The role of Blockchain in reducing cross-border remittance costs for South Africans

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ABSTRACT

The de-risking of central banking relationships (CBR's) after the 2008 Global Financial Crisis has led to a reduction in the number of financial institutions, resulting in increased costs and slower cross-border remittances (Rella, 2019). Additionally, the high remittance fees in developing economics are further attributed to cash-based transactions for first and last mile remittance deliveries, regulation, compliance costs, as well as the lack of competition in these markets (Rühmann et al., 2020).

The paper highlights the problems faced with traditional methods of remitting and develops a series of research questions that are investigated. An in depth understanding of the cost driving mechanisms are unpacked, as well as the time delays experienced when remitting. By developing an understanding and focusing on remitters within the SADC corridors of Zimbabwe, Malawi and Mozambique, the study will narrow allowing for a more detailed analysis of the 'real' costs involved.

The research design adopts a hypothesis testing approach, leveraging existing data on cross-border remittance costs and transaction speeds. A quantitative method approach using SPSS was adopted, which will enable statistical testing of the research hypotheses outlined. This paper therefore seeks to compare the average costs and transaction speeds associated with using blockchain in cross-border remittance to that of the traditional methods used in South Africa.

Globally, South Africa remains the costliest G20 nation to remit from, with an average remittance cost of 12.82% in Q4 2023, compared to the UK at 6.4%, the US at 5.9%, and Germany at 6.1% during the same period. Should South Africa leverage blockchain technology in the remittance market, the remittance costs in cross-border transactions may be reduced significantly.

KEYWORDS

Blockchain, cross-border payments, remittances, Central Bank Digital Currencies (CBDCs)

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ALDA – Authorised dealer in foreign exchange with limited authority

AML – Anti-Money Laundering

CBDC – Central Bank Digital Currency

CBN – Correspondent Banking Network

CBR – Central Banking Relationships

EUR – European Union Currency

FICA – Financial Intelligence Centre Act

FSCA – Financial Sector Conduct Authority

KYC – Know Your Customer

MTO – Mobile Transfer Operator

SARB – The South African Reserve Bank

SDG – Sustainable Development Goals

SWIFT – Society of Worldwide Interbank Financial Telecommunication

TTF – Time to Finality

USD – United States Doller

ZAR – South African Rand

CHAPTER 1. INTRODUCTION

1.1 Statement of purpose

This quantitative study is to investigate the use of blockchain in reducing the fees faced with traditional methods of cross-border remittances for South Africans.

1.2 Background of the study

De-risking of central banking relationships (CBR's), following the Global Financial Crisis of 2008, has resulted in fewer financial institutions, increased costs, and reduced speed of remittances cross-border (Rella, 2019). Emerging markets and low-income countries benefit from these remittances as migrants transfer their earnings to their native countries (Adrian et al., 2023; Kpodar & Imam, 2024). Zimbabwe, Malawi, and Mozambique collectively account for over 77% of formal remittance flows from South Africa, driven by a large base of migrant workers (FinMark Trust, 2021). These countries are highly dependent on remittances for household income and form the basis of this study.

The Sustainable Development Goals (SDG) of Agenda 2030 target to bring the costs of remittances to less than 3% and eliminate those avenues that are greater than 5% (Rühmann et al., 2020). Recent years, however, have seen slow progress on this front with the global average cost of remitting at 6.39% (Worldbank, 2023a). South Africa remains the costliest G20 nation to remit from, with an average cost of remitting in Q4 2023 of 12.82% (Worldbank, 2023a). Households in developing countries depend on remittances as a source of income, but they aren't seeing the full benefits due to the high transaction costs involved (Rühmann et al., 2020).

Blockchain in recent years can be used as a form of cross-border remittance. Blockchain is a decentralised, peer-to-peer payment system that securely records transactions in real-time without the need for a central intermediary (Nakamoto, 2009). Its application in financial services enables faster, more transparent, and lower-cost cross-border transactions, making it a viable technology in the market of remittance reform (Lewis et al., 2017).

1.3 Research problem

Traditional remittance services charge high fees inclusive of exchange rate markups, service charges, and handling costs. These add up to an average of 12.82% in South Africa's remittance corridors (Worldbank, 2023a). A key technical risk in digital money transfers is double spending, where a digital currency is spent more than once for malicious reasons. Blockchain addresses this risk through validation and consensus protocols, ensuring transaction uniqueness and immutability (CFI Team, 2023; Nakamoto, 2009).

The following sub-problems will be provided in the study:

Sub Problem 1:

The high transaction costs and long processing times of remittance services in SADC corridors hinder financial inclusion and affordability (Rühmann et al., 2020; Worldbank, 2023a).

Sub Problem 2:

The lack of trust between central banks in developing countries increases the reliance on multiple intermediaries to complete remittance transactions, leading to increased settlement costs and delays. Blockchain, through decentralised trust mechanisms and smart contracts, may reduce this reliance (Adrian et al., 2023; Deng, 2020).

Sub Problem 3:

Global adoption of blockchain for remittances is hindered by uncertainty in regulation, including how digital assets are classified and governed across borders. In South Africa, regulatory compliance under the South African Reserve Bank (SARB) and Finance Sector Conduct Authority (FSCA) slows institutional adoption, as banks remain cautious toward blockchain applications (Blake, 2024; Kamlana, 2022).

1.4 Research questions

The hypothesis testing nature of the research paper lends itself to the following research questions:

1. Does the work done in the cross-border remittance market transform the market in terms of lowering costs and increasing transaction speeds?
2. Does digital currency adoption and trust among central banks aid in reducing intermediaries and the associated costs of remitting?
3. Are global trends in blockchain allowing for easier and more trusted means of remitting while remaining regulatory compliant?

1.5 Rationale

Research has been undertaken on blockchain and the potential use cases of the technology in the processing of cross-border remittances (Kirobo et al., 2024), but not much has been done on it within the South African context. This creates a gap for further research as the benefits of the technology have the potential to lower remittance costs and increase remittance speeds (Rühmann et al., 2020).

1.6 Delimitations of the study

This study is delimited to the emerging economy of South Africa, with the focus on three South African remitting corridors, which include Zimbabwe, Malawi, and Mozambique.

The study is further delimited to transaction sizes of USD200 and USD500. These amounts will allow for the comparison with the World Bank Remittance Price database (Worldbank, 2023a).

1.7 Definition of terms

Blockchain – is a consensus mechanism underpinned by a peer-to-peer framework where immutable transactions are verified and stored on a decentralised digital ledger (Nakamoto, 2009).

Double-spending – is when digital currency is spent more than once, posing a challenge related to the ease with which it can be replicated (CFI Team, 2023).

Immutable – unchangeable transaction records that all network participants can access but not change (Lewis et al., 2017).

Public blockchains – are permissionless networks, where consensus algorithms are used to authenticate transactions and ensure the networks integrity (Kashyap & Saxena, 2024).

Private blockchains – are permissioned networks and have limitations regarding accessibility (Kashyap & Saxena, 2024).

Smart contracts – These contracts, encoded in computer language, activate without human intervention once predetermined criteria outlined in the contract are satisfied (Lewis et al., 2017).

Time to finality – represents the maximum time to complete a transaction (Chainspect, 2024a).

1.8 Assumptions

The key assumptions in the study include:

- The implementation of blockchain smart contracts increases 'trust' among central banks and therefore reduces costs and settlement times when remitting.
- If adopted by industry, regulation and compliance allows for the implementation of blockchain in cross-border remittance.
- The study is confined to emerging economies, with the focus on South African remitting corridors.

1.9 Chapter Outline

This concludes the introductory chapter of the study. Chapter's 2 and 3 that follow, the literature review and research methodology chapters, seek to develop a deeper understanding by reviewing literature on remittance systems, blockchain technology, and regulatory dynamics, and developing a research methodology suitable to the study by including the research design, data sources, and analysis techniques. Chapter 4 outlines the analysis and interpretation of results using statistical tools in

SPSS, and the research methodology designed, to conduct the study. Chapter 5, the discussion, combines the previous chapters and ties the results to the literature reviewed. Lastly the conclusion chapter in chapter 6 summaries the findings of the study, outlines limitations and suggests recommendations for further research.

CHAPTER 2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

After identifying the problem and research questions, this chapter focuses on engaging the literature underpinning blockchain technology, global trends, digital currency adoption and challenges in Africa, as well as the benefits of blockchain use in cross-border remittance.

2.2 Background discussion

The primary function of blockchain technology is to guarantee transparency and immutability of digital records, while eliminating the need for third party intermediaries to validate transactions (Kashyap & Saxena, 2024). Blockchain is a decentralised digital ledger technology that records transactions, increases transaction speeds and transparency. Each transaction is encrypted, grouped into blocks, and added sequentially, forming an immutable chain (Nakamoto, 2009).

Blockchain serves to de-risk the cross-border financial services sector by withdrawing services from institutional banks and use digital currencies to remit autonomously without the need for intermediaries (Lewis et al., 2017). The rise of digital transactions has increased the inherent risk of double spending (Nakamoto, 2009). The phenomenon applies in cross-border remittance, and trusted intermediaries are required to verify cross-border transactions for security and to prevent double-spending (Deng, 2020). To address this issue, two approaches are adopted: financial institutions who serve as trusted intermediaries or blockchain technology (CFI Team, 2023).

2.3 Traditional methods of cross-border remittance

Traditional cross-border remitting is conducted through trusted intermediaries, using remittance bank transfers (SWIFT), international credit card agencies, third-party payment companies, or professional remittance companies (Deng, 2020). Over 4,000

banks use the Society of Worldwide Interbank Financial Telecommunications (SWIFT) system for international settlements, each with unique SWIFT codes serving as their bank identifiers for inter-bank remittances (Deng, 2020).

Typically, transfers through the SWIFT system take 2 to 3 working days. However, professional remittance companies can complete transfers in just a few minutes (Deng, 2020). In South Africa, SWIFT payments or professional remittance companies like Western Union are widely used and preferred, as a formal means of remitting (Worldbank, 2023a).

Unauthorised and fraudulent transactions represent a major challenge in the remittance space. Traditional channels are prone to identity theft, social engineering, or fraud in cash-based remittance environments. Blockchain can reduce this risk by using smart contracts and public ledger transparency, which make it nearly impossible to alter or reverse confirmed transactions without network consensus (Chainspect, 2024a; Lewis et al., 2017).

2.4 Cross-border remittance landscape in South Africa

Globally, South Africa remains the costliest G20 nation to remit from, with an average cost of 12.82% in Q4 2023, compared to the UK at 6.4%, the US at 5.9%, and Germany at 6.1% during the same period (Worldbank, 2023b). These figures highlight the structural inefficiencies in South Africa's remittance market. Studies show that the current system of formal remittance methods are expensive, timely, requires capital liquidity and offers low security (Deng, 2020). Factors hindering methods of remittance stem from regulatory requirements, which impacts the choice of remittance channels (Akinboade et al., 2017).

According to the Sustainable Development Goals, the United Nations recommends reducing global remittance costs to less than 3% by 2030 (Worldbank, 2023a). Currently, the global average stands at 6.39%, with sub-Saharan Africa averaging 7.83%, and South Africa's costs significantly higher at 12.82% in Q4 2023, more than four times the SDG target (Worldbank, 2023b).

2.5 Work done on blockchain in cross-border remittance

Blockchain systems allow transactions to take place only once both sender and receiver accounts are verified, and after validating positive balances are available to complete the transfer (Kirobo et al., 2024). Blockchain utilises cryptocurrencies as a bridge asset and blockchain networks to allow transactions on a decentralised, peer-to-peer system where remittance costs are low and near real time (Qiu et al., 2019; Rühmann et al., 2020). In addition, blockchain delivers traceability and stronger visibility compared to SWIFT, tackling derisking by reducing Know Your Customer (KYC) and Anti-Money Laundering (AML) compliance costs (Rella, 2019).

2.5.1 *Regulatory Environment in South Africa and SADC*

South Africa's regulatory environment for crypto assets remains restrictive. The Financial Sector Conduct Authority (FSCA) declared crypto assets as financial products in October 2022, bringing them under the Financial Intelligence Centre (FIC) Act and requiring licensing for any advisory or intermediary services (FSCA, 2022). Furthermore, the South African Reserve Bank (SARB) prohibits banks from directly engaging with crypto assets, citing concerns about volatility and AML risks (SARB, 2023). The FIC Act further imposes stringent AML/KYC compliance measures, complicating onboarding and limiting innovation in the blockchain-based remittance sector (Ayavuya & Pholwane, 2024).

2.5.2 *Hypothesis 1*

Research hypothesis:

H1: The application of blockchain in cross-border remitting will reduce the costs, allowing for an alternative means of remitting.

Null hypothesis:

N1: Blockchain used in cross-border remitting has no impact on reducing the remittance costs.

2.6 Digital currency adoption in Africa

The interdependency between technology, culture, regulation, and socio-economic factors plays a significant role in digital currency adoption in Africa (Adeleye et al., 2023). Adeleye et al. (2023) suggests that African nations are exploring digital methods of financial inclusion through remittances via digital currencies. Digital currencies built on mobile technologies using blockchain can transform the financial market in Africa, positioning itself as a leading player, extending services to developing economies through sustainable economic development and financial inclusion (Adeleye et al., 2023).

2.6.1 *Challenges of blockchain in cross-border remittance*

Digital currency adoption in African presents both possibilities and challenges (Adeleye et al., 2023). Infrastructure limitations and financial literacy play the largest role in hindering digital currency adoption together with regulatory uncertainties, limiting digital ecosystems that foster remittance in Africa (Adeleye et al., 2023). Lewis et al. (2017) further found regulatory uncertainty to pose a significant obstacle in the implementation of blockchain in Africa. Furthermore, given the cash-based nature of developing economies, cash on-ramps and off-ramps are required when providing remittance services in Africa, and these last mile cash delivery services contribute to the high costs of remitting (Rühmann et al., 2020).

2.6.2 *Benefits of blockchain in cross-border remittance*

Deng (2020) and Adrian et al. (2023) argue that the primary cost in cross-border remittance is in the different types of settlement costs within the intermediaries, as commercial banks don't 'trust' one another. Blockchain reduces the added 'trust' cost in the system by harnessing the power of transparent transaction processing (Deng, 2020). To aid in automation of process, and create a "trust less" remitting system, smart contracts in blockchain are used (Deng, 2020). Smart contracts eliminate the need for third-party intermediaries, enhance efficiency and reliability and reduce the costs of remitting (Lewis et al., 2017; Kashyap & Saxena, 2024).

2.6.3 *Hypothesis 2*

Research hypothesis:

H2: The application of blockchain smart contracts in cross-border remitting will increase ‘trust’ among central banks, increasing the speed of transaction.

Null hypothesis:

N2: Blockchain smart contracts used in cross-border remitting has no impact on ‘trust’ among central banks and the subsequent transacting speed.

2.7 Global trends in blockchain remittance

Lewis et al. (2017) suggests that the future innovation in financial markets will stem from blockchain technology. By the year 2027, the World Economic Forum expects 10% of global GDP to be accounted for by blockchain (Allaire, 2024). The cross-border remittance market has seen significant interest in blockchain, with over 90% of financial institutions in the United States and Europe initiating inquiries into blockchain applications (Kashyap & Saxena, 2024). The latest trends around blockchain and cross-border remittance include public vs private blockchains and the use of CBDC’s.

2.7.1 *Public vs private blockchain*

Developments of the blockchain have grown to include both public and private blockchains. Public blockchains require no central authority to validate transactions on the network (Lewis et al., 2017), whereas, private blockchains are available to authorised users only and offer higher degrees of privacy and security (Kashyap & Saxena, 2024). Regulatory benefits are also realised as KYC and AML provide further requirements through pre-approval and trust, over public blockchains where the network is anonymous and open (Lewis et al., 2017).

2.7.2 *Central bank digital currencies (CBDCs)*

Kirobo et al. (2024) found that by using CBDC’s, cross-border payments are made simpler between transacting parties without the need for third-party interventions.

CBDC's can provide the link between old and new financial systems, keeping safety, security, and trust amongst central banks (Adrian et al., 2023). International transactions through CBDC's can solve interoperability challenges and alleviate cross-border regulation (Kashyap & Saxena, 2024). CBDC's can access unlimited central banking funds in Nostro-Vostro accounts, increasing financial liquidity across remitting countries (Kirobo et al., 2024).

2.8 ANALYTICAL FRAMEWORK

2.8.1 *Theoretical Framework*

Conceived by E.M. Rodgers in 1962, the theory of diffusion of innovation (DOI) is closely related to adoption theory, and according to LaMorte (2022), one cannot look at the two theories in isolation. Blockchain can be seen to be in the "early adopters" phase with more and more institutions entering the market (Tozex, 2019). Adoption rates have slowed in recent years however, as the financial sector grapples with clear guidelines to allow for cross-border use of new technologies (Blake, 2024).

The following figure, Figure 1, highlights the five adopter categories of DOI theory (LaMorte, 2022).

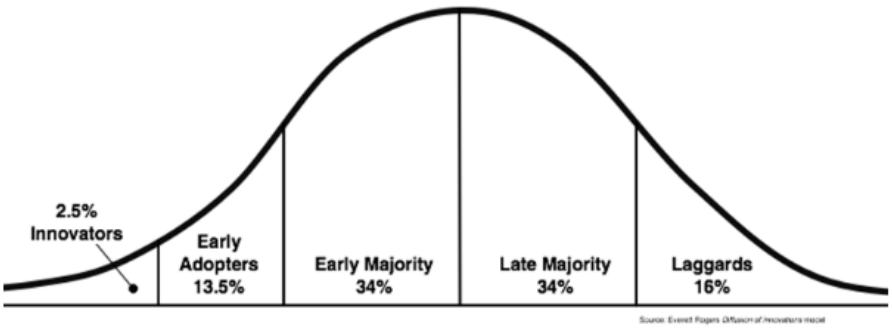

Figure 1: Diffusions of innovation (DOI) theory curve (LaMorte, 2022).

2.8.2 *Conceptual Framework*

The dependant variable includes the cost and speed of transaction. Trust amongst central banks is the main reason for intermediaries (Adrian et al., 2023; Deng, 2020),

therefore, it is the independent variable as it directly impacts the costs of remitting. The mediating variable involves regulation and compliance due to the direct impact on central banking 'trust'. To increase 'trust', blockchain smart contracts can be implemented to automate process (Lewis et al., 2017). Therefore, the moderating variable of the study is smart contracts. The control variable is developing economies, focusing on South Africa.

The following figure, Figure 2, highlights the schematic approach to the study's conceptual framework (authors own work).

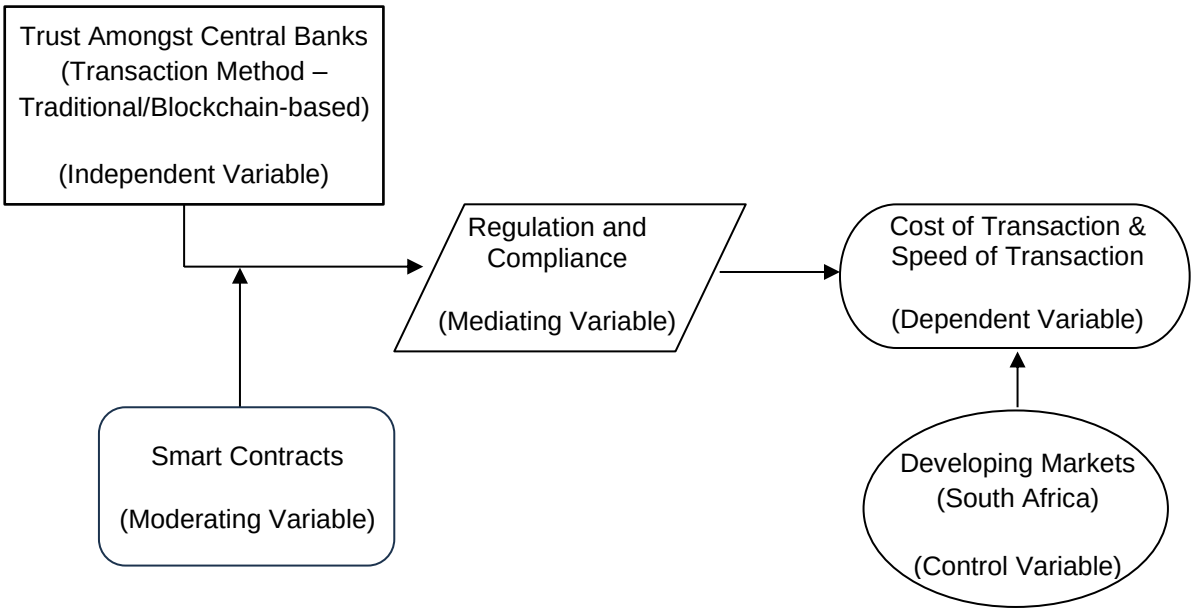

Figure 2: Schematic diagram of conceptual framework (authors own work).

2.9 Conclusion of Literature Review

In conclusion, the empirical literature review and analytical framework around the work done on blockchain in cross-border remittance, digital adoption in Africa and global trends has highlighted key insights and has assisted in the development of two research hypotheses. These hypotheses mentioned above compare blockchain transaction costs and speeds to that of traditional remitting methods. They form the basis of the study, allowing for the research questions to be answered.

2.9.1 *Hypothesis 1*

H1: The application of blockchain in cross-border remitting will reduce the costs, allowing for an alternative means of remitting.

2.9.2 *Hypothesis 2*

H2: The application of blockchain smart contracts in cross-border remitting will increase ‘trust’ among central banks, increasing the speed of transaction.

CHAPTER 3. RESEARCH METHODOLOGY

This chapter addresses the research objectives, by exploring the research methodology, through data collection strategies used for analysis and interpretation, quality assurance and ethical considerations.

3.1 Research approach

A quantitative approach was chosen to expand the research gap and compare the costs and speeds of cross-border remittances between traditional and blockchain-based systems. This approach allows for objective measurement and statistical testing of the hypotheses using numerical data (Bryman & Bell, 2011a). Adopting a statistical model through quantitative methods enables the application of non-parametric tests, to evaluate cost and speed variations between remittance methods, from primary and secondary numeric data (Bryman & Bell, 2011a).

3.2 Research design

The research design lends itself to quantitative methods and follows a similar design methodology as that taken by Finmark Trust (FinMark Trust, 2021). The primary and secondary data collected and compared statistically, assessed the average cost and speed of remitting across the SADC corridors mentioned. This was advantageous to the study as it allowed for the collection and analysis of data, from a South African and SADC perspective, supporting the studies goal of evaluating the cost efficiencies and effectiveness across remittance methods.

3.3 Data collection methods

The data collection method was of desktop nature, and the data gathered for the study was attained online and through publicly available channels. Primary data was collected from the website of blockchain service provider Binance, as Binance is the single largest global cryptocurrency exchange and used across SADC countries mentioned (Binance.com/ZA, 2024a). The secondary data gathered was taken from the World bank Price Remittance Database (Worldbank, 2023b).

3.4 Population and sample

3.4.1 *Population*

The total population includes approximately 1,173 remittance transactions drawn from the World Bank Remittance Database (2023) and the Binance cryptocurrency exchange. Blockchain accounts for 570 transactions within the population and traditional methods account for 603 transactions. The transactions include blockchain service providers, Mobile Transfer Operators (MTO's) and banks across the three primary SADC corridors (Zimbabwe, Malawi and Mozambique).

3.4.2 *Sample and sampling method*

Within each population, simple random sampling will be employed ensuring normality (Kumar, 2011). Transaction sizes of USD200 and USD500 will be selected across the three SADC corridors. A sample size of at least 150 transactions for each transaction method is selected to ensure statistical significance (Bryman & Bell, 2011b). The primary and secondary data gathered were drawn from transparent, credible sources using consistent collection methods. Reliability and validity are ensured through the sampling design described, source credibility and statistical testing (Kumar, 2011).

3.5 The research instruments

The research data in Appendix A selected includes transparent costing structures from the website of blockchain service provider Binance for primary data collection, and Appendix B the World Bank remittance database for secondary data.

3.6 Procedure for data collection

Data has been collected through primary and secondary desktop sources as mentioned above. The selection criteria for the source data includes:

- Data on the average cross-border remittance costs and transaction speeds, from traditional methods used in South Africa, and blockchain.

- Data from industry published databases and transparent transaction fees from blockchain remitting companies (available on their websites).
- Data sourced and published within the past five years (2019-2024), with the primary focus being 2023 for a complete year of data.
- The corridors chosen are included in the World Bank Remittance Pricing Database, which provide the costs of remittances for transactions of USD200 and USD500 (Worldbank, 2023b).

3.7 Data analysis strategies and interpretation

A statistical and mathematical analysis approach using SPSS software was used to analyse the data obtained to a significance level of 5% ($p<.05$) and interpret the results (NCSS, 2024). The study focused on a comparison of means test given the population and sampling methods outlined (Bryman & Bell, 2011a).

The one-way ANOVA test was selected as the appropriate statistical test in the study, provided the data satisfies three key assumptions for valid test results (NCSS, 2024). If these assumptions are not met, a non-parametric alternative, the Kruskal-Wallis test, will be applied as demonstrated in chapter 4, the results section.

The assumptions include (NCSS, 2024):

1. A normal distribution spread of the data centred around the mean.
2. Homogeneity of equal variance and tested using the Levene's statistic.
3. Independence of the independent variable tested using the Chi-square test for independence.

The assumptions of normality and homogeneity of equal variance were not met in the study. Therefore, the one-way ANOVA test could not be used, and the Kruskal-Wallis non-parametric test was applied in SPSS for hypothesis testing (NCSS, 2024).

3.8 Possible limitations and challenges of the study

Government law and regulation as well as the monopolistic nature of South Africa's banking sector potentially limits the study. The regulatory framework includes strict

FIC Act AML/KYC compliance requirements as stated under the FIC Act and the FSCA declaration of crypto assets as financial products in 2022 (Ayavuya & Pholwane, 2024; Kamlana, 2022). Additionally, the SARB prohibits commercial banks from engaging in crypto trading, transacting or holding of crypto on behalf of clients directly (SARB, 2023). This slows institutional adoption and has made access to data a challenge (Blake, 2024; Thapa, 2024). Therefore, the study is pushed to primarily use online data that is publicly available and transparent.

3.9 Quality Assurance

3.9.1 *External validity*

Clear definition of measurement and devising of an indicator for data collection are essential. The average costs and transaction speeds in cross-border remittance define the units of measurement. Official statistics and data published on cross-border remittance is the indicator. The above metrics, provide a measure of concept, for external validity (Kumar, 2011).External validity was ensured by focusing on real-world remittance corridors (Zimbabwe, Malawi, Mozambique) and using publicly available datasets (World Bank, Binance) that reflect actual user costs.

3.9.2 *Internal validity*

Internal and construct validity of data collected must exhibit continuity rather than discreteness to ensure internal validity (Bryman & Bell, Reliability and Validity, 2011c). Ensuring the simple randomness of population samples, the probability of individual data points in the population being selected is equal and provides a measure of internal validity (Kumar, 2011).

3.9.3 *Reliability*

The data was scanned, cleaned, tested and retested in SPSS ensuring that the data is stable in delivering the desired outcomes (Kumar, 2011). The data gathered was evaluated for consistency, accuracy and dependability, by evaluating the source data for credibility and transparency. The data has been collected from credible sources,

with the source of the data indicating the collection methods and sampling techniques used. The data was cleaned, to remove inconsistencies (Binance.com/ZA, 2024a; Worldbank, 2023b).

3.10 Ethical considerations

This research has been confined to a desktop study, and therefore, doesn't not engage human participants. The primary and secondary data gathered has been appropriately referenced, and all illustrations utilised are attributed to their original creators. Data privacy was ensured, to protect the confidentiality of transaction data and ensuring compliance with data protection regulations. Ethical standards have been adhered to throughout the process, with the study aiming to make a constructive contribution to knowledge around cross-border remittance and blockchain technology.

3.11 Proposed schedule and timelines

The proposed schedule and timelines for research is tabulated in Table 9, Appendix C of the report. This table details the research questions, hypotheses, data collection methods and method of analysis.

CHAPTER 4. ANALYSIS AND INTERPERTATION OF RESULTS

4.1 Introduction

Chapter 4 presents the analysis and interpretation of results section of the report. The two hypotheses will be tested, to understand if the null hypothesis is valid in both cases. The average transaction costs and speeds using blockchain service providers will be compared against traditional means of remitting.

4.2 Results analysis and interpretation

The study has been delimited to the three South African remitting corridors mentioned (Zimbabwe, Malawi, and Mozambique) as well as transaction sizes of USD200 and USD500. These corridors and amounts will allow for the comparison with the World Bank Remittance Price database (Worldbank, 2023a), and were used to determine the base costs involved when remitting using blockchain.

Blockchain service provider Binance was used as it is the largest cryptocurrency exchange globally, and their transparent fee structure is listed on their website (Binance.com/ZA, 2024a). A cryptocurrency asset and a stable coin were selected and used in the study as two alternative means of remitting using blockchain. The two included XRP as the cryptocurrency asset and USDC as the stable coin (Binance.com/ZA, 2024a). Appendix A highlights Binance's withdrawal fees, and the additional costs associated when remitting using blockchain.

To determine the cost breakdown percentage and speed in hours when remitting using blockchain, various assumptions had to be made. These cost assumptions included:

1. The use of the average ZAR/USD exchange rate for the 2023 (Nedbank, 2023). (18,4519 ZAR = 1 USD)
2. The average cryptocurrency spot price for the relevant trading pairs in 2023 was used, Appendix A.4 (YahooFinance, 2023a; YahooFinance, 2023b). (0,525791 XRP = 1 USD and 1,000043 USDC = 1 USD)

3. Binance charges a flat deposit fee of 1,4% of the amount of funds deposited (Binance.com/ZA, 2024b).
4. Binance withdrawal fees are calculated using the average spot price of the cryptocurrency asset, Appendix A.1 & A.2 (Binance.com/ZA, 2024a).
5. The 2023 cash deposit and online transaction costs were calculated for 5 major banks in South Africa and used in determining the transaction costs involved, Appendix A.3 (BusinessTech, 2022; Hippo, 2023). The banks include ABSA, Nedbank, Standard bank, First National Bank and Capitec Bank.
6. The time to finality (TTF) was used as the speed of transaction metric for blockchain, Appendix A.5 (Chainspect, 2024b; NearProtocol, 2024; Ronin Network, 2023; XRP Ledger, 2024).

Data pertaining to the traditional methods of remitting has been collected from the World Bank Price Remittance data base for the 2023 financial year (Worldbank, 2023b). The data is publicly available and open source. The methods used by the World Bank to collect the remittance data are detailed in Appendix B.

To analyse, compare and interpret the data collected, and successfully complete a comparison of means test in SPSS, the following steps were carried out (NCSS, 2024).

4.2.1 *SPSS testing steps and assumptions*

Step 1 – Preparation of the data

The data was checked for errors to ensure the correct database was chosen (NCSS, 2024). Each group has a sample size of at least 150 individuals, with continuous and discrete data sets represented (NCSS, 2024; Laerd Statistics, 2018). Additionally, the data was reviewed for outliers that could skew the test results. To simplify the analysis, outliers that did not appear across different groups were omitted from the study (NCSS, 2024).

Step 2 – Prepare and execute the ANOVA panel

The relevant data was entered into SPSS using variables appropriate for the one-way ANOVA test. The confidence interval selected for the study was 95%, and a significant

value alpha of 5% (p<.05). Before the test could be executed, the one-way ANOVA assumptions needed to be checked (NCSS, 2024).

Step 3 – Assumptions check

The output displayed has been checked to determine if the assumptions of the study were met. The key assumptions for a valid one-way ANOVA test include: (Note: These assumptions were not met in the current study, so the Kruskal-Wallis test was applied as a non-parametric alternative.)

1. Normality: The data within each group should be normally distributed about the mean (NCSS, 2024).

To ensure normality, the sample sizes in each group were large enough to give conclusive results (Laerd Statistics, 2018). Testing the two dependant variables for normality, Figure 3 and 4, found the data to be positively skewed and hence violated the normality assumption for one-way ANOVA.

The following figure, Figure 3, shows a histogram plot and normality curve of the total cost percentage (%).

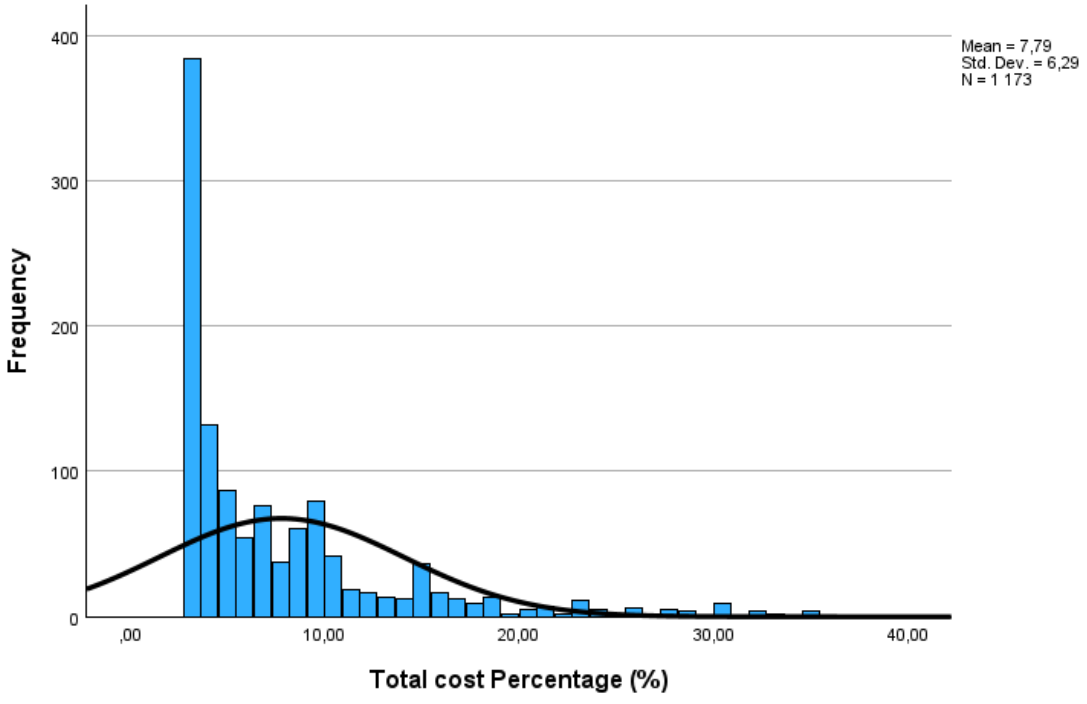

Figure 3: Histogram plot of the total cost percentage (%).

The following figure, Figure 4, shows a histogram plot and normality curve of the average transaction speed in hours.

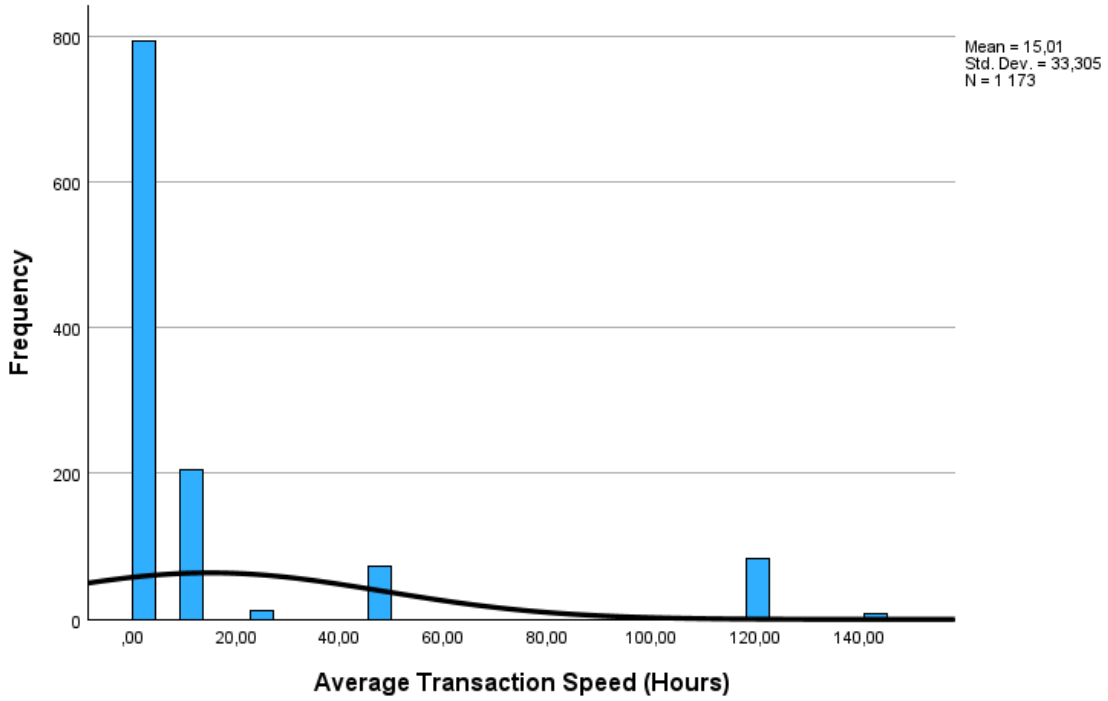

Figure 4: Histogram plot of the average transaction speed (hours).

The histogram in Figures 3 and 4 show a positively skewed distributions of total cost percentages and total transactions speeds. This skewness reinforces the decision to use non-parametric tests, as the assumptions of normality are violated.

The second assumption involves testing for homogeneity of variance.

2. Homogeneity of variance: The variance of the data within each group should be equal (NCSS, 2024).

Using SPSS, the homogeneity of variance was tested using the Levene statistic. It was found that both dependant variables displayed homogeneity of variance that was not equal as they had significant Levene statistics. Total cost percentage (%) had a Levene statistic of 544,809 and p <,001, with average transaction speed (hours) a Levene statistic of 2701,172 and p <,001.

Table 1 below highlights the results from the test for homogeneity of variance in SPSS using the Levene statistic.

Table 1: Test for Homogeneity of variance using the Levene statistic.

Variable		Leven Statistic	df1	df2	Sig.
Total cost percentage (%)	Based on Mean	544,809	2	1170	<,001
Average Transaction Speed (Hours)	Based on Mean	2701,172	2	1170	<,001

The final assumption relates to independence.

3. Independence: The observations within each group should be independent (NCSS, 2024).

The independent variable in the study is independent, as the observations in each group are independent from one another. Using the Chi-square test for independence, the method of transacting (independent variable) has a Chi-square value of 226,788 and p <,001. As a result, since the Chi-square value is significant, the assumption of independence holds.

Table 2 below highlights the Chi-square test for independence using SPSS.

Table 2: Chi-Square test for Independence.

	Transaction method used
Chi-Square	226,788
df	2
Asymp. Sig.	<,001

Step 4 – Select the appropriate statistical test

To determine which statistical procedures were valid, understanding of how the data fits the assumptions was vital (NCSS, 2024). Checking the validity of assumptions required for one-way ANOVA found that two of the three assumptions, normality and homogeneity, were not valid. Since the normality and homogeneity assumptions were

violated, one-way ANOVA cannot be used, and an equivalent non-parametric test of the analysis was more appropriate. The non-parametric test used in the study was the Kruskal-Wallis test to compare the variable means (NCSS, 2024).

Step 5 – Interpret Findings

Given the nature of the study, hypothesis testing has been used to interpret the study's findings. The Kruskal-Wallis test at the significant level (alpha) chosen was used to determine if the statistical test results favour the null hypotheses (NCSS, 2024). Following the findings regarding the null hypothesis, the results warranted further investigation to evaluate the individual means and determine the practical interests in the different variables tested (NCSS, 2024).

Step 6 – Record Your Results

The final step was to record the findings and present the key elements for further discussion in chapter 5 of the report (NCSS, 2024).

4.2.2 *The research problem*

Traditional remittance services charge high fees composed of exchange rate markups, service charges, and handling costs. These add up to an average of 12.82% in South Africa's remittance corridors (Worldbank, 2023a). A key technical risk in digital money transfers is double spending, where a digital currency is spent more than once for malicious reasons. Blockchain addresses this risk through validation and consensus protocols, ensuring transaction uniqueness and immutability (CFI Team, 2023; Nakamoto, 2009).

The following sub-problems have been provided in the study:

Sub Problem 1:

The high transaction costs and long processing times of remittance services in SADC corridors hinder financial inclusion and affordability (Rühmann et al., 2020; Worldbank, 2023a).

Sub Problem 2:

The absence of trust between central banks in developing countries increases the reliance on multiple intermediaries to complete remittance transactions, leading to increased settlement costs and delays. Blockchain, through decentralised trust mechanisms and smart contracts, may reduce this reliance (Adrian et al., 2023; Deng, 2020).

Sub Problem 3:

Global adoption of blockchain for remittances is hindered by uncertainty in regulation, including how digital assets are classified and governed across borders. In South Africa, regulatory compliance under the SARB and FSCA slows institutional adoption, as banks remain cautious toward blockchain applications (Blake, 2024; Kamlana, 2022).

Following the results of the one-way ANOVA test assumption checks (Section 4.2.1 – Step 3), and the selection of the correct equivalent non-parametric test, the Kruskal-Wallis test was selected as an appropriate non-parametric alternative. The average cost of remitting using blockchain service providers has been compared to traditional methods of remitting across the three SADC corridors mentioned using the Kruskal-Wallis test in SPSS, and the findings are presented below.

4.2.3 *Average cost of remitting*

The first hypothesis tests if the application of blockchain in cross-border remitting reduces the average cost of transactions.

H1: The application of blockchain in cross-border remitting will reduce the costs, allowing for an alternative means of remitting.

The sampled data has been divided into three groups in SPSS (Group 1: MTO; Group 2: Bank; Group 3: Blockchain). The Kruskal-Wallis results suggest that the average transaction costs of the groups differ significantly ($H_{2,\ 1173} = 888{,}681$, $p <{,}001$).

Therefore, the hypothesis is accepted, and the null hypothesis is rejected as the Kruskal-Wallis test result (H-score = 888,681) was significant (p-value = <,001).

Table 3 summarises the Kruskal-Wallis test results of the average transaction costs using SPSS.

Table 3: Average transaction costs (Kruskal-Wallis results using SPSS).

Total N	1173
Test Statistic	888,681
Degrees of Freedom	2
Asymptotic Sig. (2-sided test)	<,001

No significant outliers were found in the data that could potentially skew the results obtained. This is depicted in Figure 5 below.

The following figure, Figure 5, highlights a box plot of independent samples showcasing potential outliers using the Kruskal-Wallis test in SPSS.

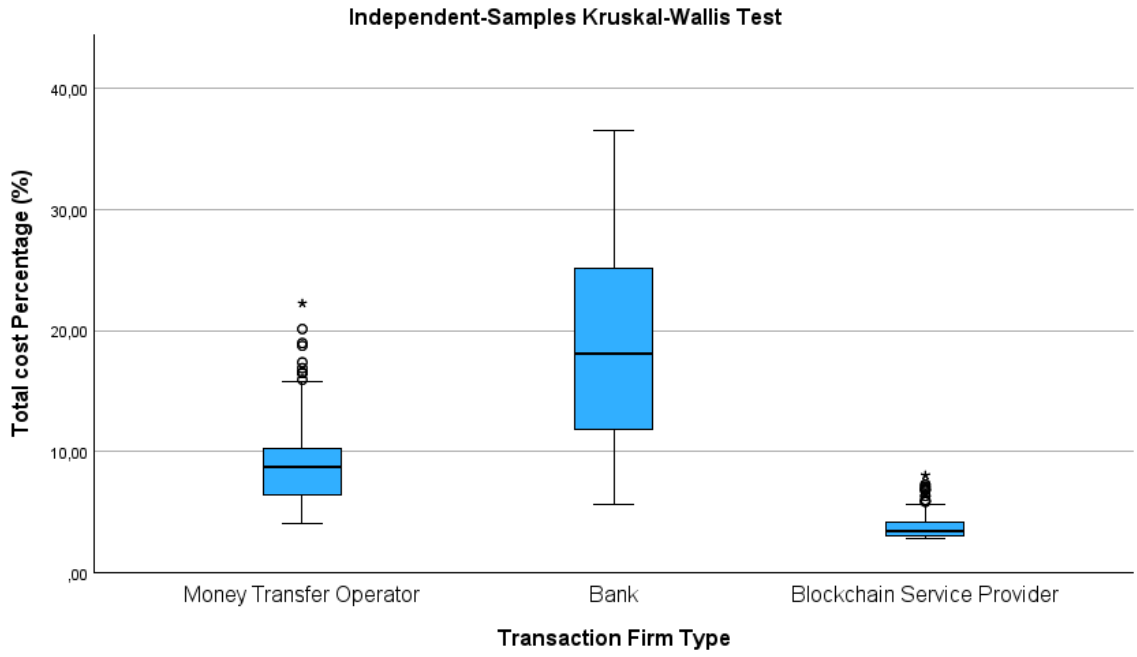

Figure 5: Box plot of independent samples using Kruskal-Wallis.

Since the Levene's Statistic was significant, equal variance was not assumed. Further comparisons of each individual transacting method with respect to the total cost percentage (%) were compared using pairwise comparisons.

Table 4 summarises the pairwise comparisons of transaction method used.

Table 4: Pairwise comparisons of the transaction methods used (SPSS).

Sample 1 – Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.
Blockchain - MTO	508,205	21,442	23,702	<,001
Blockchain - Bank	744,952	30,381	24,520	<,001
MTO - Bank	-236,747	31,307	-7,562	<,001

The pairwise comparison test tests if there are individual differences between groups using the mean rank score. The mean rank score of 801,86 for MTO's, 108,61 for banks and 293,66 for blockchain, highlights significant mean differences at the 5% (p-value < .05) level. This is depicted on the pairwise graph in Figure 6 below.

The following figure, Figure 6, highlights the comparisons of transaction methods in terms of transaction costs using pairwise comparisons and the mean rank scores.

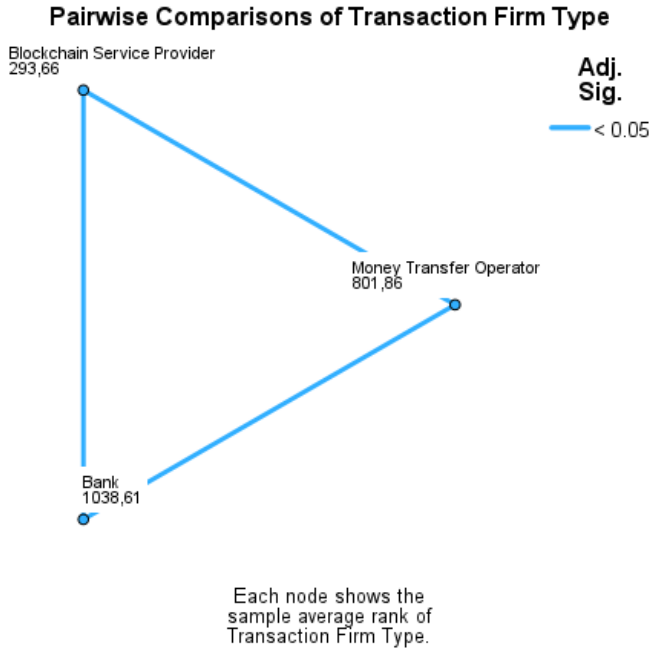

Figure 6: Pairwise comparisons of transaction methods.

The total cost percentage (%) means for each individual method of remitting was compared in SPSS and highlighted below. The mean score and standard deviation for

MTO's was M = 9,0936 and SD = 3,53198. For banks, the mean score and standard deviation was M = 18,9241 and SD = 8,04293. Lastly, blockchain's mean score and standard deviation was M = 3,6693 and SD = 0,91538. Table 5 summarises the results of the comparisons of means test conducted in SPSS using the Kruskal-Wallis non-parametric model.

Table 5: Comparison of means (total cost percentage (%)) (SPSS).

Remittance Method	N	Mean Cost %	Std. Deviation
MTO	444	9,0936	3,53198
Bank	159	18,9241	8,04293
Blockchain	570	3,6693	0,91538

The following figures, Figure 7 and 8, highlight a bar chart and line chart of the mean total cost in percentage to the transaction method used.

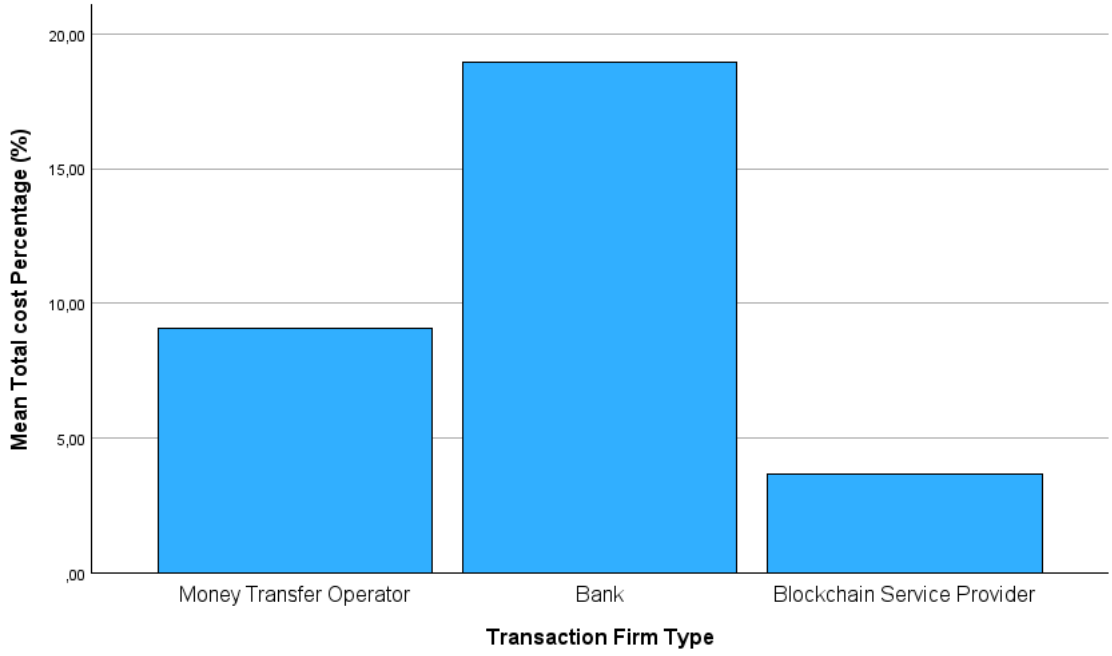

Figure 7: Bar chart of mean total costs (%) vs transaction method.

Figures 7 and 8 illustrate that blockchain remittance has the lowest mean transaction cost compared to banks and MTOs.

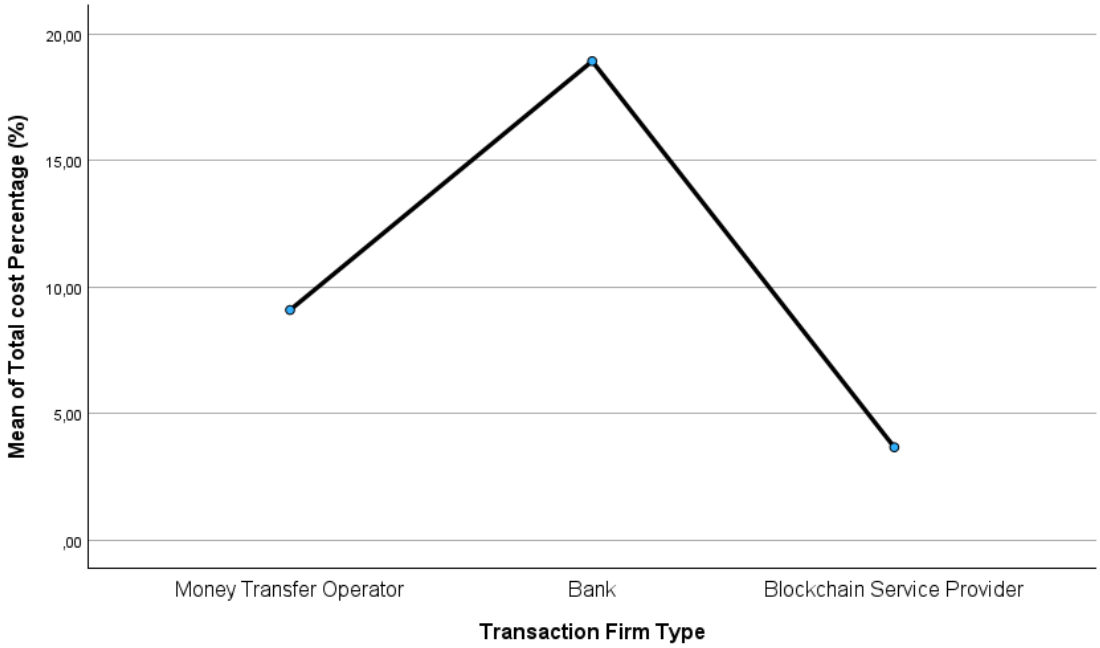

Figure 8: Line plot of mean total costs (%) vs transaction method (SPSS).

A detailed comparison of transaction costs was conducted, with Figures 7 and 8 highlighting that blockchain (Mean = 3.67%) is significantly cheaper than MTOs (Mean = 9.09%) and banks (Mean = 18.92%). These visual trends are supported by the findings from the Kruskal-Wallis statistical test.

4.2.4 *Speed of transaction*

The second hypothesis tests if the application of blockchain in cross-border remitting increases the average speed of transactions shortening the total time to finality.

H2: The application of blockchain smart contracts in cross-border remitting will increase ‘trust’ among central banks, reducing the speed of transaction.

Similarly to the test of hypothesis 1, the sampled data has been divided into three groups in SPSS (Group 1: MTO; Group 2: Bank; Group 3: Blockchain). The Kruskal-Wallis results suggest that the average transaction speed of the groups differ significantly ($H_{2,\ 1173} = 971{,}746$, $p < {,}001$).

Therefore, the hypothesis is accepted, and the null hypothesis is rejected as the Kruskal-Wallis test result (H-score = 971,746) was significant (p-value = <,001).

Table 6 summarises the Kruskal-Wallis test results of the average transaction speed using SPSS.

Table 6: Average transaction speed (Kruskal-Wallis results using SPSS).

Total N	1173
Test Statistic	971,746
Degrees of Freedom	2
Asymptotic Sig. (2-sided test)	<,001

Similarly, no significant outliers were found in the data when comparing the average transaction speeds, that could potentially skew the results obtained. This is depicted in Figure 9 below.

The following figure, Figure 9, highlights a box plot of independent samples showcasing potential outliers using the Kruskal-Wallis test in SPSS.

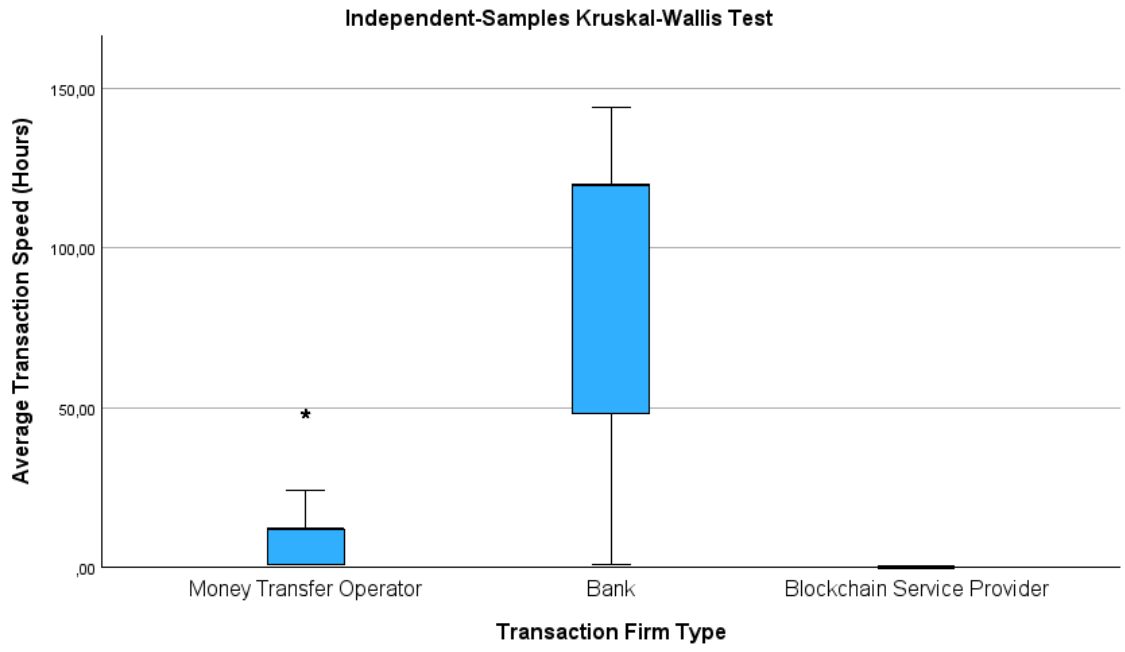

Figure 9: Box plot of independent samples using Kruskal-Wallis.

Since the Levene's Statistic was significant, equal variance was not assumed. Further comparisons of each individual transacting method with respect to the average transaction speed (hours) was compared using pairwise comparisons.

Table 7 summarises the pairwise comparisons of transaction method used.

Table 7: Pairwise comparisons of the transaction methods used (SPSS).

Sample 1 – Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.
Blockchain - MTO	513,883	21,265	24,166	<,001
Blockchain - Bank	789,280	30,130	26,196	<,001
MTO - Bank	-275,397	31,049	-8,870	<,001

The pairwise test tested if there are individual differences between groups using the mean rank score. The mean rank score of 799,38 for MTO's, 1074,78 for Banks and 285,50 for blockchain highlights significant mean differences at the 5% (p-value < .05) level. This is depicted on the pairwise graph in Figure 10 below.

The following figure, Figure 10, highlights the comparisons of transaction methods in terms of transaction speeds using pairwise comparisons and the mean rank scores.

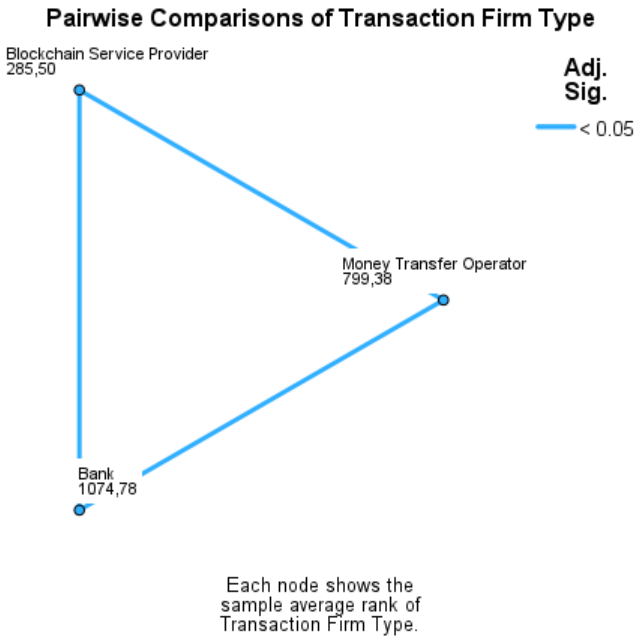

Figure 10: Pairwise comparisons of transaction methods.

The average transaction speed (hours) means for each individual method of remitting was compared in SPSS and highlighted below. The mean score and standard deviation for MTO's was M = 8,0225 and SD = 9,05137. For banks, the mean score and standard deviation was M = 88,0503 and SD = 41,07970. Lastly, blockchain's mean score and standard deviation was M = 0,0763 and SD = 0,11493. Table 8 summarises the results of the comparisons of means test conducted in SPSS using the Kruskal-Wallis non-parametric model.

Table 8: Comparison of means (average transaction speed (hrs)) (SPSS).

Remittance Method	N	Mean Speed (Hrs)	Std. Deviation
MTO	444	8,0225	9,05137
Bank	159	88,0503	41,07970
Blockchain	570	0,0763	0,11493

The following figures, Figure 11 and 12, highlight a bar chart and line chart of the mean average transaction speed (hours) to the transaction method used.

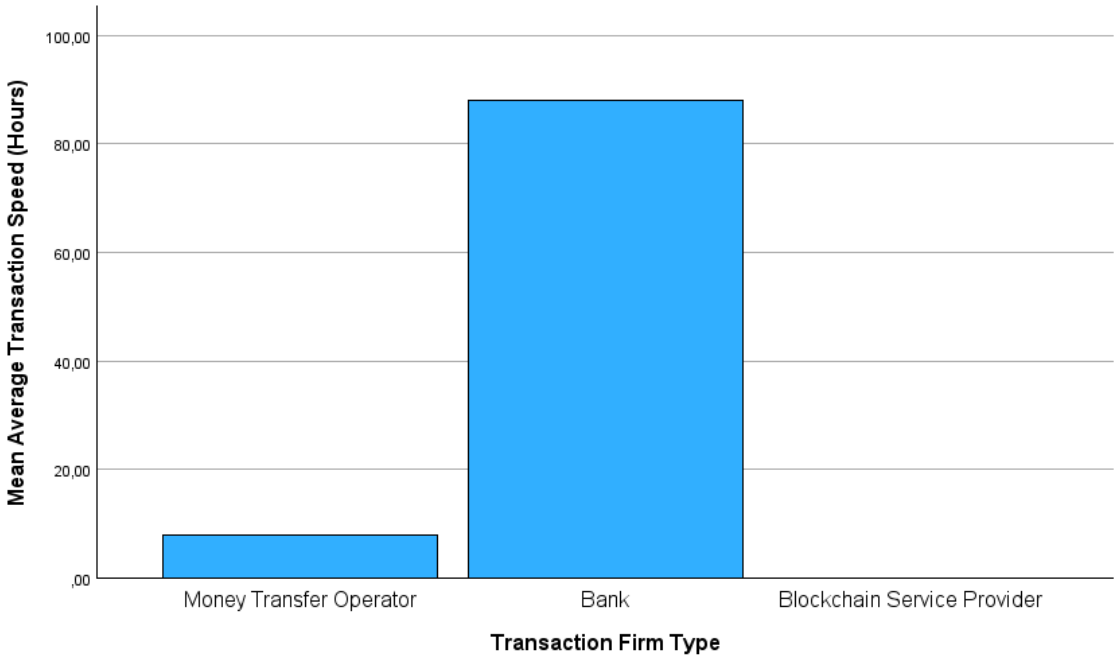

Figure 11: Bar chart of mean transaction speed (hrs) vs transaction method.

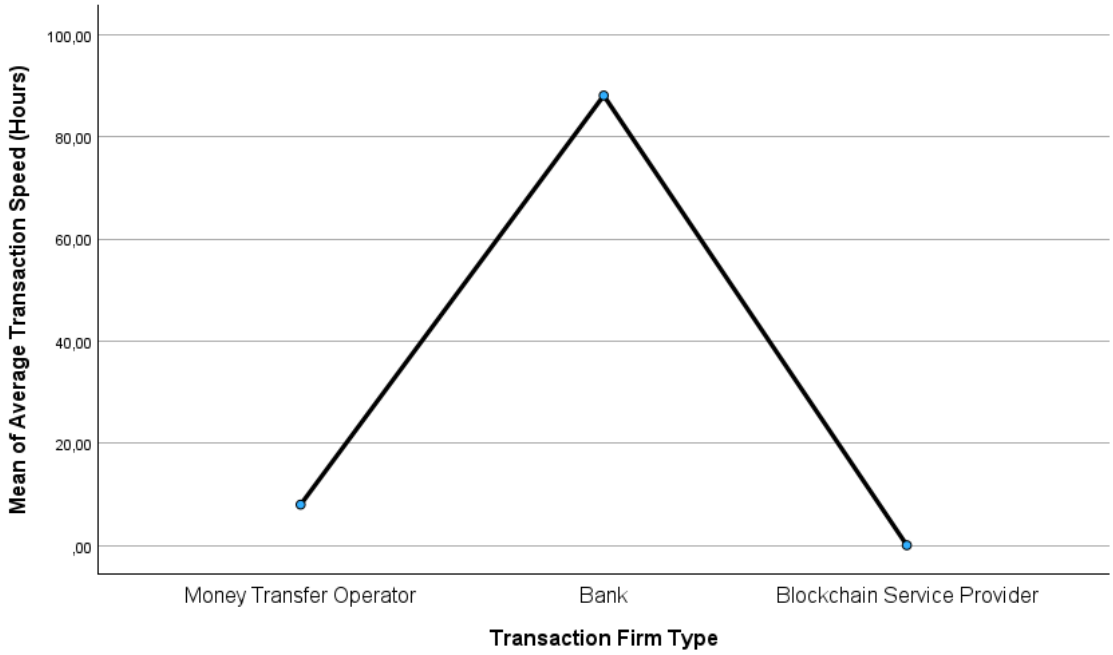

Figure 12: Line plot of mean transaction speed (hrs) vs transaction method.

A detailed comparison of transaction speed was conducted, with Figures 11 and 12 highlighting that blockchain (Mean = 0.08 hrs) is significantly faster than MTOs (Mean = 8.02 hrs) and banks (Mean = 88.05 hrs). These visual trends are supported by the findings from the Kruskal-Wallis statistical test.

4.3 Test for Reliability

Ensuring the reliability of secondary data requires assessing the consistency, accuracy, and dependability of the original source. The data collected has been tested and retested to ensure stable results, demonstrating its consistency and reliability due to the credibility of the sources used. The secondary data from the World Bank is consistent, having been gathered from a credible and transparent source, across various datasets. Both the primary and secondary data are also transparently documented and publicly available. These measures confirm the reliability of the data used in the study, supported by credible sources, clearly outlined collection methods and sampling techniques.

4.4 Conclusion

In conclusion, the results presented, present an opportunity for the development of blockchain in alleviating these exorbitant costs by decentralising the global banking system (Rühmann et al., 2020). The key results have been presented and analysed and will be further discussed in the chapter to follow.

CHAPTER 5. DISCUSSION

5.1 Introduction

After presenting the results in the previous chapter, this chapter focuses on discussing the results obtained. The research questions will further be discussed, as the study attempts to provide the necessary answers to the research questions asked.

5.2 Discussion of results

Over the past 45 years, SWIFT has served as a payment rail for cross-border remittance (Shobhit, 2023). The SWIFT system standardised the remittance market by simplifying the process, using banks as operating units for transfer settlements (Qiu et al., 2019).

The challenge with SWIFT lies in liquidity and credit risk. The payment rail is heavily dependent on tiers of banks to facilitate transactions (Qiu et al., 2019). A settlement centre is required at both ends (sender's and receiver's), resulting in a prolonged process overall (Qiu et al., 2019). Further challenges include high expenses, restricted transparency, limited accessibility, and centralised control (CCI, 2023).

In more recent times, correspondent banking arrangements in the form of international credit card agencies, third-party payment companies, or professional remittance companies have become more popular and serve as alternatives to the traditional methods of cross-border settlements (Deng, 2020; Phelane, 2024). These networks are also marked by several challenges, including transparency, extended settlement durations, elevated transaction fees, and restricted accessibility. These issues are notably pronounced in cross-border transactions originating from emerging markets, as exemplified in South Africa (Phelane, 2024).

South Africa continues to remain the costliest G20 nation to remit from despite experiencing a reduction from its peak at more than 20% in Q1 2013 (Worldbank, 2023a). Currently, the average cost of remitting from South Africa is 12.82% in Q4 2023, up from 11.62% in Q3 2023 (Worldbank, 2023a). This has created a problem for many who frequently remit from South Africa as the traditional cross-border

remittance methods are costly and slow, due to the coordination required amongst intermediaries (Financial Times, 2023; Kirobo et al., 2024).

Double spending in global banking, and the need for centralisation add to the cost and speed of transactions involved (CCI, 2023). Given the high costs and slow transaction speeds of remitting, this quantitative study is aimed at investigating the use of blockchain in reducing the fees faced with traditional methods of cross-border remittances for South Africans.

After collecting the data and analysing it in SPSS, chapter 4 highlighted significant results in the study. The average transaction costs when using MTO's and banks (SWIFT) resulted in 9,09% and 18,92% respectively. This was significantly higher than that of using blockchain service providers which was 3,67%. The speed of transactions produced similar results with MTO's and banks (SWIFT) taking on average 8,02 and 88,05 hours respectively, to complete the transfer. Blockchain displayed near instant settlement with transfers taking on average 0,08 hours to complete from initiating the transaction to settlement.

The hypothesis testing nature of the research paper lent itself to the following research questions, mentioned in chapter 1. The results allowed for clear answering of the research questions proposed:

1. Does the work done in the cross-border remittance market transform the market in terms of lowering costs and increasing transaction speeds?

   Yes. Given that blockchains cost of transacting and the speed to settlement are significantly lower than that of using MTO's and banks (SWIFT), one can conclude that blockchain has the potential to transform the remittance market by lowering the cost and increasing the speed of cross-border transactions.

2. Does digital currency adoption and trust among central banks aid in reducing intermediaries and the associated costs of remitting?

   Yes. Blockchain achieves this by eliminating the number of intermediaries using smart contracts, therefore, lowering the costs of transactions and increasing transaction speeds. Furthermore, digital currency adoption further lowers the

costs, as handling of cash is expensive and raises the cost of remitting. Transaction speeds are slowed simultaneously, given that human capital is required to handle cash in the transaction.

3. Are global trends in blockchain allowing for easier and more trusted means of remitting while remaining regulatory compliant?

   Yes. As blockchain adoption grows, the industry is becoming more and more regulated, increasing its compliance with governing associations. The global trends mentioned like CBDC's and public vs private blockchains further increases the ease and transparency of transactions, while maintaining security far greater than the traditional models of remittance.

These findings were further supported by the null hypotheses being rejected in both cases, confirming that the use of blockchain in cross-border remittance does reduce the costs and increase the transaction speeds involved. The research hypotheses developed allowed for the testing of whether blockchain can reduce the cost of remitting and increase the speed of transaction.

H1: The application of blockchain in cross-border remitting will reduce the costs, allowing for an alternative means of remitting.

N1: Blockchain used in cross-border remitting has no impact on reducing the remittance costs.

Using the comparisons of means non-parametric Kruskal-Wallis test, to test the cost transaction of the different methods of remitting, the results of the study suggested that the average transaction costs of the groups differ significantly ($H_{2,\ 1173} = 888{,}681$, $p < {,}001$). Therefore, the hypothesis (H1) was accepted, and the null hypothesis (N1) was rejected as the Kruskal-Wallis test result (H-score = 888,681) was significant (p-value = <,001).

H2: The application of blockchain smart contracts in cross-border remitting will increase 'trust' among central banks, increasing the speed of transaction.

N2: Blockchain smart contracts used in cross-border remitting has no impact on 'trust' among central banks and the subsequent transacting speed.

Similarly, using the comparisons of means non-parametric Kruskal-Wallis test, to test the speed of transaction of the different methods of remitting, the results suggest that the average transaction speed of the groups differ significantly ($H_{2, 1173}$ = 971,746, p <,001). Therefore, the hypothesis (H2) was accepted, and the null hypothesis (N2) was rejected as the Kruskal-Wallis test result (H-score = 971,746) was significant (p-value = <,001).

Therefore, the literature and results presented in this study, highlight the importance of blockchain in the remittance market. Presently, cross-border payments on blockchain offer cheaper and quicker payment solutions, reshaping the landscape of international money transfers creating a significant use case for the technology (CCI, 2023). Cross-border payments utilising blockchain harness the decentralised nature of the technology, to enable transactions among parties situated in different countries using diverse currencies (CCI, 2023). Efficiency is further increased in the system, and the reduction in transaction delays are realised through direct transactions between the transacting parties shortening the transaction cycle and eliminating the time cost of intermediary clearing (Deng, 2020).

As a result, blockchain achieves these cost reductions and transaction speed increases by circumventing intermediaries, leveraging technology to simplify the cross-border remittance process (Qiu et al., 2019). This results in blockchain-based cross-border payments that have reduced transaction costs, quicker delivery times, and enhanced security (CCI, 2023; Qiu et al., 2019).

Motivation for South African banks

Banks play the intermediary role in the remittance market and are rewarded for ensuring that system is trusted (Adrian et al., 2023). Blockchain eliminates the need for trust and further reduces costs and operational risks as the process can be automated through smart contracts (Lewis et al., 2017; Kashyap & Saxena, 2024).

Smart contracts autonomously execute blockchain transactions according to predefined rules, eliminating intermediaries in the process, enabling immediate transactions with complete transparency (CCI, 2023). Smart contracts can further eliminate the manual work associated with knowledge-based work such as labour review and billing costs, and employees can shift their attention to utalising their

cognitive skills instead (Chang et al., 2020). A transformative opportunity for banks is provided by blockchain smart contracts as the back-office processes and infrastructure can be automated (Lewis et al., 2017).

Deng (2022) further highlights the benefit of cash liquidity in cross-border remittance systems through blockchain. Increases in liquidity and the freeing-up of capital “trapped” in corresponding bank Nostro-Vostro accounts can be unlocked using blockchain (Deng, 2020; Rella, 2019). The idle capital can be allocated elsewhere as blockchain reduces the need for traditional fiat currencies, by making use of native digital currency tokens recognised by both transacting parties (Deng, 2020).

Therefore, blockchain will not only improve inefficiencies in the corresponding banking network and offer new revenue streams for banks, but also significantly reduces the costs, address fraud and operational risks, increase the speed of time to settlement and transform the remittance market from traditional financial service providers to internet finance institutions (Chang et al., 2020). This creates value for both banks, and their customers who frequently remit from South African.

5.3 Conclusion

Blockchain has the potential to transform the remittance market by lowering the cost and increasing the speed of cross-border transactions. More is to be done in the payments industry to increase the rate of adoption, so society can realise the merits of blockchain technology. The final chapter will conclude the report and provide recommendations for further work.

CHAPTER 6. CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

The development of blockchain presents an opportunity to alleviate these exorbitant costs by decentralising the global banking system and attempting to create a financial inclusive environment for all (Rühmann et al., 2020).

6.2 Conclusion and recommendations

In conclusion, the Global Financial Crisis of 2008 resulted in fewer financial institutions present in the market due to de-risking of CBR's. This has resulted in increased costs and reduced speeds of remittances worldwide cross-border (Rella, 2019). High remittance fees in developing economies are additionally driven by cash-based transactions for the initial and final stages of remittance deliveries, regulatory and compliance costs, and a lack of competition in these markets (Rühmann et al., 2020).

As of Q4 2023, the average cost of remitting globally, remained at 6.39% (Worldbank, 2023a). To reach the SDG Agenda 2030 target of bringing remittance costs to less than 3% (Rühmann et al., 2020), more work needs to be done. South Africa remains the costliest G20 nation to remit from, with an average cost of remitting in Q4 2023 of 12.82%, compared to the UK at 6.4%, the US at 5.9%, and Germany at 6.1% (Worldbank, 2023b).

Traditional cross-border transactions have been conducted through bank (SWIFT) transfers and correspondent banking networks (Ernst & Young, 2021). Due to the high costs of remitting using these methods, this quantitative study has investigated the use of blockchain in reducing the fees faced with traditional methods of cross-border remittances for South Africans. The study highlighted, through the comparisons of means non-parametric Kruskal-Wallis test in SPSS, that blockchain can significantly lower costs and increase speeds when remitting.

On the traditional front, conventional international bank transfers between a sender and recipient are entwined within a complex banking network, encompassing commercial banks, clearing houses, credit unions, and other financial service providers, thereby complicating and decelerating the process (CCI, 2023).

The cost drivers when remitting include exchange rate margins, transaction fees, failed transactions, and multiple intermediary fees (Ratha, 2021). The costs are further driven up due to a lack of automation, as many of the data reconciliations and operations are conducted manually (Chang et al., 2020). Kirobo et al. (2024) suggest that cross-border payments have been characterised by fraud, money laundering, security issues, time delays and high costs.

Cross-border payments utilising blockchain technology harness the decentralised and secure features of the blockchain to enable transactions among parties in different countries and using diverse currencies (CCI, 2023). Blockchain achieves this by decentralising the correspondent banking networks, circumventing the need for numerous intermediary tiers of banks. Blockchain leverages technology to simplify the process, enabling transactions to be confirmed within seconds (Qiu et al., 2019).

Benefits of blockchain in cross-border remittance

The benefits arise from the innovative design of blockchain technology (Deng, 2020). Deng (2020) and Adrian et al. (2023) suggest that the main expense in cross-border remittance is due to various settlement costs among intermediaries, as commercial banks lack mutual trust. Blockchain lowers the additional ‘trust’ cost in the system by utilising transparent transaction processing (Deng, 2020). To facilitate process automation and create a “trust less” remitting system, blockchain employs smart contracts (Deng, 2020). Smart contracts remove the need for third-party intermediaries, improve efficiency and reliability, and reduce remittance costs (Kashyap & Saxena, 2024; Lewis et al., 2017). The result is reduced transaction costs, quicker settlement times, and enhanced security (Qiu et al., 2019).

The major challenges, however, remain around regulatory and compliance challenges (Adeleye et al., 2023). Uncertainty regarding the rules across various regulatory agencies, and existing regulations pose significant obstacles for blockchain (Lewis et al., 2017). CBDC’s strengthen the case for blockchain adoption by addressing the

challenges around regulation and compliance. Kirobo et al. (2024) found that by using CBDC's, cross-border payments are made simpler between transacting parties without the need for third-party interventions. CBDC's also provide the link between old and new financial systems, keeping safety, security, and trust amongst central banks (Adrian et al., 2023).

The result, in its purest form, is a peer-peer payment system that is decentralised and trusted, with the aim of removing third-party intermediaries when transacting (Lewis et al., 2017).

6.2.1 *Limitations of the study*

Government law and regulation, including the SARB's prohibition on direct crypto involvement by banks (SARB, 2023), FSCA's classification of crypto assets as financial products (2022), and FICA's AML/KYC compliance requirements (Ayavuya & Pholwane, 2024) as well as the monopolistic nature of South Africa's banking sector potentially limits this study. Regulation slows the rate of blockchain institutional adoption for cross-border remittance, hindering access to real world data (Blake, 2024; Thapa, 2024). Therefore, the study has been conducted primarily using online data, that is publicly available and transparent.

6.2.2 *Recommendations and further research*

It is recommended to further investigate the strategic and regulatory drivers for South African banks in adopting blockchain technologies for cross-border remittances and settlements. Bank integration with mobile money systems may enhance accessibility and reduce remittance costs for South African users, particularly those who are unbanked and underbanked in the rural areas.

It is further recommended that banks observe that by investing in blockchain, they will be able to introduce more innovation into the market and that blockchain has the capacity to enhance efficiency and transparency in the banking sector (Moyo, 2022). Encouragemet of the development of local blockchain-based remittance solutions will drive innovation in the sector, and through healthy competiton, the remittance costs can be reduced for the benefit of the South African market.

Lastly, to foster further innovation, it is recommended that research into the effectiveness of blockchain-based remittance platform adoption in partnership with regulatory agencies be studied. Such platforms have the potential to significantly lower transaction costs and increase transaction speeds compared to the traditional methods of remitting (Lewis et al., 2017), as the decentralised nature of blockchain networks reduce the need for intermediaries and lower the associated costs.

By further researching and implementing the above-mentioned recommendations, South Africa can leverage blockchain technology in the remittance market and reduce the costs when remitting significantly.

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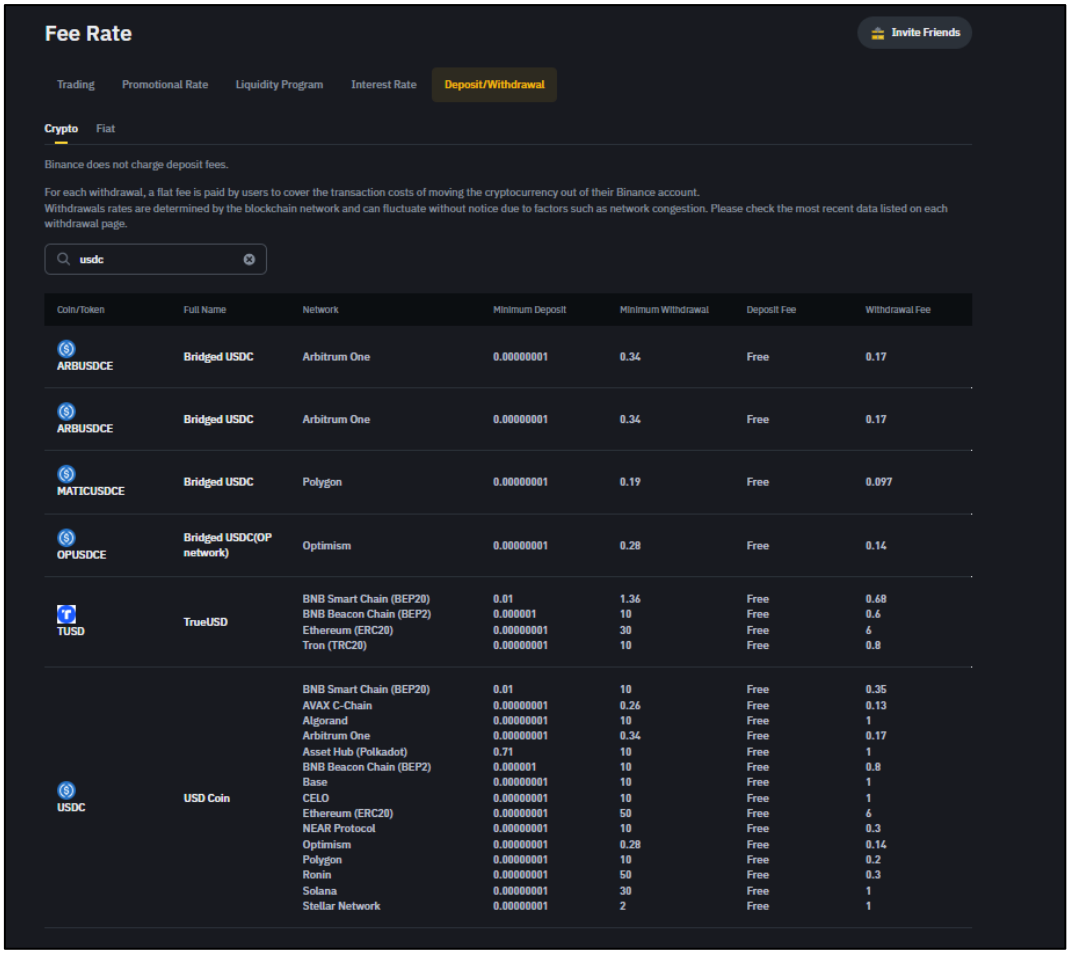
APPENDIX A – Primary data research instrument

Appendix A.1 – Binance fees and limits in South Africa



Fee Rate

Invite Friends

Trading | Promotional Rate | Liquidity Program | Interest Rate | Deposit/Withdrawal

Crypto | Fiat

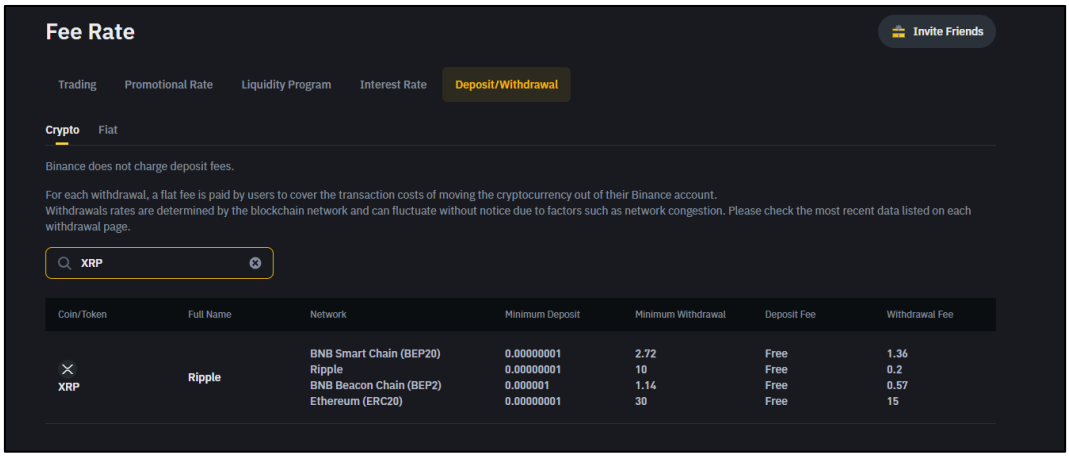
Binance does not charge deposit fees.

For each withdrawal, a flat fee is paid by users to cover the transaction costs of moving the cryptocurrency out of their Binance account.
Withdrawals rates are determined by the blockchain network and can fluctuate without notice due to factors such as network congestion. Please check the most recent data listed on each withdrawal page.

usdc

Coin/Token	Full Name	Network	Minimum Deposit	Minimum Withdrawal	Deposit Fee	Withdrawal Fee
ARBUSDCE	Bridged USDC	Arbitrum One	0.00000001	0.34	Free	0.17
ARBUSDCE	Bridged USDC	Arbitrum One	0.00000001	0.34	Free	0.17
MATICUSDCE	Bridged USDC	Polygon	0.00000001	0.19	Free	0.097
OPUSDCE	Bridged USDC(OP network)	Optimism	0.00000001	0.28	Free	0.14
TUSD	TrueUSD	BNB Smart Chain (BEP20)	0.01	1.36	Free	0.68
		BNB Beacon Chain (BEP2)	0.000001	10	Free	0.6
		Ethereum (ERC20)	0.00000001	30	Free	6
		Tron (TRC20)	0.00000001	10	Free	0.8
USDC	USD Coin	BNB Smart Chain (BEP20)	0.01	10	Free	0.35
		AVAX C-Chain	0.00000001	0.26	Free	0.13
		Algorand	0.00000001	10	Free	1
		Arbitrum One	0.00000001	0.34	Free	0.17
		Asset Hub (Polkadot)	0.71	10	Free	1
		BNB Beacon Chain (BEP2)	0.000001	10	Free	0.8
		Base	0.00000001	10	Free	1
		CELO	0.00000001	10	Free	1
		Ethereum (ERC20)	0.00000001	50	Free	6
		NEAR Protocol	0.00000001	10	Free	0.3
		Optimism	0.00000001	0.28	Free	0.14
		Polygon	0.00000001	10	Free	0.2
		Ronin	0.00000001	50	Free	0.3
		Solana	0.00000001	30	Free	1
		Stellar Network	0.00000001	2	Free	1

USDC withdrawal fees on Binance (Binance.com/ZA, 2024a).



Fee Rate

Invite Friends

Trading | Promotional Rate | Liquidity Program | Interest Rate | Deposit/Withdrawal

Crypto | Fiat

Binance does not charge deposit fees.

For each withdrawal, a flat fee is paid by users to cover the transaction costs of moving the cryptocurrency out of their Binance account.
Withdrawals rates are determined by the blockchain network and can fluctuate without notice due to factors such as network congestion. Please check the most recent data listed on each withdrawal page.

XRP

Coin/Token	Full Name	Network	Minimum Deposit	Minimum Withdrawal	Deposit Fee	Withdrawal Fee
XRP	Ripple	BNB Smart Chain (BEP20)	0.00000001	2.72	Free	1.36
		Ripple	0.00000001	10	Free	0.2
		BNB Beacon Chain (BEP2)	0.000001	1.14	Free	0.57
		Ethereum (ERC20)	0.00000001	30	Free	15

XRP withdrawal fees on Binance (Binance.com/ZA, 2024a).

Appendix A.2 – Average transaction fees using Blockchain

Conversion			
USD	ZAR		
1,00	18,45		
Deposit Fee			
USD	FEE USD @ 1,4%	ZAR	
200	2,80	51,67	
500	7,00	129,16	
Ave XRP Spot Price 2023			
XRP	USD	ZAR	Ave Trans Fee (USD)
1	0,525791	9,70	0,0014
XRP Binance Withdrawal Fee			
1,36	0,715076	13,19	
0,2	0,105158	1,94	
0,57	0,299701	5,53	
15	7,886865	145,53	
Ave USDC Spot Price 2023			
USDC	USD	ZAR	
1	1,000043	18,45	
USDC Binance Withdrawal Fee			
0,35	0,350015	6,46	
0,13	0,130006	2,40	
1	1,000043	18,45	
0,17	0,170007	3,14	
1	1,000043	18,45	
0,8	0,800034	14,76	
1	1,000043	18,45	
1	1,000043	18,45	
6	6,000258	110,72	
0,3	0,300013	5,54	
0,14	0,140006	2,58	
0,2	0,200009	3,69	
0,3	0,300013	5,54	
1	1,000043	18,45	
1	1,000043	18,45	

Authors own work with reference USDC and XRP (Binance.com/ZA, 2024a).

Appendix A.3 – Bank deposit and electronic transfer fees 2023

Bank: Capitec		
ETF Transaction Fee	R1,5/R100	
ATM Deposit Fee	R1,3/R100	
Transaction Amount	200 USD	500 USD
Transaction Cost	**R59,05**	**R147,62**
Bank: ABSA		
ETF Transaction Fee	R1,0/R100	
ATM Deposit Fee	R2,5/R100	
Transaction Amount	200 USD	500 USD
Transaction Cost	**R99,64**	**R249,10**
Bank: Standard Bank		
ETF Transaction Fee	R1,25/R100	
ATM Deposit Fee	R1,2/R100	
Transaction Amount	200 USD	500 USD
Transaction Cost	**R53,51**	**R133,78**
Bank: FNB		
ETF Transaction Fee	R1,0/R100	
ATM Deposit Fee	R1,3/R100	
Transaction Amount	200 USD	500 USD
Transaction Cost	**R55,36**	**R138,39**
Bank: Nedbank		
ETF Transaction Fee	R2,2/R100	
ATM Deposit Fee	R1,5/R100	
Transaction Amount	200 USD	500 USD
Transaction Cost	**R71,59**	**R178,98**

Authors own work with reference (BusinessTech, 2022).

Appendix A.4 – Cryptocurrency asset average spot prices 2023

Date	Open	High	Low	Close	Adj Close	Volume
2023/01/01	1,000022	1,000785	0,999089	1,000058	1,000058	92,718,383,231
2023/02/01	1,000017	1,000771	0,999176	0,999876	0,999876	101,568,094,244
2023/03/01	0,999923	1,000915	0,877400	0,999784	0,999784	178,153,876,369
2023/04/01	0,999682	1,000808	0,998912	0,999996	0,999996	124,470,260,481
2023/05/01	0,999920	1,000725	0,999230	1,000179	1,000179	91,489,301,524
2023/06/01	0,999979	1,002259	0,999031	1,000253	1,000253	110,831,902,090
2023/07/01	0,999960	1,000976	0,999360	1,000010	1,000010	91,496,657,721
2023/08/01	0,999996	1,001519	0,999226	1,000108	1,000108	95,070,809,354
2023/09/01	1,000115	1,001182	0,999747	1,000106	1,000106	77,457,835,695
2023/10/01	1,000111	1,000822	0,999326	0,999940	0,999940	96,897,830,821
2023/11/01	1,000101	1,000811	0,999203	1,000006	1,000006	139,958,592,573
2023/12/31	1,000093	1,002967	0,998895	1,000070	1,000070	169,952,219,977
2024/01/01	1,000095	1,001625	0,997814	1,000174	1,000174	180,516,726,040
				Ave (in USD)	1,000043	i.e. 1 USDC = 1,000043 USD

USDC/USD average 2023 asset spot price (YahooFinance, 2023b).

Date	Open	High	Low	Close	Adj Close	Volume
2023/01/01	0,339923	0,431117	0,321628	0,406389	0,406389	31,217,545,739
2023/02/01	0,406357	0,419349	0,364122	0,377150	0,377150	25,468,965,964
2023/03/01	0,377133	0,580400	0,352473	0,538492	0,538492	51,507,438,643
2023/04/01	0,538472	0,543841	0,441331	0,472332	0,472332	34,696,733,117
2023/05/01	0,472205	0,527198	0,412962	0,517386	0,517386	28,713,096,386
2023/06/01	0,517388	0,561377	0,456510	0,474037	0,474037	35,567,120,709
2023/07/01	0,474020	0,887511	0,460630	0,698521	0,698521	62,924,300,591
2023/08/01	0,698503	0,707211	0,468106	0,510799	0,510799	36,964,136,590
2023/09/01	0,510788	0,545457	0,467079	0,515405	0,515405	24,059,040,291
2023/10/01	0,515368	0,612737	0,475637	0,600282	0,600282	30,841,443,181
2023/11/01	0,600295	0,740569	0,579289	0,606358	0,606358	48,123,386,486
2023/12/31	0,606350	0,698838	0,583383	0,614941	0,614941	42,932,459,638
2024/01/01	0,615656	0,638627	0,494542	0,503193	0,503193	38,140,686,597
				Ave (in USD)	0,525791	i.e. 1 XRP = 0,525791 USD

XRP/USD average 2023 asset spot price (YahooFinance, 2023a).

Appendix A.5 – Cryptocurrency average TTF

Data for the time to finality (TTF) of each blockchain network for the respective cryptocurrency assets used in the study has been collected from the below sources:

Blockchain Network	Cryptocurrency Asset	Time to Finality (hrs)	Source Reference
BNB Smart Chain (BEP20)	USDC	0,0021	(Chainspect, 2024b)
AVAX C-Chain	USDC	0,0000	(Chainspect, 2024b)
Algorand	USDC	0,0000	(Chainspect, 2024b)
Arbitrum One	USDC	0,2667	(Chainspect, 2024b)
Asset Hub (Polkadot)	USDC	0,0167	(Chainspect, 2024b)
BNB Beacon Chain (BEP20)	USDC	0,0021	(Chainspect, 2024b)
Base	USDC	0,2667	(Chainspect, 2024b)
CELO	USDC	0,0000	(Chainspect, 2024b)
Ethereum (ERC20)	USDC	0,2667	(Chainspect, 2024b)
NEAR Protocol	USDC	0,0006	(NearProtocol, 2024)
Optimism	USDC	0,2667	(Chainspect, 2024b)
Polygon	USDC	0,0711	(Chainspect, 2024b)
Ronin	USDC	0,0125	(Ronin Network, 2023)
Solana	USDC	0,0036	(Chainspect, 2024b)
Stella Network	USDC	0,0017	(Chainspect, 2024b)
BNB Smart Chain (BEP20)	XRP	0,0021	(Chainspect, 2024b)
RippleNet	XRP	0,0017	(XRP Ledger, 2024)
BNB Beacon Chain (BEP20)	XRP	0,0021	(Chainspect, 2024b)
Ethereum (ERC20)	XRP	0,2667	(Chainspect, 2024b)

Authors own work with reference (Chainspect, 2024b; NearProtocol, 2024; Ronin Network, 2023; XRP Ledger, 2024).

APPENDIX B – Secondary data research instrument

Appendix B.1 – World Bank price remittance database

IMPORTANT

For data collection methodology, please see

http://remittanceprices.worldbank.org/en/methodology

For additional information, please contact paymentsystems@worldbank.org

Data Analysis Methodology

The methodology below describes how the World Bank calculates the figures on remittance prices using data from the Remittance Prices Worldwide database. For the latest report on Remittance Prices Worldwide please see

http://remittanceprices.worldbank.org

Global Average Total Cost

The World Bank calculates and tracks the global average cost for sending remittances following each iteration of RPW. This is intended to provide a tool to track the trend of remittance prices by various policy makers, including measuring progress towards the commitment by the G8 member countries to reduce the cost of remittances by five percentage points over five years (the "5x5 Objective").

The Global Average Total Cost is calculated as the average total cost for sending USD 200 with all RSPs worldwide. In other terms, the global average total cost is the simple average of the total cost for sending USD 200 charged by each single RSP included in the RPW database.

The usually few RSPs that do not disclose the exchange rate applied to the transaction (i.e. those RSPs that are listed as non-transparent as explained above) are not considered when calculating the Global Average since they do not meet the requirements for transparency and would have an unfair advantage over RSPs that disclose the foreign exchange rate and hence would show a higher overall percentage price.

The Global Average includes all RSPs, and countries surveyed by RPW. As the number of countries and hence RSPs included in the RPW changes (it has typically increased between iterations), the Global Average is not a historically consistent baseline but calculated from an expanding base of remittance markets. Since it is a tool to establish and track the global cost and highlight high prices to direct interventions rather than track the development of prices in specific markets or countries, the wider coverage and higher relevance created by including new RSPs is an advantage that outweighs the impact on tracking historical trends.

G8 member countries and the other regional and national average total costs

The regional and national average total costs are calculated using the same methodology used to calculate the Global Average Total Cost. These represent the simple average total cost for sending USD 200 with every single RSP to a specific region of the world (regional), or from or to a specific country (national). The same applies to other averages such as the G8 average, which calculates the average cost of sending USD 200 from the G8 member countries, or the bank average, which represent the average cost of sending USD 200 with a bank worldwide.

Global Weighted Average Total Cost

In addition to the Global Average, the World Bank accounts for the relative size of remittance flows in each corridor. The Global Weighted Average Total Cost is calculated as the weighted average of the total cost of sending USD 200 in each corridor included in the RPW database weighted by the relative size of the remittance flows in each corridor. Similar to the Global Average, the few RSPs that do not disclose the exchange rate applied to the transaction are not considered during calculation. However, the Global Weighted Average includes RSPs operating in Russia and the former Soviet Republics. RPW utilizes bilateral remittance flow information from the Global Knowledge Partnership on Migration and Development (KNOMAD) to calculate the relative size of remittance flows, in other words, the weight of each corridor.

International MTO Index

In addition to the Global Average, the World Bank also traces the International MTO Index. This index is calculated as the simple average of the total cost for sending USD 200 with all the MTOs that are present in at least 85 percent of the markets surveyed in RPW. Up to March 2011 the MTOs meeting this requirement and, hence, included in the index were MoneyGram (present in 92 percent of the corridors) and Western Union (present in 97 percent of the corridors).

The International MTO Index reflects the prices of the most widely used remittance service providers with the largest market share. The vast majority of remittances are still sent using MTOs and the companies included in the International MTO Index are representative of the larger and smaller MTOs. Western Union is still by far the largest MTO with a market share of 30% in very competitive markets and up to 90% in very uncompetitive ones, and often prices above the average of the other MTOs. Money Gram is internationally the second largest provider with an estimated market share typically between 10% and 30%, and a price level that is at par with that of the other smaller operators. The International MTO Index therefore is an accurate reflection of what most remitters will pay for their remittances (but ignores the level of prices of newer innovative companies as well as traditional providers such as banks which are covered in the Global Average).

Smart Remitter Target (SmaRT)

For information on SmaRT definition and methodology, please see

https://remittanceprices.worldbank.org/sites/default/files/smart_methodology.pdf

APPENDIX C – Proposed schedule and timelines

Table 9: Research schedule and timeline

RQ #		State Research Question or Objective	Prop/ hyp #	State Proposition or Hypothesis	Data collection detail	Data analysis method
1		Does the work done in the cross-border remittance market transform the market in terms of lowering costs and increasing transaction speeds?	1	H1: The application of blockchain in cross-border remitting will reduce the costs, allowing for an alternative means of remitting. N1: Blockchain used in cross-border remitting has no impact on reducing the remittance costs.	World bank global remittance database Binance (Blockchain service provider)	Statistical analysis: Comparisons of means (One Way ANOVA/ Kruskal-Wallis test)
2		Does digital currency adoption and trust among central banks aid in reducing intermediaries and the associated costs of remitting?	2	H1: The application of blockchain smart contracts in cross-border remitting will increase 'trust' among central banks, increasing the speed of transaction. N1: Blockchain smart contracts used in cross-border remitting has no impact on 'trust' among central banks and the subsequent transacting speed.	World bank global remittance database Binance (Blockchain service provider)	Statistical analysis: Comparisons of means (One Way ANOVA/ Kruskal-Wallis test)

RQ #		State Research Question or Objective	Prop/ hyp #	State Proposition or Hypothesis	Data collection detail	Data analysis method
3		Are global trends in blockchain allowing for easier and more trusted means of remitting while remaining regulatory compliant?	1 & 2	See hypotheses (research and null) 1 and 2 above.	World bank global remittance database Binance (Blockchain service provider)	Statistical analysis: Comparisons of means (One Way ANOVA/ Kruskal-Wallis test)

APPENDIX D – Ethics approval notification

Graduate School of Business Administration
University of the Witwatersrand, Johannesburg

Wits Business School

Wits Business School Ethics Committee
Constituted under the University Human Research Ethics Committee (Non-Medical)

Ethics Clearance Certificate

Ethics protocol number: WBS/BA838356/914
This certificate is only valid with a legitimate ethics protocol number and signed by the Researcher (below).

Project title	The role of Blockchain in reducing cross-border remittance costs for South Africans
Investigator / Researcher	Mr Thorne Zurfluh
Nature of Project	MBA (Research Article)
Decision of the Committee	Approved, provided stakeholders and participants are guaranteed anonymity and confidentiality.
Issue Date of Certificate	10/07/2024
Expiry date	Date of submission of the project / research report
Chairperson	Dr Ayanda Magida ☎ +27 11 717 3953 ✉ ayanda.magida@wits.ac.za

Declaration by Researcher

One copy must be signed by the Researcher and returned to the Chairperson of the Wits Business School Ethics Committee.

I fully understand the conditions under which I am authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I undertake to resubmit the protocol to the Committee.

Signature

14/07/2024
Date: