capabilities inherent in BlockChain (Mulligan et al., 2018). In obtaining this additional business and customers, the ability to service them more efficiently through effective, customised and value providing services is likely to improve for the better.

3 Research Methodology

It is possible that research that utilises the two surveys can be seen as non-participant observation based research due to the fact that the researcher is not present when the respondents take the surveys and the respondents take the survey without direct interaction. This possibility based on the assumption that views from those who understand the subject matter better, though prone to bias, will result in key insights from the survey responses. The researcher has an alternate view that though the variables can be approached as observable, there was no one specific activity, process or task that the respondents were subjected to. Their views were sort regarding operational efficiencies achieved through BlockChain technology enablement achieved through carrying out different types of processes or tasks in a commercial bank. The researcher did not observe them carry out these tasks or processes and instead used the results to analyse to what extent these processes and tasks when coupled with BlockChain technology yielded operational efficiencies.

The results were also not necessarily based on respondent views directly after carrying out a process or task using BlockChain technology, but rather on their experience in carrying these out with such technologies and what views they had about the effects of this in enabling operational efficiencies. The researcher avoided direct observation as it can be prone to inaccuracies and bias, since people often behave differently when they are aware that they are being observed. Even indirect observation would be unable to meet the respondent ethical assurances and not be achievable without ComBank senior management approvals.

The drive to contribute to management knowledge on how this technology can assist banks in transforming their strategies while remaining competitive and efficient was a significant driver for the research. There is an allowance for qualitative responses within the surveys adopted by the researcher through an exploratory approach (structured and analysed thematically); however, the majority of the responses are linked to quantitative information that was sourced and approached from a descriptive research perspective.

3.1 Study basic approach and assumptions

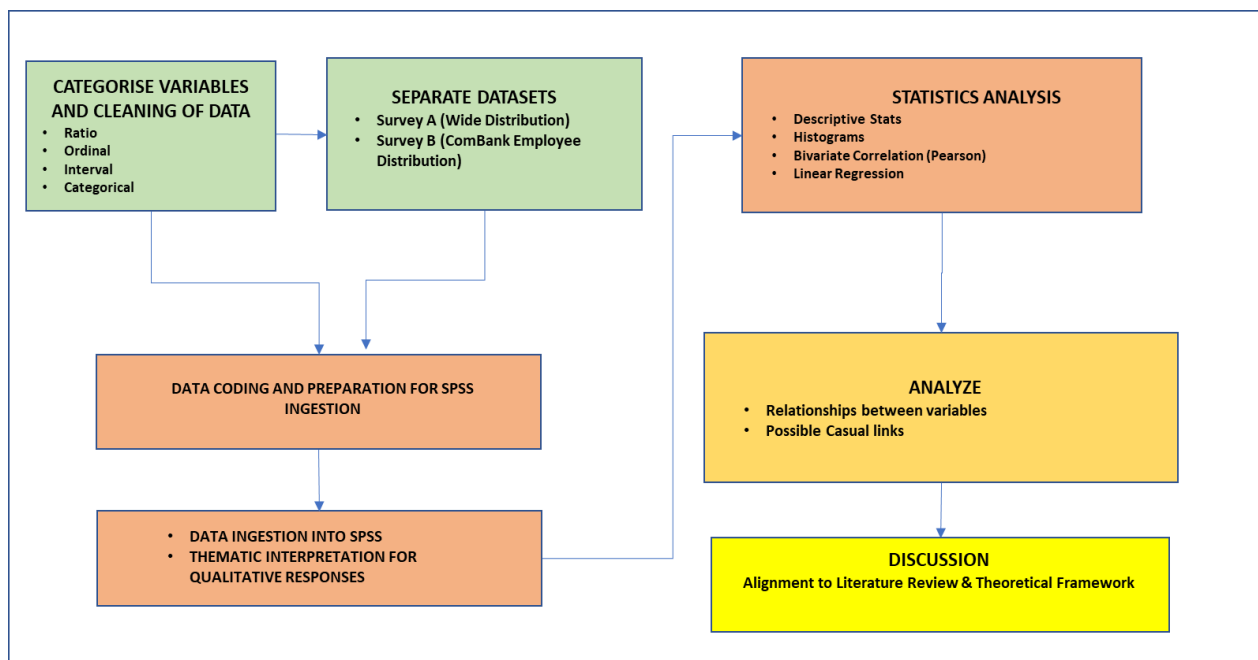


Figure 1: BlockChain Research Methodology Flow Diagram

The study focuses on the impact of BlockChain on the operational efficiencies of a top tier South African commercial bank, specifically, in terms of enabling these operational efficiencies regardless of whether they pertain to improved capital optimisation, reduced error handling and reconciliation, increased transparency, reducing costs through streamlining of processes or any other specific operational efficiency focus area.

The researcher explored the impact of BlockChain and provided insights into how it is changing the way that traditional banking is approached, what digital strategies are required for the commercial banking sector as well as the benefits of innovation introduced into banking environments to obtain a competitive advantage within the industry.

Survey A focused on obtaining objective views from a wide range of respondents through distribution across multiple channels (Social Media, Business School post-graduate students and other public fora) who may be generalists, enthusiasts and experts of BlockChain technology. In eliciting such views from the respondents, the researcher was able to abstract generalisations from the opinions put forward by the respondents as the questions focused on multiple aspects of BlockChain technology, that combined, can be analysed in terms of operational efficiency enablement.

Survey B was an experience survey focusing on obtaining the views of employees of ComBank and ascertaining to what extent they have not only been exposed to the technology, but also how it has improved the banking operational efficiencies, further to this, to what extent the provided use cases are future proof and can be utilised well into the future in the process enabling a potential competitive advantage and revised strategic direction. Ultimately, the critical focus drilled down to the impact on enabling these efficiencies, and this was further analysed while utilising the literature review to guide the positioning of the overall approach.

The overall study was primarily a descriptive study with allowance for certain exploratory elements. Within Survey A, there were two questions that allowed for open-ended responses and the remaining nine questions focused on structured pre-determined option responses. Therefore a small part of the study was unstructured with a thematic design for how the data collected would be analysed whereas the majority utilised simple random sampling with structured questions and clarity on design for how the data collected would be analysed (Explorable, 2009).

In conclusion, from a methodology perspective, two surveys were utilised with slightly different approaches. Simple random sampling was utilised for Survey A with accessibility to the respondents obtained through multiple channels as per BlockChain methodology flow diagram. For Survey B, convenience sampling was utilised as a way of ensuring ease and convenience for the researcher, specifically in relation to geographic proximity, availability at a given time and access to ComBank employees through the relationships the researcher has within the commercial banking sector (Ilker, 2015). Survey B focused on the insights of banking employees as the identified research subjects who were most likely to have had first-hand experience or exposure in the benefits of BlockChain technology and whether it had an impact on operational efficiencies in their banking environment (Explorable, 2009).

3.2 Data collection design

The key pillars that the research was based on is a two-pronged survey approach whereby the surveys were designed to extract the most valuable information from study participants while utilising literature reviews as secondary data to gain additional knowledge on BlockChain technology and its impact. Online reports were explored to understand better what had been previously published about the topic, including but not limited to web-

published articles, case studies and existing pilot study data. It must be clear however that the descriptive research was supplemented by that which comes before it which is the literature review study that sought to understand the subject matter and obtain views articulated by many globally who have collected data, analysed and reached conclusions on BlockChain technology (Marshall et al., 1999).

This was in contradiction to some popular views that literature review and its thorough analysis, prior to collecting data and analysing it to gain insights would undoubtedly influence the structuring of the analysis and the conclusions formed as a result (Marshall et al., 1999). Despite the potential of such influence from the literature review, the researcher utilised a combination of the literature review, web articles, journals as well as the respondent input to form conclusions and analyse whether the original hypotheses applied or not.

A theoretical framework linked hypothesis was formulated stating that these operational efficiencies are derived from BlockChain as it provides a competitive advantage in the operational efficiencies realised through its adoption and proliferation of its use cases in banking. To determine whether this was genuinely the case, feedback from survey participants was required, and once the data from the survey had been collected, it was analysed to understand the opinions of the participants and whether the views are subjective or objective.

In concluding the data collection design, the researcher utilised both data collection approaches for both primary data (experience surveys) and secondary data (journals, websites and reports). The reasoning behind not utilising only primary data is that BlockChain is a new technology that came into the mainstream technology world only in the last decade and there is a lot of value in the material produced in the last decade to supplement the views of the research subjects. The primary data was fundamental to the research due to the likelihood that the secondary data did not directly answer the research questions posed by the researcher and may not have been collected in South Africa focusing on operational efficiencies enabled by BlockChain technology, thus not being fully applicable to the research being conducted (Hox, 2005).

3.3 Population and sample for the study (With Justification)

The target population size of ComBank in terms of its employees is 55 000 across its African operations in total. This population size is however not representative of its South African operations as the population size for the South African operation is less than the overall African operations population size.

Therefore, the assumption made was that the South African operations comprised 60% of the total African workforce and therefore, the South African operations would have a population size of approximately 33 000. This is not a small population size and therefore the ability to include all of the employees in the study is not feasible. The sample of the population of this study stood at a total of 136 respondents across the two separate surveys. This equates to 55 respondents from across South Africa (Survey A) and 81 employees of ComBank (Survey B).

There are multiple channels of survey deployment with an approach of utilising WITS Postgraduate students, social media and public fora adopted. As a result of these various channels being used for delivery of the survey and collection of the data, it was possible views would originate from varying knowledge capabilities amongst respondents, specifically for Survey A. For Survey B, a single channel was utilised to engage the ComBank employees via email through the assistance of other ComBank employees. The sample demographics were not limited based on gender, age, occupation, department, BlockChain understanding or any additional factors.

3.4 Research instrument

The research instrument utilised was a survey with critical questions to understand the impact of BlockChain on banking business operational efficiencies. Due to the size of the data responses required, a survey was selected as it allowed for the packaging of questions in a structured manner to a research subject base that had varying levels of exposure to BlockChain. It is non-expensive to create a survey and to send it out for feedback, review it and the simplified manner in which one can reach subjects across an entire country along with the ease of obtaining statistical significance is an additional justification for why surveys were utilised for the primary data research (Sincero, n.d.).

3.4.1 Survey A focused on the following sub-topics

- The level of understanding of BlockChain Technology
- Willingness to transact in different ways and adopt digital wallet services
- Experience in working with BlockChain enabled solutions driving operational efficiencies
- Impact of BlockChain on Commercial Banking Strategies
- Innovative Use Cases for BlockChain Technology in commercial banking
- Long term impact of BlockChain and particular transacting preferences

3.4.2 Survey B focused on the following sub-topics

- Period of employment within ComBank for each surveyed employee
- Department in which the employee works
- Age and Gender of the employee
- The level of understanding of BlockChain Technology
- Innovative Use Cases for BlockChain Technology in commercial banking
- Strategies that deliver the most value in the enablement of BlockChain in commercial banking
- Future Proof capability of BlockChain and how it is utilised in the employees' banking environment
- Long term impact of BlockChain in Commercial Banking

3.5 Mode of data analysis

The approach taken by the researcher was to adopt a quantitative research approach in which surveys were sent out to research subjects, their responses were then categorised, data coded or converted into a numerical format and then statistically analysed to summarise and describe the quantitative data which was then presented, utilising graphs and visualisations. Where the questions allowed for open-ended responses, the responses were collated and then thematically analysed once grouped into specific themes and presented as such. The entire process of data analysis went through the process of data requirements specification, data collection, data processing, data cleaning and ultimately an analysis of the data.

The respondent opinions were very important and not only secondary data or the researcher's views based on analysis. Focusing on the views and analysis of the researcher alone can lead to subconscious opinions or biases which ultimately affect the analysis. This was the reason for the researcher utilising their views from the analysis, but also allowing the views of the respondents to provide analysis insights.

The researcher went through the process of developing a theoretical framework that was aligned to a hypothesis that stated that utilisation of BlockChain technology-enabled operational efficiencies within a top tier South African bank and these efficiencies then potentially provided a competitive advantage to the bank in question. The data that was collected was analysed utilising an inductive method that involved the development of a hypothesis and theoretical framework, then moved on from the theoretical framework and used the hypothesis and the collected data to confirm the researcher's findings (O'Byrne, 2016).

Once feedback was solicited, it was analysed to ascertain if there was a significant impact on banking operational efficiencies through the emergence and adoption of this technology and once a view was reached; these findings were tested for frequency, correlation, statistical significance and normality. Such validity seeking through this process determined if the original hypothesis of there being a competitive advantage provided through utilising the technology materialising in an increase in banking operational efficiencies is correct and whether the data supported this.

3.6 Limitations of the study

Exclusions from scope include, but are not limited to evaluating the benefits of BlockChain in insurance, supply chain processes, smart cities, the entire banking industry (including all top four banks) as well as whether there is the existence of an impact pertaining to human resources, organisational technology landscape or even internal employees not involved in the back office functions. While understanding these capabilities is critical, accepting that a multi-stakeholder approach is necessary is pertinent and the only way in which the era of this disruptive technology can be embraced to achieve transformative results (World Economic Forum, 2017).

As ComBank employees engaged to assist with the research wanted ethical assurances and needed to obtain internal senior management approval, the resultant research process was selected by the researcher. This research process adopted due to lengthy processes to obtain approvals proving extremely difficult to secure. Therefore no direct or indirect observations were utilised for this research.

3.7 Ensuring validity and reliability

To ensure the validity of the data that was analysed, the entire survey results were anonymised for all respondents (Elo, 2007), then this data was analysed per respondent ensuring that there was an analysis of the topics and themes emanating from the responses and how these aligned to the high-level research questions in Section 1.6. There had to be a reasonable number of topics and categories identified from the analysis of the data and how these aligned to the research questions, failing which, the study would be more involved and take a longer time (Morse & Field, 1995).

As a hierarchical structure then developed, with categories, sub-categories and relationships between the different categories, the analysis became more evident. This approach of structuring the data and analysing it in its broken down parts led to ensuring the analysis results were valid, and ultimately reliable to test against the original hypothesis (Morse & Field, 1995).

3.8 Ethical assurances

To gain trust and the ability to obtain information from subjects, the maintenance of their confidentiality regarding the views they have provided is vital. It allows them to willingly provide views without fear of any type of retribution for providing such data (Beghin et al., 2008).

Mostly, what is guaranteed is traditional confidentiality whereby the agreement is that data will be solicited but the identity of those providing this data not revealed in the final report (Tolich, 2004). The aspect that is usually less focused on is whether those who were all involved in the research are able to identify each other in the final research publication. In the case of this research, the ethical assurances extended to this less focused on area to

ensure that the survey participants and their views were kept confidential (Beghin et al., 2008).

This was achieved by not listing the name of the participants or even the specific commercial bank where the employees are employed and also not collecting as far as possible any data that could be directly attributed back to them in any way or form (Tolich, 2004). Since there was no information that if read by another subject completing the survey could be potentially damaging to any party, ethical assurances could be maintained to all who participate in the research (Tolich, 2004). This was further achieved by ensuring that there was no direct or indirect observations done as part of the research process. The views of those who enabled the processes for the bank were obtained as part of the research with the principal purpose of this being to obtain an understanding of whether the technology is widely understood, whether what it offers simplifies their day-to-day operations and whether this potentially results in a competitive advantage for the commercial bank.

4 Presentation of the Findings

To ensure that the research data was reflective of views from a wide variety of banking personnel who would have had exposure to BlockChain technologies and what impact it had on the operational efficiencies within their banking organization, Survey A was sent to a broader group through multiple channels as articulated in Section 3. It is however clear from the responses that there was a mix of generalists, experts and potentially non-experts who had some level of exposure to the topic for Survey A. Some of the responses were incomplete and some of the data had spelling mistakes which needed to be corrected, grouped into themes and analysed as such.

This is because the method used to engage them reached out to a broader audience and was not targeted at a specific user base. Further to this, the likelihood of reaching only specific banking employees, who had exposure previously to BlockChain technology solutions and could attest to them leading to improved operational efficiencies was lower than going directly to banking employees and engaging them. This was done by the researcher also to ascertain the effectiveness of targeting the desired user base directly, versus trying to obtain their views amongst a more diverse user base and across multiple engagement platforms.

The approach taken was to group the different variables according to dependent and independent variables and also to categorise the variables. Following this, the dependent variables were analysed for descriptive statistics including frequency tables, histograms as well as linear regression analysis looking at the correlation of variables and statistical significance of these correlations. The analysis of these dependent variables was done in relation to the set of independent variables and not focused on the analysis of the relationships of the dependent variables to one another.

4.1 Survey A (Multi-Channel Distribution)

Where there were no responses or the surveys were not completed in totality, in other words, where respondents started surveys and did not complete them, there were assumptions made on categorical variables whereby the responses were not fully completed. For example, where the response required a “yes” or a “no”, where there was no completed response, the assumption made was that “no” is applicable and the analysis was conducted with this as the

basis for analysis of incomplete data. Where the response related to gender-based data, the assumption made was that where a respondent did not add an answer, it was their right not even to have to select a non-binary, but to opt not to respond at all. For the age variable, the assumption made is that where there was no response at all, the data would be enriched with “18 - 25 years” entries as the category of those that may opt not to respond.

4.1.1 Respondent understanding of BlockChain (Independent Variable)

In soliciting views from the survey participants, the researcher wanted to get a full understanding of what is the general understanding of BlockChain technology. Out of a total of 54 surveyed participants, 43 of the respondents responded to the general understanding question. Of the 43 respondents, nine respondents had limited or no understanding of the technology and limited exposure to its benefits.

Theme	Ledger Technology (A)	Internet of things (B)	Digital Currency (C)	Revolutionary and Transactional (D)	Total Respondents
Respondents	11	1	4	15	31

Table 1: Survey A - Respondent Understanding Themes

The remaining 31 respondents listed responses that spoke to multiple use cases of the DLT, and these were varying amongst the respondents. This displays a mix of knowledge from the respondents, where their responses have been put into different themes or response groups. Within these groups, there is a representation from those who provided responses of 15 of the 31 respondents (48.39%) having the view that it is related to transactional use cases and is revolutionary in how it is executed, 11 of the 31 respondents (35.48%) having the view that it is a ledger based technology, four of the 31 (12.9%) respondents having the view that it is related to digital currency and one out of 31 respondents (3.22%) believing that it relates to the Internet of things.

4.1.2 BlockChain as a disruptor in banking (Dependent Variable)

As part of the research, the respondents were required to indicate whether BlockChain as technology is challenging traditional ways of banking, such as clearing and settlements,

provision of loans and executing payments, amongst other services provided. Of the 54 respondents surveyed, all 54 of them responded to this question.

SurveyA_BC_Disrupt_Trad_Payments					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	10	18.5	18.5	18.5
	1	44	81.5	81.5	100.0
	Total	54	100.0	100.0	

Table 2: Survey A – BC Disrupt Traditional Payments

Of those that responded to this question, only 10 out of the 54 respondents responded “no” indicating an 18.50% representation of those that do not believe that BlockChain in their opinion was challenging traditional ways of banking. The other 44 respondents responded “yes” indicating an 81.50% representation of those that believe that BlockChain in their opinion was challenging traditional ways of banking.

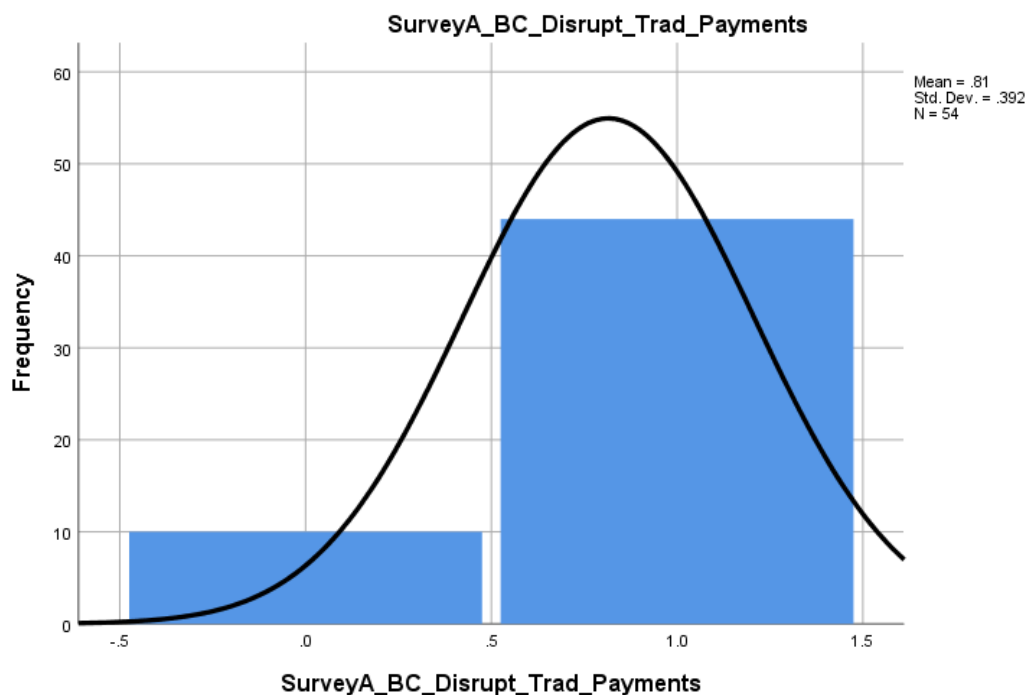


Figure 2: Survey A - BlockChain Traditional Strategy Disruption Histogram

The range is from -0.5 to +1.5, relating to the question responses whereby the majority of the respondents (44 respondents) were of the opinion that BlockChain technology is challenging the way traditional banking strategies were executed. Ten of the respondents believed that

these strategies were not being challenged at all, echoing a view that though less popular, was present none the less. This curve is skewed to the left (negative skewness) representing that the majority of respondents are above the mean of 0.81 indicating more “yes” responses with the modality of the curve being unimodal. The standard deviation of 0.392 indicates that one standard deviation from the mean range is between 0.418 and 1.202. The Shapiro-Wilk statistical significance value is 0.000 (Refer to Appendix A) indicating that the null hypothesis that the “SurveyA_BC_Disrupt_Trad_Payments” data are normally distributed is rejected at 5% and 1% significance level.

The responses indicate more advocates than naysayers in terms of the vision of strategies and how they will be influenced by BlockChain technology. This includes but is not limited to strategies in how people, process and technology will be embraced in order to execute processes, provide multiple types of loans and enable continuous clearing and settlement of payments.

4.2 Survey B (Provided to ComBank employees – Email distribution)

Survey B was sent to specific individuals who worked in one of the top commercial banks in South Africa as well as in Africa as a whole (herein referred to as ComBank). The researcher utilised a network of acquaintances, business contracts, family members and past colleagues to distribute to employees within ComBank, with a specific focus on the age categories of the respondents, their time employed within the bank and their views on BlockChain innovation and adoption within their work environment, further to this, how BlockChain strategies adoption is becoming more prevalent as well as the proliferation of commercial banking specific BlockChain use cases that are already being explored in regulatory sandboxes and live environments alike.

For Survey B there is more confidence from the researcher that the views, though potentially being similar to those of Survey A, due to the targeted approach, likely yields a better understanding of the technology and its benefits.

Due to the relative infancy in widespread adoption and brought to light through cryptocurrency (specifically Bitcoin introduction) adoption, there was an approach as well from the researcher to rely on secondary data to support the decision making process. For a

technology that in reality has been around for 10 years but has been exponentially growing in the last three to five years, such a reliance on more than the collected primary data becomes ever more critical as long as it is aligned with the researcher's hypothesis, and the study was conducted with similar parameters at play.

The total amount of respondents for Survey B was 81 respondents of which specific responses were not completed thus yielding a reduced response data set. Where there were no responses or the surveys were not completed in totality, in other words, where respondents started surveys and did not complete them, there were assumptions made on categorical variables where the responses were not fully completed. For example, where the response required a "yes" or a "no", where there was no completed response, the assumption made was that "no" is applicable and the analysis was conducted with this as the basis for analysis of incomplete data. Where the response related to gender-based data, the assumption made was that where a respondent did not add an answer, it was for their right not even to have to select non-binary, but to opt not to respond at all. For employment tenure, the assumption made is that where there was no response at all, the data would be enriched to indicate "0 - 2 years" entries. For the age variable, the assumption made was that where there was no response at all, the data would be enriched to indicate "18 - 25 years" entries.

4.2.1 Most impactful Blockchain enabling strategies (Dependent Variable)

SurveyB_Impactful_Strategies					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	7	8.6	8.6	8.6
	1	17	21.0	21.0	29.6
	2	15	18.5	18.5	48.1
	3	32	39.5	39.5	87.7
	4	10	12.3	12.3	100.0
	Total	81	100.0	100.0	

Table 3: Survey B – Impactful Strategies

From the respondent base for this question, the researcher wanted to understand to what extent the respondents understood the strategic alignment required to execute a Blockchain use case enabled through a technological solution and ensuring delivery of business value to

ComBank. From the original response base of 81 respondents, seven out of the total 81 respondents opted not to respond to this question leaving 74 respondents to respond.

Of the 74 respondents from this response base, the option that was selected as delivering the most impact on the overall bank success is the “Process Costs (reduce the unit cost-to-value ratio of each activity or transaction)” strategy with 32 of the 74 responses, leading to a representation of 43.24% for this “Process Costs” strategy from this response base. Business Realignment (exit business lines that have high costs and low margins) was the next highest rated strategy with 17 of the 74 respondents selecting this option as most impactful representing 22.97% of the total question response base. Fifteen out of the 74 respondents selected the option of “Channel Optimisation (to meet customers’ changing expectations)” strategy representing 20.27% of the response base. Ten out of the 74 respondents selected “Vendor Relationships (consolidating vendors and monitoring performance issues)” representing a percentage of 13.51% of the response base.

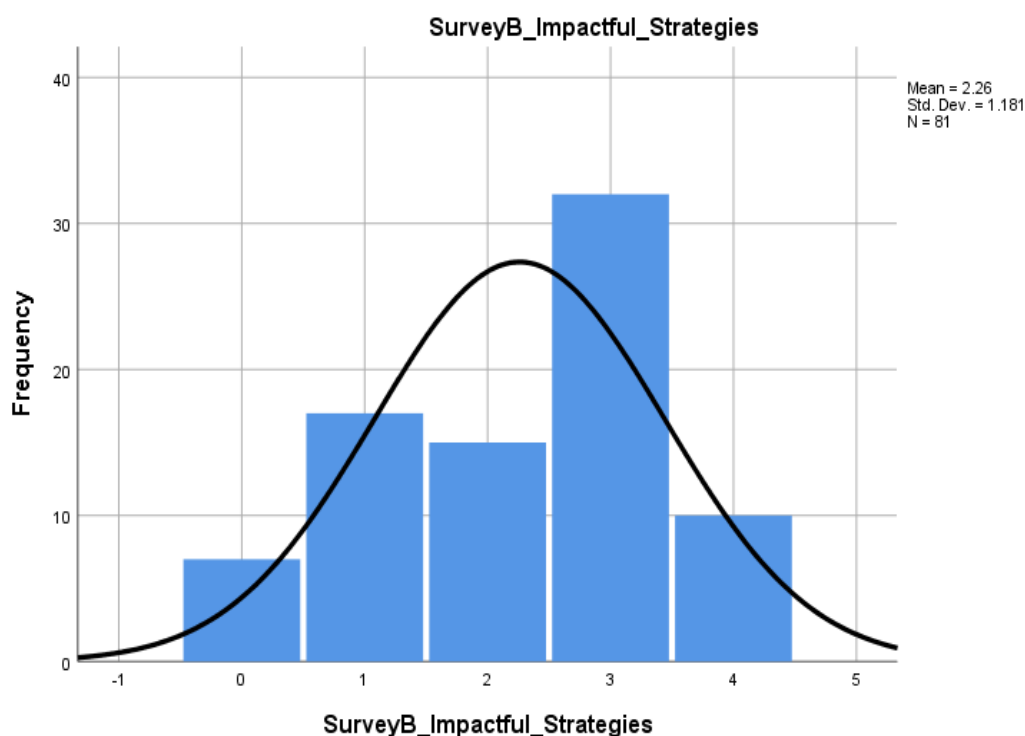


Figure 3: Survey B – Impactful Strategies Histogram

The range is from -1.0 to +5.0, relating to the question responses whereby the most substantial amount of the respondents (32 respondents) indicated that they believe that “Process Costs (reduce the unit cost-to-value ratio of each activity or transaction)” is the most

impactful strategy for consideration in the enablement of BlockChain in banking. Seventeen respondents indicated that “Business Realignment (exit business lines that have high costs and low margins)” is the most impactful strategy for consideration, 15 respondents indicated that “Channel Optimisation (to meet customers’ changing expectations)” is the most impactful strategy for consideration and 10 respondents indicated that “Vendor Relationships (consolidating vendors and monitoring performance issues)” is the most impactful strategy. Seven respondents chose not to respond and indicate a view and were not allocated to any strategy option as part of the standardisation of data. This curve is symmetrical representing a relatively even split of respondent views across potentially impactful strategies. The mean of 2.26 indicating an almost even split with an even spread of respondents across options of impactful strategies. The standard deviation of 1.181 is quite large and indicating that one standard deviation from the mean range is between 1.079 and 3.441. The Shapiro-Wilk statistical significance value is 0.000 (Refer to Appendix A) indicating that the null hypothesis that the “SurveyB_Impactful_Strategies” data are normally distributed is rejected at 5% and 1% significance level.

4.2.2 BlockChain Adoption - Operational Efficiency Impact (Dependent Variable)

SurveyB_BlockChain_Adoption					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	8	9.9	9.9	9.9
	1	13	16.0	16.0	25.9
	2	10	12.3	12.3	38.3
	3	11	13.6	13.6	51.9
	4	15	18.5	18.5	70.4
	6	24	29.6	29.6	100.0
	Total	81	100.0	100.0	

Table 4: Survey B - Operational Efficiency Impact (BlockChain Adoption)

From the respondent base for this question, the researcher wanted to pose a direct question to the ComBank employees in terms of the first-hand experience in a BlockChain solution end-to-end delivery throughout the systems’ development lifecycle.

In so doing, the researcher sought to understand to what extent the respondents understood what technologies were at play in their environment or whether there was potential

ignorance of the presence and breadth of exponential technology adoption. From the original response base of 81 respondents, only 73 out of the total 81 responded to this question.

Of the 73 respondents from this response base, the option that was selected as delivering the most impact, specifically in terms of operational efficiency increase, is actually the option representing no adoption as “BlockChain is not utilised in my banking environment” selection with 24 of the 73 responses, leading to a representation of 32.88% for this indication of limited understanding or knowledge of what is transpiring in their environment, or possibly where there is understanding, still a potential reluctance to fully embrace what exponential technology journey is taking place within their work environment. “Improved Capital Optimisation” was the next highest rated impact on operational efficiencies with 15 of the 73 respondents selecting this option as most impactful, representing 20.55% of the total question response base. Thirteen out of the 73 respondents selected the option of “Reduced Error Handling and Reconciliation” selection representing 17.81% of the response base. Eleven out of the 73 respondents selected “Improved Contractual Performance due to Smart Contracts” representing a percentage of 15.07% of the response base. Ten out of the 73 respondents that responded to this question selected “Increased Transparency” representing a percentage composition of 13.70% of this specific questions response base.

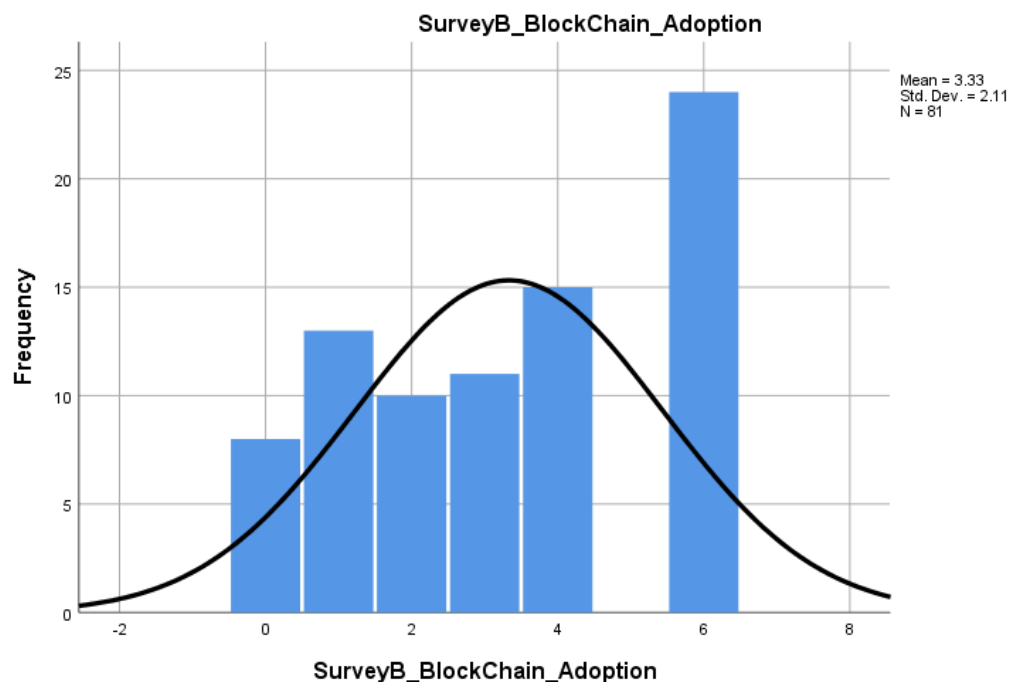


Figure 4: Survey B - BlockChain Adoption Histogram

The range is from -2.0 to +8.0, relating to the question responses whereby the most substantial number of the respondents (24 respondents) indicated that they believe that Blockchain is not utilised in their banking environment. Fifteen respondents indicated that Blockchain is utilised in their banking environment to improve operational efficiencies through “Improved Capital Optimisation” and 13 respondents indicated that Blockchain is utilised in their banking environment to improve operational efficiencies through “Reduced Error Handling and Reconciliation”. Eleven respondents indicated that Blockchain is utilised in their banking environment to improve operational efficiencies through “Improved Contractual Performance due to Smart Contracts” and 10 respondents indicated that Blockchain is utilised in their banking environment to improve operational efficiencies through “Increased Transparency”. Eight respondents chose not to respond and indicate a view and were not allocated to any category as part of the standardisation of data. This curve is symmetrical, representing a relatively even split of respondent views across options of how Blockchain is being utilised in their banking environment. The mean of 3.33 indicates an almost even split with an even spread of respondents across options of how Blockchain is adopted in their banking environment. The standard deviation of 2.11 is substantial and indicating that one standard deviation from the mean range is between 1.22 and 5.44. The Shapiro-Wilk statistical significance value is 0.000 (Refer to Appendix A) indicating that the null hypothesis that the “SurveyB_Impactful_Strategies” data are normally distributed is rejected at 5% and 1% significance level.

None of the respondents opted for the “Other” category indicating that either the listed options of Blockchain adoption were aligned with their views or there were no other Blockchain adoption scenarios that they envisaged applying to this particular question.

4.3 Correlation Matrices and findings

4.3.1 Survey A - BC_Disrupt_Trad_Payments Regression

Correlations

Statistics **Pearson Correlation**

	SurveyA_BC_Disrupt_Trad_Payments	SurveyA_Appetite_Diff_Trans_Options	SurveyA_Dig_Wallet_Support	SurveyA_Multiple_Banking_Accounts	SurveyA_Actual_Transaction_Preferences	SurveyA_Crypto_Currency_Ownership	SurveyA_BC_Future_Impact
SurveyA_BC_Disrupt_Trad_Payments	1.000	-.078	.303	.430	-.113	-.040	.203
SurveyA_Appetite_Diff_Trans_Options	-.078	1.000	.347	-.182	-.014	.152	.236
SurveyA_Dig_Wallet_Support	.303	.347	1.000	.230	-.371	.501	.343
SurveyA_Multiple_Banking_Accounts	.430	-.182	.230	1.000	.142	-.036	.088
SurveyA_Actual_Transaction_Preferences	-.113	-.014	-.371	.142	1.000	-.344	-.150
SurveyA_Crypto_Currency_Ownership	-.040	.152	.501	-.036	-.344	1.000	.109
SurveyA_BC_Future_Impact	.203	.236	.343	.088	-.150	.109	1.000

Table 5: Survey A - BC_Disrupt_Trad_Payments Pearson Correlations

Correlations

Statistics **Sig. (1-tailed)**

	SurveyA_BC_Disrupt_Trad_Payments	SurveyA_Appetite_Diff_Trans_Options	SurveyA_Dig_Wallet_Support	SurveyA_Multiple_Banking_Accounts	SurveyA_Actual_Transaction_Preferences	SurveyA_Crypto_Currency_Ownership	SurveyA_BC_Future_Impact
SurveyA_BC_Disrupt_Trad_Payments	.	.307	.023	.002	.233	.397	.093
SurveyA_Appetite_Diff_Trans_Options	.307	.	.011	.119	.465	.162	.062
SurveyA_Dig_Wallet_Support	.023	.011	.	.067	.007	.000	.011
SurveyA_Multiple_Banking_Accounts	.002	.119	.067	.	.178	.407	.286
SurveyA_Actual_Transaction_Preferences	.233	.465	.007	.178	.	.011	.165
SurveyA_Crypto_Currency_Ownership	.397	.162	.000	.407	.011	.	.240
SurveyA_BC_Future_Impact	.093	.062	.011	.286	.165	.240	.

Table 6: Survey A - BC_Disrupt_Trad_Payments Correlation Significance

There are moderate correlations between SurveyA_BC_Disrupt_Trad_Payments and SurveyA_Dig_Wallet_Support as well as between SurveyA_BC_Disrupt_Trad_Payments and SurveyA_Multiple_Banking_Accounts. The other two dependent variables in Survey A (BC_Experience_Banking and BC_Innov_Use_Case) showed weak correlations with correlation co-efficient R-values for them below 0.3 and thus were not included.

The remaining correlations were as per the table below:

Variable 1	Variable 2	r-value (correlation co-efficient)	Statistical Significance
SurveyA_Dig_Wallet_Support	SurveyA_Appetite_Diff_Trans_Options	0.347	0.011
SurveyA_Actual_Transact_Preferences	SurveyA_Dig_Wallet_Support	0.371	0.007
SurveyA_Crypto_Currency_Ownership	SurveyA_Dig_Wallet_Support	0.501	0.000
SurveyA_Crypto_Currency_Ownership	SurveyA_Actual_Transact_Preferences	0.344	0.011
SurveyA_BC_Future_Impact	SurveyA_Dig_Wallet_Support	0.343	0.011

Table 7: Survey A – Additional Correlations

4.3.2 Survey B - Impactful_Strategies Regression

Correlations

Statistics **Pearson Correlation**

	SurveyB_Impactful_Strategies	SurveyB_Employment_Tenure	SurveyB_Department	SurveyB_Future_Proof	SurveyB_Future_Impact	SurveyB_Age	SurveyB_Gender
SurveyB_Impactful_Strategies	1.000	.058	-.038	.248	.235	.183	.056
SurveyB_Employment_Tenure	.058	1.000	.277	.035	.158	.384	-.005
SurveyB_Department	-.038	.277	1.000	.201	.208	.237	.137
SurveyB_Future_Proof	.248	.035	.201	1.000	.647	.226	.231
SurveyB_Future_Impact	.235	.158	.208	.647	1.000	.253	.376
SurveyB_Age	.183	.384	.237	.226	.253	1.000	.079
SurveyB_Gender	.056	-.005	.137	.231	.376	.079	1.000

Table 8: Survey B - Impactful Strategies Pearson Correlations

Correlations

Statistics **Sig. (1-tailed)**

	SurveyB_Impactful_Strategies	SurveyB_Employment_Tenure	SurveyB_Department	SurveyB_Future_Proof	SurveyB_Future_Impact	SurveyB_Age	SurveyB_Gender
SurveyB_Impactful_Strategies	.	.326	.385	.026	.033	.077	.332
SurveyB_Employment_Tenure	.326	.	.015	.394	.109	.001	.486
SurveyB_Department	.385	.015	.	.059	.052	.032	.144
SurveyB_Future_Proof	.026	.394	.059	.	.000	.039	.036
SurveyB_Future_Impact	.033	.109	.052	.000	.	.024	.001
SurveyB_Age	.077	.001	.032	.039	.024	.	.270
SurveyB_Gender	.332	.486	.144	.036	.001	.270	.

Table 9: Survey B - Impactful Strategies Correlations Significance

SurveyB_BC_Impactful_Strategies correlated with SurveyB_Future_Proof with a weak strength of the relationship with an R-value of 0.248 and a p-value of 0.026 which indicated a

statistically significant correlation. SurveyB_BC_Impactful_Strategies correlated with SurveyB_Future_Impact variable with a weak strength of the relationship with an R-value of 0.235 and a p-value of 0.033 which indicated a strong statistically significant correlation.

The remaining significant correlations were as per the table below:

Variable 1	Variable 2	r-value (correlation co-efficient)	Statistical Significance
SurveyB_Future_Impact	SurveyB_Future_Proof	0.647	0.000
SurveyB_Age	SurveyB_Employment_Tenure	0.384	0.001
SurveyB_Gender	SurveyB_Future_Impact	0.376	0.001

Table 10: Survey B - Impactful Strategies Additional Correlations

4.3.3 Survey B - BC_Adoption Regression

Correlations

Statistics **Pearson Correlation**

	SurveyB_BlockChain_Adoption	SurveyB_Employment_Tenure	SurveyB_Department	SurveyB_Future_Proof	SurveyB_Future_Impact	SurveyB_Age	SurveyB_Gender
SurveyB_BlockChain_Adoption	1.000	.178	.055	.190	.344	.200	.112
SurveyB_Employment_Tenure	.178	1.000	.277	.035	.158	.384	-.005
SurveyB_Department	.055	.277	1.000	.201	.208	.237	.137
SurveyB_Future_Proof	.190	.035	.201	1.000	.647	.226	.231
SurveyB_Future_Impact	.344	.158	.208	.647	1.000	.253	.376
SurveyB_Age	.200	.384	.237	.226	.253	1.000	.079
SurveyB_Gender	.112	-.005	.137	.231	.376	.079	1.000

Table 11: Survey B - BlockChain Adoption Pearson Correlations

Correlations

Statistics **Sig. (1-tailed)**

	SurveyB_BlockChain_Adoption	SurveyB_Employment_Tenure	SurveyB_Department	SurveyB_Future_Proof	SurveyB_Future_Impact	SurveyB_Age	SurveyB_Gender
SurveyB_BlockChain_Adoption	.	.083	.336	.070	.003	.060	.193
SurveyB_Employment_Tenure	.083	.	.015	.394	.109	.001	.486
SurveyB_Department	.336	.015	.	.059	.052	.032	.144
SurveyB_Future_Proof	.070	.394	.059	.	.000	.039	.036
SurveyB_Future_Impact	.003	.109	.052	.000	.	.024	.001
SurveyB_Age	.060	.001	.032	.039	.024	.	.270
SurveyB_Gender	.193	.486	.144	.036	.001	.270	.

Table 12: Survey B - BlockChain Adoption Correlation Significance

SurveyB_BlockChain_Adoption correlated with SurveyB_Future_Impact with a moderate strength of relationship with an R-value of 0.344 and a p-value of 0.03 which indicated an extremely high level of statistical significance in this correlation.

The other two dependent variables in Survey B (Innov_Use_Case and BC_Understanding) showed weak correlations with correlation co-efficient R-values for them below 0.21 and thus were not included.

4.3.4 Survey A – Bivariate Correlation and Statistical Significance Analysis

Correlations

Statistics: **Pearson Correlation**

	SurveyA_Appetite_Diff_Trans_Options	SurveyA_Dig_Wallet_Support	SurveyA_BC_Disrupt_Trade_Payments	SurveyA_BC_Experience_Banking	SurveyA_BC_Innov_Use_Case	SurveyA_Multiple_Banking_Accounts	SurveyA_Actual_Transaction_Preferences	SurveyA_Crypto_Currency_Ownership	SurveyA_BC_Future_Impact
SurveyA_Appetite_Diff_Trans_Options	1	.576**	.588**	.163	-.152	.361**	-.014	.329*	.600**
SurveyA_Dig_Wallet_Support	.576**	1	.533**	.250	.064	.434**	-.371*	.553**	.517**
SurveyA_BC_Disrupt_Trade_Payments	.588**	.533**	1	.129	.195	.647**	-.113	.236	.601**
SurveyA_BC_Experience_Banking	.163	.250	.129	1	.238	.205	-.026	.248	.188
SurveyA_BC_Innov_Use_Case	-.152	.064	.195	.238	1	.144	.079	.120	.184
SurveyA_Multiple_Banking_Accounts	.361**	.434**	.647**	.205	.144	1	.142	.192	.503**
SurveyA_Actual_Transaction_Preferences	-.014	-.371*	-.113	-.026	.079	.142	1	-.344*	-.150
SurveyA_Crypto_Currency_Ownership	.329*	.553**	.236	.248	.120	.192	-.344*	1	.310*
SurveyA_BC_Future_Impact	.600**	.517**	.601**	.188	.184	.503**	-.150	.310*	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 13: Survey A - Bivariate Pearson Correlation

Correlations

Statistics: **Sig. (2-tailed)**

	SurveyA_Appetite_Diff_Trans_Options	SurveyA_Dig_Wallet_Support	SurveyA_BC_Disrupt_Trade_Payments	SurveyA_BC_Experience_Banking	SurveyA_BC_Innov_Use_Case	SurveyA_Multiple_Banking_Accounts	SurveyA_Actual_Transaction_Preferences	SurveyA_Crypto_Currency_Ownership	SurveyA_BC_Future_Impact
SurveyA_Appetite_Diff_Trans_Options		.000	.000	.244	.331	.007	.930	.015	.000
SurveyA_Dig_Wallet_Support	.000		.000	.071	.683	.001	.013	.000	.000
SurveyA_BC_Disrupt_Trade_Payments	.000	.000		.356	.210	.000	.467	.086	.000
SurveyA_BC_Experience_Banking	.244	.071	.356		.124	.141	.868	.074	.178
SurveyA_BC_Innov_Use_Case	.331	.683	.210	.124		.356	.612	.443	.236
SurveyA_Multiple_Banking_Accounts	.007	.001	.000	.141	.356		.357	.164	.000
SurveyA_Actual_Transaction_Preferences	.930	.013	.467	.868	.612	.357		.022	.330
SurveyA_Crypto_Currency_Ownership	.015	.000	.086	.074	.443	.164	.022		.022
SurveyA_BC_Future_Impact	.000	.000	.000	.178	.236	.000	.330	.022	

Table 14: Survey A - Bivariate Statistical Significance

The Bivariate correlation results show correlations across multiple variables with the strongest correlations (greater than 0.5 correlation coefficient) statistically analysed.

- Variable SurveyA_Dig_Wallet_Support is strongly correlated at the 0.01 level with variable SurveyA_Appetite_Diff_Trans_Options with an R-value of 0.576.
- Variable SurveyA_BC_Disrupt_Trade_Payments is strongly correlated at the 0.01 level with variable SurveyA_Appetite_Diff_Trans_Options with an R-value of 0.588.
- Variable SurveyA_BC_Disrupt_Trade_Payments is strongly correlated at the 0.01 level with variable SurveyA_Dig_Wallet_Support with an R-value of 0.533.
- Variable SurveyA_Multiple_Banking_Accounts is strongly correlated at the 0.01 level with variable SurveyA_BC_Disrupt_Trade_Payments with an R-value of 0.647
- Variable SurveyA_Crypto_Currency_Ownership is strongly correlated at the 0.01 level with variable SurveyA_Dig_Wallet_Support with an R-value of 0.553
- Variable SurveyA_BC_Future_Impact is strongly correlated at the 0.01 level with variable SurveyA_Appetite_Diff_Trans_Options with an R-value of 0.600.
- Variable SurveyA_BC_Future_Impact is strongly correlated at the 0.01 level with variable SurveyA_Dig_Wallet_Support with an R-value of 0.517
- Variable SurveyA_BC_Future_Impact is strongly correlated at the 0.01 level with variable SurveyA_BC_Disrupt_Trade_Payments with an R-value of 0.601
- Variable SurveyA_BC_Future_Impact is strongly correlated at the 0.01 level with variable SurveyA_Multiple_Banking_Accounts with an R-value of 0.503

4.3.5 Survey B – Bivariate Correlation and Statistical Significance Analysis

Correlations

Statistics **Pearson Correlation**

	SurveyB_Emp loyment_Ten ure	SurveyB_Dep artment	SurveyB_BC_ Understandin g	SurveyB_Inno v_Use_Case	SurveyB_Imp actful_Strateg ies	SurveyB_Bloc kChain_Adopt ion	SurveyB_Futu re_Proof	SurveyB_Futu re_Impact	SurveyB_Age	SurveyB_Gen der
SurveyB_Employment_Tenure	1	.369**	.198	.170	.163	.189	-.159	.154	.371**	.148
SurveyB_Department	.369**	1	-.017	.219*	.132	.169	-.054	.276*	.368**	.331**
SurveyB_BC_Understanding	.198	-.017	1	-.069	.076	-.016	-.216	.027	-.051	-.037
SurveyB_Innov_Use_Case	.170	.219*	-.069	1	.615**	.256*	-.122	.235*	.134	.131
SurveyB_Impactful_Strategies	.163	.132	.076	.615**	1	.271*	-.228*	.397**	.298**	.300**
SurveyB_BlockChain_Adoption	.189	.169	-.016	.256*	.271*	1	-.242*	.476**	.330**	.333**
SurveyB_Future_Proof	-.159	-.054	-.216	-.122	-.228*	-.242*	1	.001	-.146	-.213
SurveyB_Future_Impact	.154	.276*	.027	.235*	.397**	.476**	.001	1	.288**	.376**
SurveyB_Age	.371**	.368**	-.051	.134	.298**	.330**	-.146	.288**	1	.535**
SurveyB_Gender	.148	.331**	-.037	.131	.300**	.333**	-.213	.376**	.535**	1

** . Correlation is significant at the 0.01 level (2-tailed).
* . Correlation is significant at the 0.05 level (2-tailed).

Table 15: Survey B - Bivariate Pearson Correlation

Correlations

Statistics **Sig. (2-tailed)**

	SurveyB_Emp loyment_Ten ure	SurveyB_Dep artment	SurveyB_BC_ Understandin g	SurveyB_Inno v_Use_Case	SurveyB_Imp actful_Strateg ies	SurveyB_Bloc kChain_Adopt ion	SurveyB_Futu re_Proof	SurveyB_Futu re_Impact	SurveyB_Age	SurveyB_Gen der
SurveyB_Employment_Tenure		.001	.076	.128	.146	.091	.155	.171	.001	.186
SurveyB_Department	.001		.883	.049	.240	.131	.630	.013	.001	.003
SurveyB_BC_Understanding	.076	.883		.542	.498	.889	.052	.814	.653	.746
SurveyB_Innov_Use_Case	.128	.049	.542		.000	.021	.279	.035	.234	.245
SurveyB_Impactful_Strategies	.146	.240	.498	.000		.014	.041	.000	.007	.007
SurveyB_BlockChain_Adoption	.091	.131	.889	.021	.014		.029	.000	.003	.002
SurveyB_Future_Proof	.155	.630	.052	.279	.041	.029		.992	.192	.056
SurveyB_Future_Impact	.171	.013	.814	.035	.000	.000	.992		.009	.001
SurveyB_Age	.001	.001	.653	.234	.007	.003	.192	.009		.000
SurveyB_Gender	.186	.003	.746	.245	.007	.002	.056	.001	.000	

Table 16: Survey B - Bivariate Statistical Significance

The Bivariate correlation analysis was done across multiple variables with the strongest correlations (greater than 0.5 correlation coefficient) statistically analysed.

- Variable SurveyB_Impactful_Strategies is strongly correlated at the 0.01 level with variable SurveyB_Innov_Use_Cases with an R-value of 0.615
- Variable SurveyB_Future_Impact is moderately correlated at the 0.01 level with variable SurveyB_Impactful_Strategies with an R-value of 0.397
- Variable SurveyB_Future_Impact is moderately correlated at the 0.01 level with variable SurveyB_BlockChain_Adoption with an R-value of 0.476

- Variable SurveyB_Gender is strongly correlated at the 0.01 level with variable SurveyB_Age with an R-value of 0.535

The statistical significance on the analysed variables is exceptionally high, with p-values of 0.000 across the four variable pair analyses.

5 Interpretation and analysis

5.1 Analysis of Findings – Strategies that deliver value and are impactful

5.1.1 SurveyA_BlockChain_Understanding

Theme	Ledger Technology (A)	Internet of things (B)	Digital Currency (C)	Revolutionary and Transactional (D)	Total Respondents
Respondents	11	1	4	15	31
Percentage	35.48%	3.22%	12.9%	48.39%	100%

Table 17: BlockChain Understanding Themes

The categorising of the responses from the respondents highlighted four themes that the researcher organised the responses into for ease of analysis. The key themes or focus areas highlighted were as follows:

- Ledger Technology
- Internet of Things
- Digital Currency
- Revolutionary and Transactional

The four themes are aligned with the application areas in which BlockChain can be utilised to drive value and benefits. As commercial banks look to transition to the offering of services in a way that ensures efficiencies on their end, and benefits on the customer's end, it is essential that they understand what BlockChain can offer and that customers can reap these benefits.

The response shows a view that highlights a mix of knowledge in general in the South African market in terms of understanding what BlockChain technology actually is. It also highlights that from the sample base, the majority of responses (96.77%) understand the actual benefits of BlockChain as a distributed ledger technology that is revolutionary, facilitates secure transactions and is utilised as the base technology for crypto-currencies. Only 3.22% believed it related to the Internet of Things, which is not entirely incorrect, but not as aligned to the other themes/focus areas. This challenges the earlier literature review perspective that there

is broad perception that it has security flaws (Xu, 2016) and this is one of the main reasons its real impact is fully understood and why there is caution towards its adoption.

5.1.2 SurveyA_BC_Disrupt_Trad_Payments

A significant majority of the respondents, specifically 81.5%, were of the opinion that BlockChain technology is challenging traditional banking strategies (e.g. executing payments, providing loans, clearing and settlements). This provides a view that BlockChain is inevitably impacting strategies of commercial banks and assisting them in positioning themselves for the digital era where the 4th Industrial revolution is being embraced in order to stay relevant and competitive, with such an overwhelming view in favour of strategies being challenged, and the view being sought across the response base.

Through the literature review, one of the key focus areas for the researcher was to ascertain to what extent the theoretical framework of BlockChain as a technology that could provide a competitive advantage (Powell, 1997), was applicable and whether the research data would provide an indication of this. In understanding whether BlockChain could impact strategies, the linkage between BlockChain solution adoption and strategy execution to obtain operational efficiencies is displayed by the responses to this research question (Duygun-Fethi et al., 2009). Thus, this shows that embracing these new ways of executing banking functions is a possible way to adapt strategies and remain competitive in the commercial banking sector. Such a competitive advantage is maintained through commercial banks' analysis of the risks and benefits of BlockChain for their business problems and how these risks can be mitigated and the benefits leveraged to be operationally more efficient (Tapscott, 2017) and thus having the ability to pass these benefits to their customers downstream.

5.1.3 SurveyB_Impactful_Strategies

Embracing BlockChain and what it brings to the table for ComBank would entail a strategic decision to drive how BlockChain will be approached within the bank, as well as how it will be devised, communicated and executed within the bank. This involves linking the decision to embrace BlockChain and the impact it will have on the bank's strategy, while aligning with the theoretical framework view that clearly comprehends the risks and benefits of such a

technology, while evaluating if it can really make ComBank's systems more efficient and whether this leads to cost benefits within the bank (Tapscott , 2017).

Within ComBank, the employees have the perception that overall bank success is determined by the "Process Costs (reduce the unit cost-to-value ratio of each activity or transaction)" strategy and this is what bears the most value. This is followed by Business Realignment (exit business lines that have high costs and low margins), "Channel Optimisation (to meet customers' changing expectations)" and, last but not least, "Vendor Relationships (consolidating vendors and monitoring performance issues)".

This shows that managing process costs are of paramount importance while also ensuring that the business units that are focused on are those that have the lowest costs and high margins of return. These strategies prioritise cost leadership and ensure that services can be provisioned cost-effectively, while maintaining adequate returns from the investment to deliver them (Cocco et al., 2017).

5.2 Analysis of Findings – Blockchain enabling operational efficiencies

5.2.1 SurveyB_BlockChain_Adoption

The most important factor is linked to whether Blockchain adoption is caused by any one factor or a multitude of factors. This is because the use cases for how it can drive operational efficiencies are related to ways in which ComBank can position itself to excel while streamlining its internal processes and optimising its business functions. Fascinating was the number of employees who were adamant that Blockchain was not being utilised in their environment, despite there being a Blockchain specific unit that looks at where the technology can assist the bank in optimising its performance.

In the same breath, there are a significant number of employees who believe there is extensive use for it for improving capital optimisation and reducing issues of error handling and reconciliation while maintaining transparency to stakeholders and achieving improved contractual performance due to Smart contracts being utilised to drive optimised processes, in this way ensuring that as per literature review, the efficiencies gained from utilising smart contracts can be enabled with simple if-then conditions implemented and met (Cermeno, 2016).

5.3 Analysis of Findings – BlockChain use cases being Future Proof

5.3.1 SurveyB_Innov_Use_Case

There were varying views amongst the ComBank employees in terms of potential use cases that showed the most innovation and potential application within their banking environment. As much as the views were diverse, there is clarity that within this specific environment, there are good opportunities either for the use cases to be explored, or there are potentially already plans to look at these use cases, hence the differing but closely grouped responses on these use cases.

This is aligned to the theoretical framework in that all of these use cases are executed through technological innovations or solutions that are not only critical to ComBank, but also play a role in transforming commercial banking as a whole, as opposed to merely focusing on providing a strategic advantage whereby the resultant benefits can be passed on to customers in terms of savings, simplicity and reliability of services provisioned.

5.4 Correlation and Statistical Significance

In terms of identifying correlation across the variables, the researcher has approached the statistical analysis from multiple angles as follows:

- a) The initial focus is on grouping each of the dependent variables (survey specific) and analysing to what extent each of these dependent variables correlates with the independent variables and whether there is positive or negative correlation amongst variables. This was from a correlation angle from the perspective of the dependent variables and a 1-tailed statistical significance perspective.
- b) The second approach was to take all the variables in Survey A and the variables in Survey B and conduct a bivariate correlation analysis that combined all the variables and looked for correlation across them and 2-tailed statistical significance. Survey A was analysed separately to Survey B for this approach using Pearson Correlation method.
- c) Refer to Section 4.3 for detailed Correlation Matrices used for analysis stated above

5.4.1 Survey A - BC_Disrupt_Trad_Payments Regression

There are moderate correlations between SurveyA_BC_Disrupt_Trad_Payments and SurveyA_Dig_Wallet_Support as well as between SurveyA_BC_Disrupt_Trad_Payments and SurveyA_Multiple_Banking_Accounts. This is indicative of those who are willing to sign up to a digital wallet service that allows one to transact in crypto-currencies, likely to also be those who believe that BlockChain technology is challenging traditional banking strategies (e.g. executing payments, providing loans, clearing and settlements). Despite a moderate strength of this correlation, the statistical significance is high, and thus the null hypothesis is rejected at the at 5% significance level. This can potentially be as a result of the situation where, as perceptions move towards BlockChain as an enabler of modern and transformative banking strategies, more and more people will start to accept its use cases, specifically the digital currency use case and be more open to acquiring crypto-currencies themselves to try and experience the benefits of the technology for themselves. The second correlation is indicative of those who indicated that they have multiple banking accounts, likely also to be those that believe that BlockChain technology is challenging traditional banking strategies (e.g. executing payments, providing loans, clearing and settlements). Despite a moderate strength of this correlation, the statistical significance is extremely high, and thus the null hypothesis is rejected at the 1% significance level.

The other two dependent variables in Survey A (BC_Experience_Banking and BC_Innov_Use_Case) showed weak correlations with correlation co-efficient R-values for them below 0.3 and thus were not included.

The remaining correlations were as per the table below:

Variable 1	Variable 2	r-value (correlation co-efficient)	Statistical Significance
SurveyA_Dig_Wallet_Support	SurveyA_Appetite_Diff_Trans_Options	0.347	0.011
SurveyA_Actual_Transact_Preferences	SurveyA_Dig_Wallet_Support	0.371	0.007
SurveyA_Crypto_Currency_Ownership	SurveyA_Dig_Wallet_Support	0.501	0.000
SurveyA_Crypto_Currency_Ownership	SurveyA_Actual_Transact_Preferences	0.344	0.011
SurveyA_BC_Future_Impact	SurveyA_Dig_Wallet_Support	0.343	0.011

Table 18: Survey A Additional Correlations

The above is indicative of the likelihood of those who are willing to acquire digital wallet services, also having an appetite for exploring different ways of banking using technologies

like Blockchain to offer services. This is further indicative of those who have particular transacting preferences, also willing to sign up for digital wallet services. Those who own crypto-currencies are likely willing to sign up for digital wallet service to manage, purchase and sell their crypto-currencies. Those who own crypto-currencies have particular transacting preferences, which are more aligned with e-commerce options as opposed to traditional purchasing behaviour. Those who see Blockchain having a future revolutionary impact are also willing to sign up for digital wallet services.

5.4.2 Survey B - Impactful_Strategies Regression

SurveyB_BC_Impactful_strategies correlated with SurveyB_Future_Proof with a weak strength of relationship with an R-value of 0.248 and a p-value of 0.026 which indicated a statistically significant correlation. This shows that there is an allowance for an increase in the acceptance of a specific strategy that embraces Blockchain as being critical to its successful execution, leading to an increase in the resolution that Blockchain banking use cases currently being developed are future proof. This is not an entirely strong positive correlation but a positive one nonetheless with high statistical significance.

SurveyB_BC_Impactful_strategies correlated with SurveyB_Future_Impact variable with a weak strength of relationship with an R-value of 0.235 and a p-value of 0.033 which indicated a strong statistically significant correlation. This can potentially be as a result of strategies within commercial banking evolving as not only is Blockchain technology used in solutions but where it is used, it is for delivering maximum value or not utilised at all. This ultimately leads to more and more of these use cases being developed and spread across commercial banks to enable operational efficiencies and in this process, maintaining their strategic advantage while maintaining macro environment importance in a competitive environment.

The remaining significant correlations were as per the table below:

Variable 1	Variable 2	r-value (correlation co-efficient)	Statistical Significance
SurveyB_Future_Impact	SurveyB_Future_Proof	0.647	0.000
SurveyB_Age	SurveyB_Employment_Tenure	0.384	0.001
SurveyB_Gender	SurveyB_Future_Impact	0.376	0.001

Table 19: Survey B Additional Correlations

The above is indicative of the likelihood of those who view the future impact of BlockChain in commercial banking within the next five years as revolutionary, also believing that the use cases being developed for it currently are future proof. Also indicative of age being associated with the length that an employee has been employed by ComBank and thus, that the older the employee is, the more likely it is that they have been employed longer within ComBank. Further indicative of the gender of the employees being a determinant of whether they view BlockChain as having a future impact in commercial banking that is insignificant or revolutionary.

5.4.3 Survey B - BC_Adoption Regression

SurveyB_BlockChain_Adoption correlated with SurveyB_Future_Impact with a moderate strength of relationship with an R-value of 0.344 and a p-value of 0.03 which indicated an extremely high level of statistical significance in this correlation.

The correlation between these variables shows that as BlockChain was being utilised to improve operational efficiencies with multiple use cases within ComBank, there is the potential for an increase in its adoption across use cases such as increased transparency of fund movements and improved capital optimisation, in this process, leading to an impact from BlockChain technology that is revolutionary for the long term and beyond and can be looked at five years down the road with an appreciation for how it has improved the ComBank market performance and in the process, aligning with its strategic imperatives.

5.4.4 Survey A – Bivariate Correlation and Statistical Significance Analysis

For the analysis of Survey A, only correlation coefficients above 0.5 are discussed representing strong correlations. Pearson correlation was utilised, based on the assumption that both variables in the correlation pairs are normally distributed and there are linear correlations between each of the two variables (Statbook, 2018)

The Bivariate correlation analysis was done across multiple variables with the strongest correlations (greater than 0.5 correlation coefficient) statistically analysed.

- Variable SurveyA_Dig_Wallet_Support is strongly correlated at the 0.01 level with variable SurveyA_Appetite_Diff_Trans_Options with an R-value of 0.576. This

indicates that those respondents who were willing to sign up for digital wallets are also open to different ways of banking using technology like BlockChain.

- Variable SurveyA_BC_Disrupt_Trad_Payments is strongly correlated at the 0.01 level with variable SurveyA_Appetite_Diff_Trans_Options with an R-value of 0.588. This indicates that those respondents who believe BlockChain technology is challenging traditional banking strategies are also open to exploring different ways of banking using technologies like BlockChain
- Variable SurveyA_BC_Disrupt_Trad_Payments is strongly correlated at the 0.01 level with variable SurveyA_Dig_Wallet_Support with an R-value of 0.533. This indicates that those respondents who believe that BlockChain technology is challenging traditional banking strategies are also willing to sign up to a digital wallet service that allows them to transact in crypto-currencies
- Variable SurveyA_Multiple_Banking_Accounts is strongly correlated at the 0.01 level with variable SurveyA_BC_Disrupt_Trad_Payments with an R-value of 0.647. This indicates that those respondents who have multiple bank accounts are also of the belief that BlockChain technology is challenging traditional banking strategies
- Variable SurveyA_Crypto_Currency_Ownership is strongly correlated at the 0.01 level with variable SurveyA_Dig_Wallet_Support with an R-value of 0.553. This indicates that if a respondent owns crypto-currency, they are more likely to be open to and willing to sign up to a digital wallet service that allows them to transact in crypto-currencies
- Variable SurveyA_BC_Future_Impact is strongly correlated at the 0.01 level with variable SurveyA_Appetite_Diff_Trans_Options with an R-value of 0.600. This indicates that those respondents who believe that the impact of BlockChain in commercial banking in the next five years will be revolutionary are more likely to be open to exploring different ways of banking using technologies like BlockChain
- Variable SurveyA_BC_Future_Impact is strongly correlated at the 0.01 level with variable SurveyA_Dig_Wallet_Support with an R-value of 0.517. This indicates that those respondents who believe that the impact of BlockChain in commercial banking in the next five years will be revolutionary are more likely to be willing to sign up to a digital wallet service that allows them to transact in crypto-currencies

- Variable SurveyA_BC_Future_Impact is strongly correlated at the 0.01 level with variable SurveyA_BC_Disrupt_Trad_Payments with an R-value of 0.601. This indicates that those respondents who believe that the impact of BlockChain in commercial banking in the next five years will be revolutionary are more likely also to have the belief that BlockChain technology is challenging traditional banking strategies
- Variable SurveyA_BC_Future_Impact is strongly correlated at the 0.01 level with variable SurveyA_Multiple_Banking_Accounts with an R-value of 0.503. This indicates that those respondents who believe that the impact of BlockChain in commercial banking in the next five years will be revolutionary are more likely to have multiple banking accounts with more than one commercial bank.

The statistical significance on the analysed variables is exceptionally high, with p-values of less than or equal to 0.022.

5.4.5 Survey B – Bivariate Correlation and Statistical Significance Analysis

For the analysis of Survey B, only correlation coefficients above 0.395 are discussed representing moderate and strong correlations. Pearson correlation was utilised based on the assumption that both variables in the correlation pairs are normally distributed and there are linear correlations between each of the two variables (Statbook, 2018).

The Bivariate correlation analysis was done across multiple variables with the strongest correlations (greater than 0.5 correlation coefficient) statistically analysed.

- Variable SurveyB_Impactful_Strategies is strongly correlated at the 0.01 level with variable SurveyB_Innov_Use_Cases with an R-value of 0.615
- Variable SurveyB_Future_Impact is moderately correlated at the 0.01 level with variable SurveyB_Impactful_Strategies with an R-value of 0.397
- Variable SurveyB_Future_Impact is moderately correlated at the 0.01 level with variable SurveyB_BlockChain_Adoption with an R-value of 0.476
- Variable SurveyB_Gender is strongly correlated at the 0.01 level with variable SurveyB_Age with an R-value of 0.535

The statistical significance on the analysed variables is exceptionally high, with p-values of 0.000 across the four variable pair analyses.

In conclusion, there is a clarity in ComBank that BlockChain brings with it benefits and can be applied across multiple use cases which can benefit different parts of the business. This is key to driving the ComBank strategy, ensuring that its employees are part of the process and they are key driving force in its digital transformation while embracing BlockChain and the 4th Industrial revolution. In staying relevant and innovative, ComBank will review its strategy continuously to ensure that they remain competitive and where possible, be the driving force through a competitive advantage gained and maintained. A significant percentage of the ComBank workforce favour BlockChain use in improving capital optimisation and minimising the impact of reconciliation errors. The primary purpose of this being informing stakeholders of benefits and value to allow them to make better decisions through optimised processes that value open communication.

Ultimately as more and more are exposed to simple use cases such as digital currency, adoption of the technology will grow, and traditional banking strategies will evolve out of necessity. This will result in the entire commercial banking sector being able to leverage use cases that are cross-functional and beneficial to the sectors long term success and relevance. For ComBank in particular, the benefits of adoption will be revolutionary within the next five years, and this will lead to improved market performance and strategic advantage.

6 Conclusion and Recommendations

The researcher set out to ascertain to what extent BlockChain technology can positively impact the operational efficiencies of a commercial bank, how this impact influenced the strategy of the bank and whether in this process, the use cases developed and executed would be future proof and applicable across the commercial banking sector for the mid to long term. Two Surveys were used to obtain a mixed view of generalists and specialists as well as to obtain top tier South African commercial banking employees' view. The justification was that the researcher wanted to see whether in reaching out to a broader audience, the value of the input would exceed or compare with that of a specific commercial banking employee. The responses were statistically analysed for validity, reliability, correlation and statistical significance. What the researcher found through the process is outlined below.

6.1 Alignment to original Hypotheses

The dependent variables that show correlations that are reflective of whether the original hypotheses were correct are BC_Disrupt_Trad_Payments for Survey A and Impactful_Strategies and BC_Adoption for Survey B. SurveyA_BlockChain Understanding also showed that there is a general understanding of what BlockChain entails across multiple themes or focus areas. There is clarity through the responses to the questions linked to these variables that there is a strong view that BlockChain technology is challenging traditional commercial banking strategies, assisting the banks to embrace and flourish within the 4th Industrial revolution. It is adding to how traditional banking is being adapted, and there is increased adoption of BlockChain in the commercial banking sector as well as banking as a whole. This is due to use cases being developed that can assist with multiple business issues that are beneficial across multiple commercial banks (e.g. Liquidity Coverage Ratio Process Automation, Fund Distribution and regulatory reporting process automation).

A significant majority of the respondents, specifically 81.5%, were of the opinion that BlockChain technology is challenging traditional banking strategies (e.g. executing payments, providing loans, clearing and settlements). This provides a view that BlockChain is inevitably impacting strategies of commercial banks and assisting them in positioning themselves for the digital era where the 4th Industrial revolution is being embraced in order to stay relevant

and competitive. With such an overwhelming view in favour of strategies being challenged, and the view being sought across the response base, Blockchain solution adoption and the ability to execute on a bank's strategy while ensuring that operational efficiencies are enabled is a reality that is happening within ComBank, and possibly within the broader commercial banking landscape. This highlights to the researcher that adapting strategies can position a bank strategically and ultimately result in a competitive advantage if they not only look at Blockchain as a technology in isolation but also ensure that they equip themselves with the people and skills to leverage the benefits of the technology, while also ensuring that their processes can be executed without a need for re-engineering.

In order to maintain this competitive advantage, the focus on people, process and technology is vital and the only way to ensure sustained success. Therefore those commercial banks that ensure that they invest the time, effort and funding into understanding the risks and benefits of Blockchain and how it can be utilised to solve complex business problems will see that this is the route to being operationally efficient for the long term.

6.1.1 Recommendation 1

Additional studies could add to management knowledge by not only looking at the operational efficiencies that can be achieved through the utilisation of Blockchain in commercial banking but could conduct a more in-depth analysis on the downstream benefits that could possibly materialise as a result of embracing the technology and exploring its benefits.

6.1.2 Recommendation 2

Additional studies could add to management knowledge by looking into how Blockchain is utilised to enable operational efficiencies across the top four banks in South Africa, and how their approaches compare and what cross learnings can be shared across the banks.

6.1.3 Recommendation 3

Additional studies could add to management knowledge by looking into how exponential technologies (BlockChain, artificial intelligence, and predictive analytics) can be utilised to enable the SA regulatory landscape and to standardise how all SA banks interface and engage with the central bank of the country. This could include policy setting, structuring regulatory sandboxes and driving clearance and settlements within our borders and beyond.

6.1.4 Recommendation 4

As part of the potential future studies, the researcher would recommend that more qualitative responses are obtained, and thematically analysed in tandem with the quantitative data.

The key message that the researcher would want to be conveyed through the research is that there is an increase in the adoption of BlockChain and this adoption leads to operational efficiencies within commercial banks, undoubtedly influences strategic direction and can add immense value despite the technology not being suited to solving every single complex business problem.

In conclusion, the sample sizes were sufficient for Survey B to yield significant views that aligned with the research hypotheses and could prove them, supported by Survey A for exploratory analysis and obtaining more in-depth views around what the understanding of BlockChain is. The approach of the two surveys however provided clarity on why it is essential to directly target the response base that is envisaged as able to provide the most valuable inputs. The researcher is confident that the findings are conclusive and that the hypotheses have been proven through this deductive research process despite the limitations of sample size, the focus on a primarily quantitative approach and the compact structure of the surveys.

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Appendix A

Survey A (Wide Distribution) Normality Test

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SurveyA_Appetite_Diff_Trans_Options	.524	43	.000	.374	43	.000
SurveyA_Dig_Wallet_Support	.416	43	.000	.603	43	.000
SurveyA_BC_Disrupt_Trad_Payments	.540	43	.000	.219	43	.000
SurveyA_BC_Experience_Banking	.531	43	.000	.331	43	.000
SurveyA_BC_Innov_Use_Case	.344	43	.000	.694	43	.000
SurveyA_Multiple_Banking_Accounts	.485	43	.000	.501	43	.000
SurveyA_Actual_Transaction_Preferences	.404	43	.000	.645	43	.000
SurveyA_Crypto_Currency_Ownership	.381	43	.000	.627	43	.000
SurveyA_BC_Future_Impact	.506	43	.000	.445	43	.000

a. Lilliefors Significance Correction

Survey B (ComBank Employees) Normality Test

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SurveyB_Employment_Tenure	.188	81	.000	.863	81	.000
SurveyB_Department	.286	81	.000	.803	81	.000
SurveyB_BC_Understanding	.343	81	.000	.636	81	.000
SurveyB_Innov_Use_Case	.167	81	.000	.905	81	.000
SurveyB_Impactful_Strategies	.253	81	.000	.888	81	.000
SurveyB_BlockChain_Adoption	.193	81	.000	.882	81	.000
SurveyB_Future_Proof	.354	81	.000	.712	81	.000
SurveyB_Future_Impact	.395	81	.000	.659	81	.000
SurveyB_Age	.208	81	.000	.852	81	.000
SurveyB_Gender	.267	81	.000	.803	81	.000

a. Lilliefors Significance Correction

Appendix B – Survey A Questions

What is your understanding of BlockChain Technology?

Are you open to exploring different ways of banking using technologies like BlockChain to offer services differently to how many are accustomed to in South Africa?

- ☐ Yes
- ☐ No

Are you willing to sign up to a digital wallet service that allows you to transact in cryptocurrencies such as Bitcoin and Ethereum?

- ☐ Yes
- ☐ No

Do you believe that BlockChain technology is challenging traditional banking strategies (e.g. executing payments, providing loans, clearing and settlements)?

- ☐ Yes
- ☐ No

Have you ever worked in commercial banking and had first-hand experience with a BlockChain enabled solution enabling operational efficiencies?

- ☐ Yes
- ☐ No

If you have seen or been involved in a BlockChain Solution being implemented with a different use case and outcome? Please elaborate on the details? Please provide a detailed response

What in your view is the most innovative use case for BlockChain Technology in commercial banking today?

- ☐ Business to Business payments on-boarded onto a common BlockChain
- ☐ Fund distribution and regulatory reporting
- ☐ Car, house or asset loan provision through simplified KYC processes

Do you have multiple accounts with multiple commercial banks

- ☐ Yes
- ☐ No

What are your particular transacting preferences?

- ☐ E-commerce based transactions
- ☐ Transacting in cash at traditional stores
- ☐ Card-based transacting in traditional stores

Do you own any crypto-currencies such as Bitcoin or Ethereum?

- ☐ Yes
- ☐ No

What do you believe will be the impact of BlockChain in commercial banking in the next 5 years?

- ☐ Revolutionary
- ☐ Insignificant

Appendix C – Survey B Questions

How long have you worked for your current banking employer?

- ☐ 0 - 2 years
- ☐ 2 - 5 years
- ☐ 5 - 8 years
- ☐ 8 years +

Which department do you work in within your banking employer?

- ☐ Information Technology
- ☐ Finance
- ☐ Human Resources
- ☐ Supply Chain Management
- ☐ Other Department (Please specify)

What is your understanding of BlockChain Technology? (Please choose all options that apply)

- ☐ It is a Distributed Ledger Technology
- ☐ It is built from 3 technologies (Private Key Cryptography, P2P networking and the BlockChain protocol)
- ☐ It is an innovation in information registration and distribution eliminating the need for trusted parties
- ☐ I have a very limited understanding

What in your view is the most innovative use case for BlockChain Technology in banking today?

- ☐ Liquidity Coverage Ratio Process Automation
- ☐ Asset loan provision through simplified KYC processes (Car, House etc.)
- ☐ Fund Distribution (Between Commercial banks, Regulators and other parties)
- ☐ Regulatory Reporting Process Automation

What are the most impactful strategies for consideration in the enablement of BlockChain in banking? (Please select all options that apply)

- Business Realignment (exit business lines that have high costs and low margins)
- Channel Optimization (to meet customers' changing expectations)
- Process Costs (reduce the unit cost-to-value ratio of each activity or transaction)
- Vendor Relationships (consolidating vendors and monitoring performance issues)

How is BlockChain being utilized to improve operational efficiencies in your banking environment?

- Reduced Error Handling and Reconciliation
- Increased Transparency
- Improved Contractual Performance due to Smart Contracts
- Improved Capital Optimization
- Other (Please specify)
- BlockChain is not utilized in my banking environment

Do you believe that BlockChain banking use cases currently being developed are future proof?

- Yes
- Maybe
- No

What do you believe will be the impact of BlockChain in commercial banking in the next 5 years?

- Revolutionary
- Insignificant

Please provide your age below?

- 18 - 25 years
- 25 - 32 years
- 32 - 40 years
- 40 years +

Please indicate your gender below?

- ☐ Male
- ☐ Female
- ☐ Non-binary (those who do not feel exclusively male or female)