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Blockchain technology and international money transfers into the Nigerian Remittance market

Research report

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'A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of master's in Management in Governance in the field of Development and Economics'

February 2022



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JOHANNESBURG

Declaration

I, Aicha Bah declare that this Research Report is my independent work. It is being submitted for the Degree of Master of Management (Governance) at the University of the Witwatersrand in Johannesburg and has never been submitted before.



_____

Aicha Bah

February 28th, 2022, in Johannesburg

Abstract

Blockchain has been making a buzz for a moment now. The nascent industry based on a “distributed ledger technology” is being globally explored especially by innovative start-ups and financial institutions looking to benefit from the technology. Revolutionized by the usage of cryptocurrencies in its processes, blockchain algorism is believed to have the potential to indubitably agitate the financial world. The promises of blockchain pretty much touch any domains imaginable provided the necessary resources are allocated towards its implementation. From governmental tools in election processes to individual peer-to-peer transactions, blockchain is being targeted by various parties seeking to extract the obvious advantages, the technology offers.

This study focuses on how blockchain technology can benefit the Nigerian remittance market and observes how it has the potential to completely reinvent the financial and money transfer industry. Peer to peer money transfer methods have traditionally been done through financial institutions such as a bank or Western Union. In many regions around the world, especially on the African continent, the charges related to these transfers represent a high cost for the individuals performing them. Additionally, the regulations and required verifications on each step of an operation account for longer processing time. The main objective of this research is to explore an alternative financial solution for cheaper and more efficient remittance transactions internationally. The method used is a combination of desk research and qualitative field research that involves preliminary research on information already available about Blockchain technology, but also interviews with expert on the financial world.

This research concluded that Blockchain technology and the use of cryptocurrencies into everyday transactions represents a real chance at entirely transforming the way individuals exchange money. A few limitations were observed in regard to regulations and control over its functioning. Either way, it is expected that both governmental entities and private corporations will lean towards exploring the “true” capabilities of this technology.

Acknowledgment

Herewith, I am expressing my gratefulness for all instances that have helped or guided me throughout the whole process of this research project. First and foremost, I would like to express thanks to my former company manager at the bank where I used to work, Mr. Okechukwu Obanya, for his guidance throughout the whole progression of my research paper's development but also because of the motivation he provided for me to decide on such a specific subject to research. The unending support and expertise he provided during this project were of great value to me as they enabled me to effectively direct the process of what I was aiming to achieve. I am also thankful to all the external participants in my environment (friends and family) for the time they allocated to give advice and suggestions on the subject I had decided to tackle.

Finally, I would also like to thank my university supervisor, Dr John Khumalo for his structured feedback during the interactions we had.

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List of Abbreviations

GNP	Gross National Product
GDP	Gross Domestic Product
MSMEs	Micro, Small, and Medium Enterprises
IMF	International Monetary Fund
PWC	PricewaterhouseCoopers
MTO	Money Transfer Organisation
ESP	Economic Sustainability Program
ILO	International Labour Organisation
OPEC	Organization of the Petroleum Exporting Countries
KYC	Know Your Customer
FX	Foreign Exchange
API	Application Programming Interface
DLT	Distributed Ledger Technology
CBDC	Central bank digital currencies
OECD	Organisation for Economic Co-operation and Development
NFC	Near-field communication
MMT	Mobile Money Transfer
MNO	Mobile Network Operator
ADF	Augmented Dickey-Fuller test
MFI	Microfinance Institutions

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Chapter One: Introduction

1.1 Background information

A 2019 World Bank press release revealed that the global market for international money transfer between individuals exceeded a record high of $ 600 billion in 2018 with flows of cash to low- and middle-income nations reaching $529 billion (World Bank, 2019). Though, the ongoing spread of the COVID 19 pandemic difficultly impacted this evolution, with the World Bank predicting that remittances to developing countries will plunge this year by 20% to $445 billion. According to this same release, banks remain the most expensive intermediaries for money transfer abroad between individuals, with an average cost of 10.96% (of the specific amount being sent), whereas Western Union Specialists and MoneyGram represented 6.59% (Lunden, 2020). This justified the payment media market opening to non-bank players (digital payment, mobile wallet, etc.). Bitcoins, Ethereum, and other major cryptocurrencies have seen themselves thrive over the last few years as an alternative for individuals. The cryptocurrencies' value is rapidly increasing in Africa as well. Many financial experts predict that virtual currencies will blossom on the continent through numerous illustrations of innovative initiatives (Rao, 2018). The American bank Citigroup has ranked Nigeria as the third-largest bitcoin holder in the world as a percentage of gross domestic product (GDP), just behind Russia and New Zealand (AGEFI, 2018). The country is currently only second to the United States in terms of Bitcoin trading. Based on research done by Blockchain organization *Chainanalysis*, the dollar amount of cryptocurrency received by Nigerian users in May was $2.4 billion, up from $684 million in December last year (Akinwotu, 2021).

Blockchain technology is defined by the official website of Blockchain France as the implementation of information transmission and storage technology that does not require a control organ. It is theoretically a distributed database whose user-sent information is checked and grouped in "blocks" at regular intervals, connected and encrypted using cryptography, thus generating a thread. By extension, the technology is essentially a distributed database that holds records through storage nodes to protect them from modification or falsification. A blockchain is thus, a decentralized and secured registry of every transaction made since the beginning of the distributed system (Lemoine, Aubonneta, & Simoni, 2020). The current global interest in

cryptocurrencies and blockchain technologies, in general, has made financial institutions to consider it and potentially implement it as part of their strategic development plan. In fact, the use of this decentralized technology is broad enough to cover aspects that are of interest for banks such as Trade Finance, Payment, Identity verification, Clearing and settlement, Loans, but also peer-to-peer international transfers characterized by the remittance market (Arnold, 2017). Money transfer companies have been present on the African continent since the late 1990s allowing the unbanked population to conveniently transfer cash. This booming market has opened the door for multiple fintech organisation to challenge already established institutions. However, fees remain an important factor for diasporas around the world sending money home and lowering those fees would grant these new start-ups a significant advantage (Alam & Ali, 2021). It is thus, a competitive issue in this crowded industry, that is at stake especially because Nigeria alone which receives about 67% of the total remittance received in the sub-Saharan Africa Region, was seeing its inbound remittances climb sharply. The country was projected to have its international remittances market peak at $42 billion by 2022 (Ojeme, 2018), however, the economic and financial complications that followed from the Covid-19 pandemic have affected this evolution. Nevertheless, Nigeria remains the second largest receiver of international remittances on the continent, just after Egypt (Lawal, 2021). As a financial institution, finding ways to reduce transfer fees for clients and be more competitive in terms of international transfer is becoming a priority in this fast-changing society where innovation is the key to business survival. The technology behind blockchain could represent a cost-efficient way to reach this objective.

1.1.1 A struggling Giant: key phases of the Nigerian Economy

Located on the edge of the Gulf of Guinea between Benin in the west and Cameroon in the east, Nigeria occupies a strategic position between the countries of West Africa and those of Central Africa. The most populous country in Africa with its 210 million-plus inhabitants, is the continent's second-largest economy (IMF, 2021). Nigeria is considered an “African giant” and contributes more than half of the region's GDP. Since the early 2000s, the country has experienced continuous growth of around 7.5% per year (ACET, 2014). Nigeria's economy relies on its abundance of hydrocarbons (oil, gas, etc). It accounts for 95% of the total country’s exports, and its agriculture.

A member of the Organization of the Petroleum Exporting Countries (OPEC) joined in 1971 (Ladagu, 2020), the country is the eleventh world's largest oil producer and has the second-largest known oil reserves in Africa (EIA, 2020). Non-oil sectors have also considerably contributed to the growth of the Nigerian economy since 2011: the building and public works sector (BTP); the telecommunication industry, transportation (Abuja Light Rail, the first regional rail transport system in West Africa inaugurated in 2018), (Achirga, 2018). In many developing nations, such as Nigeria, most of its inhabitants are employed in the informal sector. The Nigerian economy is predominantly reliant on this sector, which includes street vendors, farmers, minibuses, hairdressers, private clinics, pharmacies, and so on. According to a 2018 published report from the International Labour Organisation (ILO), the informal economy accounts for 85.8% of employment in Africa. (ILO, 2018). In Nigeria, the informal sector was estimated to number over 41.5 million people in 2019 and accounts for 50% of the nation's GDP, making it a significant source of economic growth. Businesses that are concerned create the most jobs, provide training in technical skills, and are vital to the development of managerial competencies in both the private and public sectors. As of December 2017, micro, small and medium enterprises (MSMEs) generated over 59 million employments, with 2.9 million positions created by these businesses mostly in the education sector (Monye, 2020). The share of the informal market in Nigeria is one of the highest in Africa and would represent in 2003 roughly 75% of non-oil GNP (as a comparison, this share is only 11% in the States United and 16% in France) even though the sector is by nature difficult to document. In an economy subject to the extreme cyclical conditions of the oil market, however, despite a chronic financing problem, it contributes significantly to general economic growth as well as to the basic income of many households (Monye, 2020). Indeed, the Nigerian informal market plays a vital role in the national economy, by providing jobs, competition, training, and stimulating general economic dynamism - the existence of connections and gateways between these SMEs and large enterprises being of fundamental importance for the supply of skilled labour to the latter. Nigeria’s GDP per capita places it in the African average, although it remains well beneath the level prior to the country’s independence. About two-thirds of the population still live under the Poverty threshold, against 43% in 1985 (Onyeiwu, 2021). Its large human potential and abundance of natural resources, allow Nigeria to rank as Africa’s leading economic power with a GDP of $481.07 billion, ahead of South Africa ($415 billion in 2021). Its GDP (in purchasing

power parity) was the second in Africa just behind Egypt in 2018. Most of the economic activities take place in the coastal regions, in the south of the country, especially around Lagos (Nwafor, 2021). However, due mainly to dropping crude oil prices because of decreased global demand and containment measures adopted to stem the progression of Covid-related contaminations, the nation's economy went into recession in 2020, overturning three years of improvement (Tamunowariye & Elisha, 2021). Aviation, hotels, restaurants, manufacturing, and commerce have all been affected by these policies. The demand-driven development of financial services and information and communication technology has been undermined by the shrinkage of these industries (Kazeem, 2020).



Figure I Nigeria GDP Growth Trend and forecast from 2014-2021 (NBS, 2020)

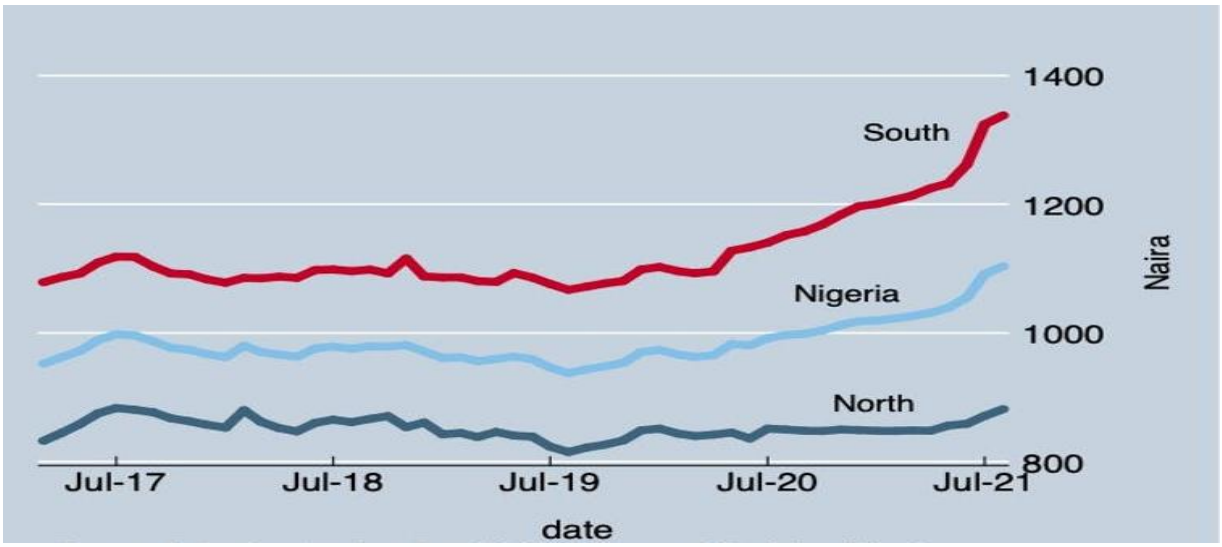


Figure II Average food prices in Nigeria from 2017 to 2021 (NBS, 2021)

The African Development Bank (AfDB) forecasted a 3% drop in total real GDP in 2020 despite the mitigating measures taken under the Nigerian Economic Sustainability Program (ESP) that prevented a substantially greater decline (AfDB, 2021). Increased food prices related to local supply constraints and the pass-through consequences of a forward premium exchange rate that rose to nearly 24% propelled inflation in 2019 from 11.4% to 12.8% in 2020. In addition, an increase in electricity rates, as well as the removal of fuel subsidiaries, pushed inflationary pressure to worsen (Tamunowariye et al., 2021). The policy rate was consequently reduced by the Nigerian Central Bank by 11.5% (100 basis points) in the hope to stimulate an economic push. Indicating income deficits and spending restrictions related to the pandemic, the budget deficit that is essentially financed by domestic and international borrowing extended in 2019, from 4.3% to 5.2%. The total governmental debt, as of June 30, 2020, represented 25% of GDP of the GDP and reached $85.9 billion. This number represented 2.4% in the same period the year prior. Domestic debt reached 63% of global debt, as external debt equalled 37% (AfDB, 2021). Nigeria represents a major fiscal risk because of its significant level of debt service obligations. They are estimated to be more than 50% of all federal revenue generated. Because of the drop in oil income and the weakening of external financial flows, the current account position should stay in deficit at 3.7% of GDP (World Bank, 2021). Nevertheless, this downturn trend is expected to reverse with a rebound in the country's GDP for the last quarter of 2021. The national statistical bureau recently released that in the third quarter of 2021, the country's GDP expanded by 4.03% (Nan, 2021). The economy is expected to rise further the following year. The receding effects of COVID-19, the government's new oil bill, as well as its effort towards infrastructure improvement will all support investment boost. However, rising prices, security matters, and a rougher recession in China (which is affecting exports) all represent important economic concerns. GDP growth in 2022 is likely to be 2.6%, unchanged from last month's prediction, and 2.8% in 2023, according to economists (IMF, 2021).

1.1.2 Nigeria's Remittance market: a non-neglectable addition to the economy

Remittances represent a share of income earned abroad that migrants repatriate home. It generally describes the financial flows made by the expatriates or 'migrants' to financially assist their relatives in their origin countries (Rapoport, 2006).

Nevertheless, the statistical description of worldwide remittances only reflects this standard analysis partially. The International Monetary Fund (IMF), which is the primary source of statistical information on international remittances based on Central Bank sources, defines remittances as two major elements:

-"Employee compensation" refers to the income a short-term expatriate worker in the destination country receives, as well as the earnings of workers hired by international corporations or embassies.

-"Personal transfers" refers to any in-kind or current money transfers done or received by migrants or non-migrant residents from or to people in other countries (IMF, 2009).

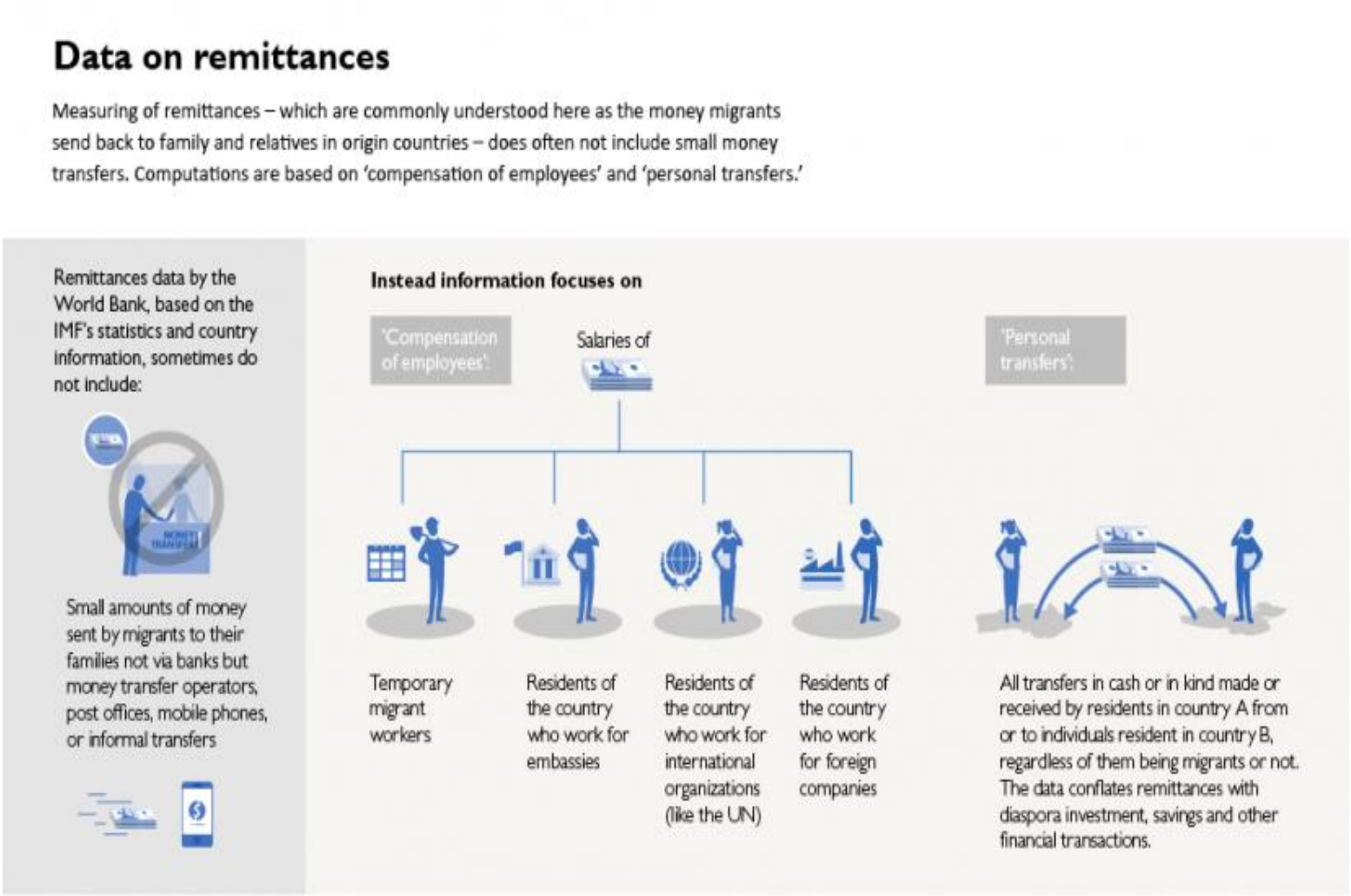


Figure III Data on remittances (IMF, 2009).

Total foreign migrants were predicted to reach 281 million in 2020, accounting for 3.6% of the global population, with roughly 15 million from Nigeria. In retrospect, 1.3 million individuals fled Nigeria in 2017 alone in pursuit of better opportunities (Aletor, 2021).

It is however important to note that remittances from abroad fell 24% in the first quarter of 2021, in comparison to the first quarter of the year before. They reached $4.2 billion, i.e., a decrease in the absolute value of $1.4 billion. The year 2020 had already recorded a notable drop in this type of transfer compared to 2019 ($16.9 billion compared to $23.4 billion respectively) (Oyekanmi, 2021). The situation is cause for concern, as agent transfers play a very important role in the Nigerian economy - whether it is household disposable income or the country's external position. Paradoxically, this drop recorded by state statistics could be explained by the strict exchange rate policy, forcing Nigerians residing abroad to go through unofficial channels, and therefore unaccounted for, to send money. money to their relatives back home (Adejumo, 2019). Transfers are affected by fluctuations in the international economy. Thus, during the economic crisis linked to the Covid-19 pandemic, international shipments fell sharply, before rising again. Nigeria provided 40% of remittances into Sub-Saharan Africa, according to the World Bank report "Defying predictions, remittance flows remain strong during COVID-19 crisis" (World Bank, 2021). Moreover, this decline comes after remittance flows to low- and middle-income countries (LMICs) had attained a record high of $554 billion, exceeding foreign direct investment for the first time in 2019 (WorldBank, 2020). According to PWC, Nigerians abroad sent the country $23.63 billion in 2018, or 6.1% of GDP. These remittances could reach $34.89 billion by 2023, according to the same institution, while Western Union, the largest company in the field, estimates at 5 million, the number of Nigerians living abroad who send money to their loved ones. The country is the world's fifth-largest destination for remittances (Omosomi, 2019).

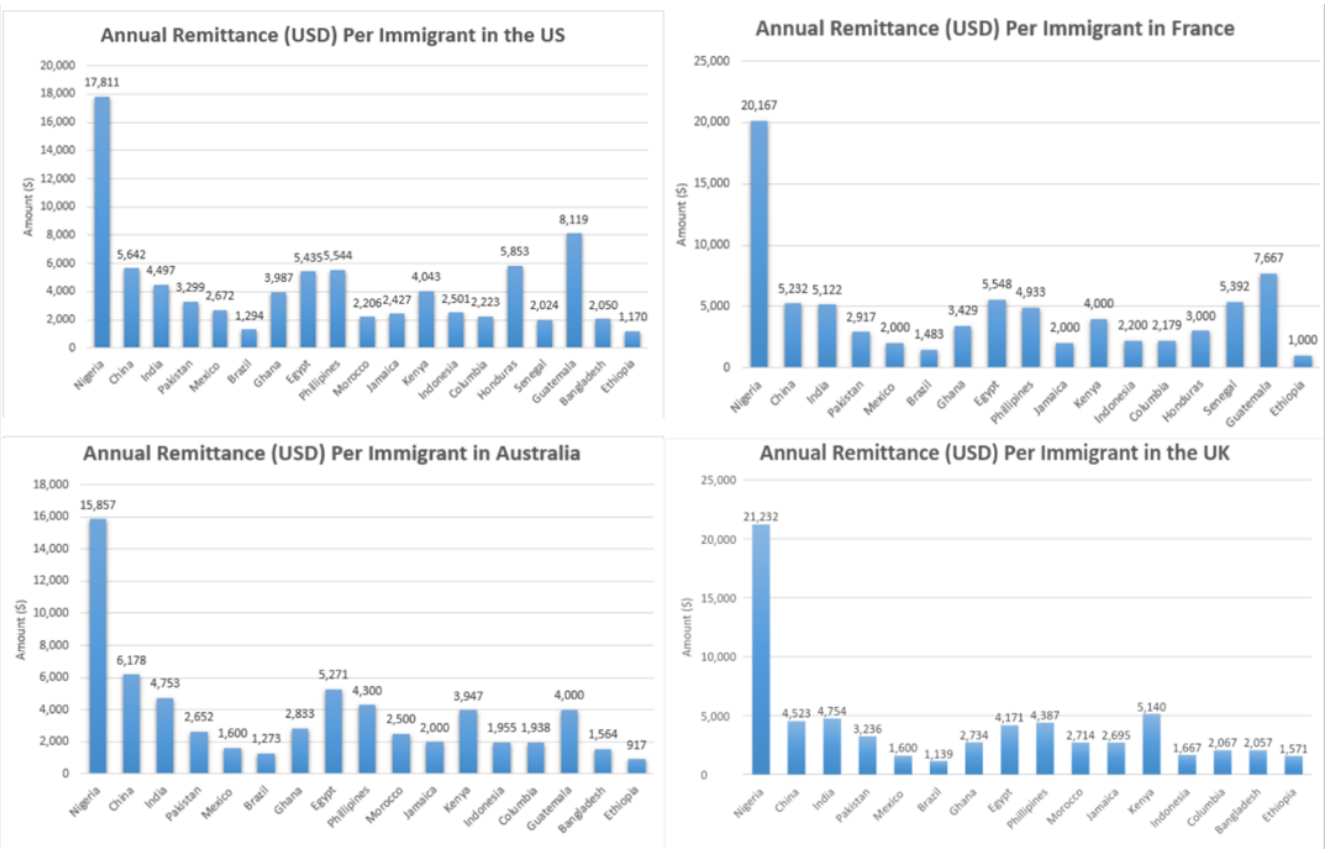


Figure IV Annual remittances from the Nigerian Diaspora in 2017 (Kaoshi, 2020)

Remittances are commonly described as the most direct connection between development and migration. Private funds that are being repatriated, go way beyond official development assistance. Because the statistical criteria used to gather data on remittances are broader, global estimates of migrant remittances include transactions that would not necessarily be considered remittances. Furthermore, these figures do not account for informal transfers (Deemoney, 2020). It's also worth noting that only funds that have been repatriated using official channels such as banks are considered in the World Bank and the IMF's estimations. Other market players like Western Union or mobile money transfer organisation like M-Pesa (Kenya), where smaller transactions are done by expatriates are not necessarily taken into account in every country, depending on the different central bank's data sources. The volume of these transfers can be particularly significant since they are not systematically accounted for in the balance of payments (especially remittances among developing countries). As a result, official numbers may underestimate this trend by up to 50% of their total value. Remittance flows stayed stable in 2020, despite the pandemic as they dropped at a slower rate than predicted. The latest World Bank brief on migration and development

predicted that registered remittance exchange to LMIC totalled $540 billion in 2020, just 1.6% less than in 2019 with $548 billion. (WorldBank, 2021). It is anticipated that LMICs will see their remittance number expand further to $565 billion which represents a 2.2% increase in 2022 with the global economy expecting a rebound (World Bank, 2021). Remittance flows' rather strong performance during the pandemic has also underlined the need for timely data availability. Considering its increasing importance as a source of external money for LMICs, more efficient data collection on remittances is necessary, both in terms of frequency and timely reporting (Ratha, 2021). The leverage effect of remittances on poverty reduction is maximum. Because they are a colossal source of the disposable income of their recipients. According to the UN, the bulk of remittances, that is regularly being sent by expatriated workers in the direction to their country of origin, account for an average of 60% of the total income of recipient households. Nigerians overseas sent a total of $25 billion in 2018, accounting for around 6.1% of GDP, placing Nigeria second in Africa behind Egypt ($28 billion). Moreover, despite the drop in remittance flows the following year, it still represented 4% of Nigeria’s GPD in 2020 (Aletor, 2021). More than two-thirds of these funds are used for immediate needs (food, especially agriculture in rural areas, education, and health) while a small part is injected into entrepreneurship projects. or local economic development. Therefore, analyses carried out in 71 developing countries by the United Nations show that increasing remittances per capita by only 10% is enough to incite a drop of 3.5% of the total impoverished portion of the population (United Nations, 2021).

1.1.3 Financial institutions dominating the remittance market

Migrants while sending out money, decide on a method of transfer based on how diverse the available services proposed by banking institutions are, their overall performance, and the money transfer organisation accessible to them. Money transfer groups have had a presence on the African continent since the late 90s. They supported the under-banked population to conveniently transfer funds (AfDB, 2007). This sector has for long been dominated by oligarch organisations that control a large part of the total volume of these transfers. Three remittances companies - Western Union, MoneyGram, and Ria - have been leading this industry for years until recently. The three combined are established in more than 200 countries offering their services for cash pick up in one of the nearly 1.1 million retail locations across the globe (Alam

& Ali, 2021). Western Union (WU), one of the pioneers in the operation of telegraphs in the United States, was born in the mid-19th century and is an undisputed leader. The American group alone would control around 40% of all international flows (Vacher, 2021).

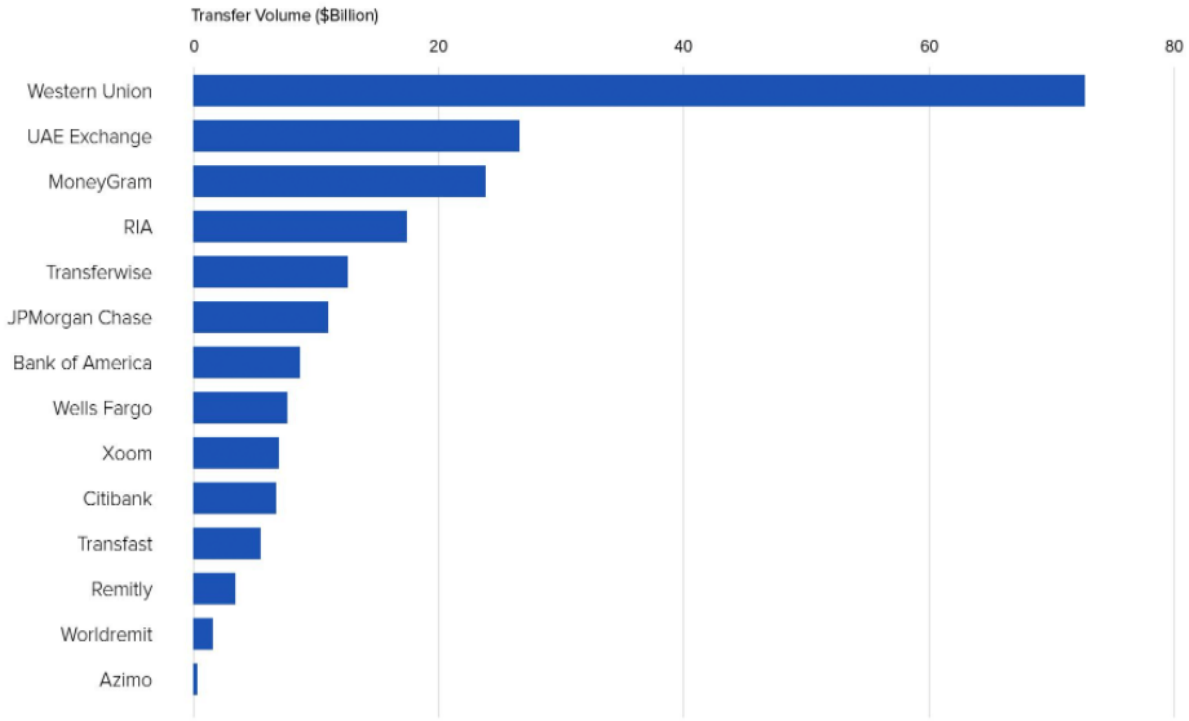


Figure V Cross-Border Money Transfer Volumes by Company TTM 2017 (Romaldini M. F., 2018)

Nevertheless, digital-first organizations are emerging, employing online and mobile channels to compete with those traditional intermediate both on scales and fees. New players are boosting the competition by applying fees as a visible distinction to promote and differentiate themselves. They are lowering their fixed cost by developing their business model on a basic digital platform while offering faster processing time to consumers on cleaner operational platforms (Alam & Ali, 2021). The development of fintech in recent years has opened the door of this very closed market to a few start-ups, such as Wise (ex-TransferWise), already valued at some $13 billion, WorldRemit or even the younger start-ups such as Azimo and Monisnap (Vacher, 2021). These operators manage to charge more limited prices than those of Western Union and banking establishments, which average 2.6%, according to the French Federal Union of Consumers: *Que Choisir*, with a range of services and a smaller geographic

coverage. With Wise, which specializes in super-fast online bank-to-bank account payments, 38% of transfers are completed instantly, and over 60% arrive within an hour. The British organisation claims a very competitive average fee level of 0.69% across all corridors, even if it remains very difficult to provide an average representative of the number of their commissions which depends on a set of factors, in particular currencies in which transactions are carried out (Vacher, 2021). International organizations (United Nations, G20, etc.) are putting a lot of pressure on the major market players to cut the costs of remittances for consumers, as their pricing is being scrutinized more and more closely. Given the highest costs are charged by banking institutions, one could assume that they would be more concerned by such scrutiny. However, banking institutions are well-diversified businesses with several income streams. In comparison to a money transfer organisation MTO, which is their entire "*raison d'être*", international payments are not a fundamental business for a bank. Foreign currency ("FX") spread, and transaction fees charged to the consumer are the two sources of revenue for international money transfer providers. In its 2016 statistics, Western Union, for instance, had a 70% fee revenue split and a 27% FX revenue split (Romaldini M. F., 2018).

1.2 Problem statement

Peer-to-peer international money transfer involves a disproportionate cost of processing -both in money and time - especially if done through banks. Traditional banking institutions rely on third parties and intermediaries for international transactions. Every single one of these transactions is billed through SWIFT and regulated through the nation's central bank. These operations take an average of 3 to 4 working days to be processed and result in an even higher cost for the sender and most of the time the receiver (exchange rate, banks receiving fees, etc.). With an average cost of 9.8%, the region of Sub-Saharan Africa represents the highest cost region (WorldBank, 2017). Although one of the most reliable channels around the world, the SWIFT network still involves high costs both for the bank and the individuals but is also time-consuming. In addition, although the technology is the basis upon which many other systems, more particularly cryptocurrencies, have been created, many have not been able to comprehend the full extent of its capacities and/or restrictions. This highlights the second challenge of this research, which is the potential

limitations that surround the technology that is blockchain. Corporate management does not yet realize how to integrate blockchain into the processes of the organization, which means that there is a lack of trained blockchain specialists willing to fill the gap in expertise. This slowed the global acceptance of the technology despite the promising expectation it claims to offer (decentralization, transparency, etc.) and the opportunities that it will bring on to the international remittance market. Finally, the last matter that will be tackled through this study is the lack of proper deployed blockchain model implementation especially in Nigeria to have a better understanding of the appropriate ways to apply the technology into international peer-to-peer money exchange. This technology having never been tested, knowingly established, or overall adopted by Nigerian financial institutions dealing with money transfers, it is difficult to accurately have an understanding of the science and knowledge behind it as well as what it could bring to the industry.

1.3 Research purpose

The main goal of this research is to explore new technological opportunities, a financial institution could theoretically deploy to radically change the remittance market, in Nigeria. This could mean offering retail customers an easier, more affordable, and trusted (regulated) experience, and facilitating financial institutions to expand their market share in this highly competitive space. Exploring innovative solutions towards overcoming the SWIFT code requirement system involves developing an independent international transfer platform that does not rely on costly third parties' intermediaries. Innovative live time transfers and reduction of cost for individuals using regulated traditional banking networks is the main issue that is going to be tackled in this research project. The secondary objectives of this study are broken down into three sub-goals linked to the sub-questions elaborated in the next section. The first focus is the exploration of how an elaboration of a blockchain framework can allow significant cost reduction for international money transfers for individuals and the financial institutions involves in the operation. The second sub-objective of this research is to help identify the main limitations that are associated with blockchain and cryptocurrencies, in an international money transfer context. This is for the relevant institutions implementing the technology to be able to mitigate the risks as efficiently as possible and allow for optimal development of the technology. The last secondary purpose that will help

address the lack of knowledge on potential blockchain implementation, will be to analyse some of the most efficient blockchain applications already in place around the globe regarding cryptocurrency transactions and exchange of foreign currency. Considering the technology still being quite “new” and unexplored on a large scale, the purpose of this matter will be to gather as much data on the existing implementations that have been efficiently undertaken, by various financial and/or governmental institutions.

1.4 Research question

To address the problem and reach the objectives of this study the following research question was defined:

How can a blockchain technology framework be implemented and benefit the Nigerian remittance market?

The following sub-questions were determined to precisely answer the research question mentioned above:

1. What are the cost-efficient characteristics of a blockchain environment in a cross-border financial transaction?
2. What are the main risks and limitations associated with the implementation of blockchain technology regarding international payments?
3. How has blockchain technology been efficiently implemented into money transfers in other countries around the world?

Chapter Two: Literature Review

The main goal of this section is to provide an insight into the theoretical and empirical literature on the subject studied. It is going to give a certain explanation and a literature analysis related to the notions of international transfer, digital payment, and cryptocurrencies through the examples of conceptual models. A perception of what researchers have found on similar subjects will be covered in this segment.

2.1 The development of mobile money & digital payment

In recent years, the global payment environment has evolved tremendously, with conventional payment instruments, such as cash and checks, globally declining and the use of electronic payments rising (Rathore, 2016). The newest innovation in cashless payment transactions is digital payments and mobile wallets. The establishment of mobile wallets turns smartphones and other NFC-equipped devices into rapid and secure payment means. A digital wallet is described as a device, an app, or an online service that allows individuals to send and receive money as well as perform financial transactions without having to hold a physical wallet, physical cash, or credit card (Hamilton, 2020). As an alternative, the encrypted credit card information stowed on their electronic device makes mobile payment possible. Near Field Communication (NFC) is the technology most mobile wallets depend on. NFC facilitates the communication between the mobile and a payment terminal without having to physically touch it, enabling the exchange of data via radio waves (Shukla, 2020). A relatively recent trend that has been observed by financial experts, is the rapid boom in mobile payment and money transfer usage in developing countries, especially on the African continent. Mobile Money Transfer (MMT) technology has grown to be indispensable for day-to-day transactions as the financially excluded part of the population (of the “unbanked”) and the ones of low and middle-income classes are the ones that have adopted the technology the most (Ahmed & Ali, 2017).

Safaricom and Vodacom in Kenya initially made the mobile money service popular in 2007 and debuted with M-Pesa (“Pesa” meaning “money” in Swahili which translates M-Pesa to “mobile money”). The M-Pesa system started as a sim-card-based money transfer service for microlending and evolved into a remittance messaging system.

M-Pesa allowed users to convert their mobile "minutes" (purchased with cash), into a virtual currency that turns the mobile into a virtual bank account. Only 14% of Kenyans had a bank account at the time, and 54% owned a mobile phone, which ultimately gave customers more payment options without the need to open a traditional bank account. Today more than 93% of the Kenyan population takes advantage of mobile payments with more than 25 million M-Pesa customers which represent over 45% of the population (Nayax, 2019). Mobile money services have rapidly gained popularity in many developing countries. Yet very few of such initiatives have attained sustainable scale, particularly in South Africa, and Uganda with MTN Money, Orange Money in Ivory Coast, or Celpay Holdings in Zambia (ACP, 2014). Mobile money is one aspect of the broader concept emerging in the payment and electronic banking industry. It is considered an integral part of e-commerce and therefore of mobile commerce (Adholiya & Dave, 2012). However, mobile money has not been well defined in the literature. Its definition varies within the communications industry since it envelops a broad and overlapping range of applications (Dermish, Kneiding, Leishman, & Mas, 2011). Generally speaking, mobile money is used as a term to describe financial services provided through a mobile phone (ACP, 2014). The mobile wallet that can be linked to mobile money describes an electronic deposit of digitalised cash that is developed and implemented on mobile phone devices. enabling person-to-person transactions (P2P) between mobile devices (M2M) and between users of a same service. The mobile money service offers new opportunities to better ensure access to financial services (ACP, 2014). Unlike traditional banking and financial service providers, mobile network operators have invested heavily in building ever-larger networks that reach deep into hitherto rural areas that are likely marginalized in an effort to respond to the present demand for communication.

2.1.1 How mobile money works

The typical mobile money platform gathers several actors and stakeholders who have distinct roles and derive various advantages from the whole “ecosystem”.

Mobile Network Operators (MNOs)	Provide mobile money service infrastructure and bring in customers who are already using their communication services. Ensure compliance with country telecommunications regulations and policy.
Bank or any other financial institution with a banking license	Provide oversight functions. Ensure compliance with national financial regulations and policies.
Sector regulators	Provide an enabling environment Protecting the stability of the financial system Examples: central banks, for the financial sector, while for the communications sector, these would represent the telecommunications regulators.
Traders and retailers	Contribute to increasing demand for mobile money by providing users with new ways to spend the money stored in their mobile wallets. Reduce the need for cash.
Companies	Examples: microfinance institutions and insurers that use mobile money as a tool for their own services, but also businesses that make many payments and issue many invoices.
Users	Use the mobile money service to have a cheaper and more efficient way to make transfers or payments to other people or businesses.

Table 1 Mobile money Transfer Ecosystem (Source: Author, 2022).

The Alliance for Financial Inclusion divides mobile money services into two broad categories (AFI, 2010):

 Mobile banking services or “m-banking”: refers to the usage of a mobile device as the main method of carrying out financial operations from one bank account to another. These operations can involve payments from one bank account to several other

accounts. Mobile banking services also usually offer a variety of informational features such as account balance inquiries, transaction notifications or alerts, bank statements, etc. These services represent a subdivision of e-banking transactions that include internet banking activities and the availability of point-of-sale systems and ATMs.

 Mobile payment or “m-payment”: describes utilizing a mobile device to make a payment. Mobile payment may require the creation of a new tool, such as e-money, to use as the origin and destination point to where value is transmitted to. However, mobile payment can be made using an existing instrument or store of value such as an account.

Even though the term “mobile payment” is generally applied to illustrate monetary transactions that do not come from a bank account, a large range of mobile payment types are available, including:

- Government to Person (G2P): social pension or salary payment to an individual made from an official entity.
- Person to Person (P2P): that is also recognized as a mobile money transfer.
- Person to Business (P2B):, payments for goods and services, bills, or even for cell phone minutes. Business to Person (B2P) happens when a private organisation pays individuals (in salary or for the delivery of goods for instance).

The transmission channels used are comprised of:

- Short Message Service (SMS)
- The Unstructured Supplementary Service Data protocol (USSD) or added services for unstructured data and
- The SIM toolbox that combines the first two.

2.1.2 Theoretical analysis of the impact of money transfer

The core theoretical rationale for cash transfers is based on a series of projected positive effects. When cash is delivered to individuals or households in a predictable manner, it is anticipated to be spent in ways that have immediate implications on overall expenses (health, food, or education, among other things) and saving/investment habits. Moreover, it has the potential to have long-term benefits on households' livelihood strategies, asset accumulation, and human capital, while

decreasing poverty and strengthening resilience. These theories have been investigated in a wide range of effective assessments of money transfer services worldwide, but at the same time trying to direct attention to more unintended consequences like social trends, gender debates, variations in bargaining power, etc (Giulianoa & Ruiz-Arranz, 2009). Cash transfers may also have an impact on community-level dynamics, such as growth and productivity inside local economies, local labour force markets, and existing social networks, or macro-level results. Mobile money services can be considered to have an impact at the micro-economic and macro-economic levels. The macroeconomic approach considers transfers as one of the most stable capital inputs. It also analyses their contribution to economic growth and poverty reduction. The microeconomic approach analyses the role of transfers in poverty reduction through control variables (like household income, gender) to consider the characteristics of the family receiving the money.

In general, macroeconomic studies generally use panel data involving several countries. Thus, studies conducted by researchers on the matter revealed that “the impact of remittances on the economies of poor countries provides certain indications such as the uses made of these transfers” (Gupta, Patillo, & Wagh, 2007). They conducted this study in 76 countries around the globe, including 24 in sub-Saharan Africa, and found that most remittances are beneficial to finance consumption or to contribute to investment into health and education. In addition, poor families, which have an emigrant member, are more likely to receive a regular supplement from outside. It follows from their analysis that 10% of the transfer ratio corresponds to a 1% drop in people living on less than a dollar a day and in the poverty gap rate. Along the same lines, the article from the United Nations entitled "Workers' Remittances, Economic Growth and Poverty in Developing Asia and the Pacific Countries", examines "the impact of worker transfers on economic growth and reduction of poverty in the Asia-Pacific’s countries which, during the last three decades, have experienced a major increase in remittances constituting their largest source of income, i.e., 10% of their GDP". The author uses a data panel over the period 1993- 2003 (Jongwanich, 2007). The method used is inspired by the empirical study done by Barro on determinants for economic growth (Barro, 1996).

A substantial additional amount of literature suggests that mobile money services most likely have the potential to positively impact household incomes and therefore facilitate

savings and be a platform for financing development projects. Improving household income and facilitating safe savings: Reducing the cost of remittances increases the magnitude and frequency of remittances and consequently affects household income. Besides, given that mobile money services offer a safe storage mechanism, this could also encourage household savings (Adams & Page, 2005), (Agunias, 2006), (Black, Natali, & Skinner, 2005). Additionally, Bounie, Diminescu, and François (2010) also provide a socio-economic analysis of mobile money flow by demonstrating how it can also facilitate the development of projects by transferring funds into relevant programs. Mobile money services can benefit humanitarian initiatives by facilitating transfer payments of social nature from governmental entities to citizens of their countries. These mobile transfers can proliferate in different sectors, like agriculture or emergency response. Considering mobile money is a possibly valuable instrument to agriculture development projects, easier access to financial services represents an important economic factor for developing countries (Bounie et al., 2010). Having various parties inside the money transfer market is, thus crucial for the unbanked segment of these populations. In 2018, researchers estimated that 31% of the global population (nearly 1,7 billion people) did not have a bank account. Africa has the weakest financial inclusion figures with just 5 bank branches per 100 000 people whereas in North America it is 32 per 100 000 (Triki & Faye, 2019).

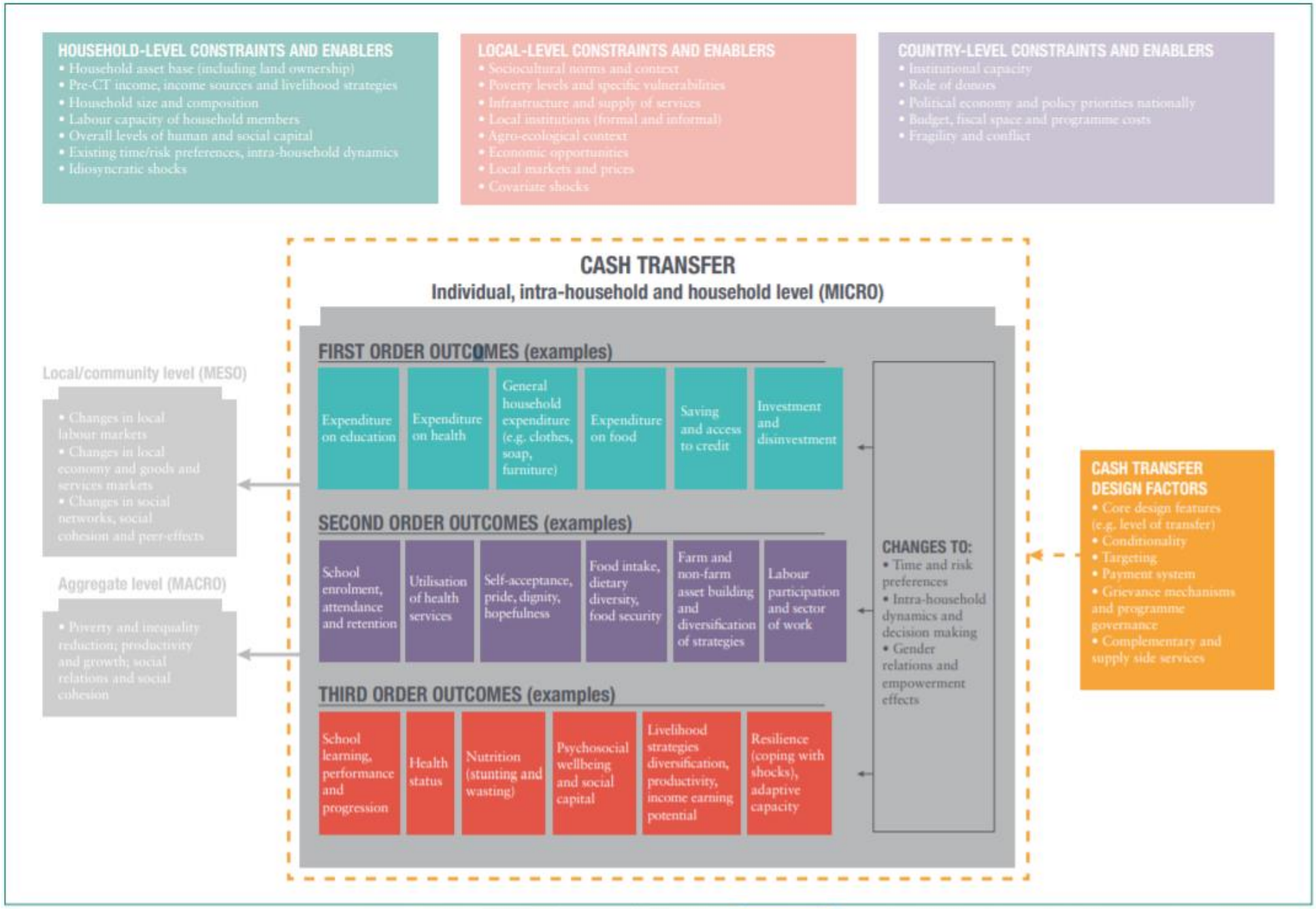


Figure VI Conceptual framework on use of cash transfer (Bastagli, et al., 2016)

In the microeconomic approach, there are few articles on current transfers. The most prominent is that of the researcher Aredo carried out in Ethiopia in 2005. His work consisted in verifying whether transfers are directed towards poor households. In his studies, Aredo concluded that “the vulnerability of a household increases its probability of receiving a transfer” (Aredo, 2005). We can also cite the work of Adams et al., (2005) also going in the same direction. The services that mobile money entail are vastly accessible to most layers of society because they are cheaper, more convenient, and faster, than formal financial services (ACP, 2014).

 Fast and more convenient money transfers thanks to broad territorial awareness: mobile phones are present in remote areas where financial services provided by regular banks remain very expensive or have simply been physically not present. In most developing countries, the formal financial sector is plagued by weak structure and restrictive conditions (price, necessary documentation) and that basically exclude low-income populations in rural areas (Magwedere, 2019). The primary reasons discouraging banks from offering their services to most people in these countries, particularly in rural regions, are the expensive transaction costs and the difficulties the banks face in setting up branches or ATMs in these areas. Therefore, unbanked people often use informal financial services. Mobile money services can be accessed from anywhere and at any time, unlike banking institutions. They eliminate the necessity to have physical offices to deposit or withdraw money. Senders and receivers are not necessarily obliged to travel to a Western Union location, fill out forms, or wait in lines to complete a transaction or receive cash.

 Reduced money transfer costs: Sending money through money transfer companies or agencies like MoneyGram or Western Union, is generally considered pricey. The high costs of sending remittances through official channels are partly connected to expensive currency conversion and strict regulations on transfers. Furthermore, the fact that these money transfer companies are practically non-existence, have repercussion on the high fees the customer will ultimately have to pay, and this drives those who cannot access them to consider informal transfer channels. In contrast, the unbanked population can transfer smaller amounts in and out of the country at a lower cost thanks to mobile money services, in comparison with banks and transfer companies.

In Senegal, remittances from Senegalese migrants have enabled 31% of the households that benefit from them not to fall below the poverty line. They are also the source of an increase in per capita expenditure in Senegalese households of 59.85% on average (Beye, 2009). This is indicated by a recent study done by the department of forecasting and economic studies. recorded on consumption, firstly because of the "relative weakness of transfers to this environment". Remittances from migrants are included in a section of the balance of payments which includes the lines “compensation of employees” and “remittances from migrants”. These transfers can follow different channels depending on the degree of financial inclusion of migrants. They depend on the status of the emigrants and their membership in an international network that has fast and inexpensive shipping methods available to them. The formal circuits of the transfer market are made up of traditional financial institutions (banks in general) and microfinance institutions (MFIs) which have a financial body under the PARMEC law of January 5, 1995. These volumes of remittances have been achieved because financial establishments have significantly adapted their financial product offerings to the requirement of simplicity and speed in remittance procedures for emigrants. They regularly seek to improve this service to better meet customer demand.

The majority of research into the influence of mobile money on the remittance industry has been on the frequency and volume of remittances. According to ethnographic research completed in two locations in Kenya to analyse the impact of the introduction of M-Pesa, urban migrants who use M-Pesa increase the regularity of sending while decreasing the quantity of money moved at the same time. M-Pesa would allow migrants in urban areas to go without having to have cash on hand while waiting to make a one-time payment. They can transfer money to their family in rural regions as soon as they get it and that on a weekly or bi-weekly basis (Morawczynski, 2009). Sending money "in bits" results in an increase in the total amount sent out. To put it another way, the quantities regularly transferred via mobile money are lower than those sent via other channels; but, when the amounts sent via mobile money are aggregated, the amounts sent via mobile money are larger overall. There are various reasons why migrants transfer little sums of money on a regular basis. For relatively little amounts, on the one hand, MTOs offer cheaper remittance costs than other channels such as banks. Furthermore, the costs imposed by the informal channels tend to be volatile,

varying depending on demand and the time of year. Making frequent small-dollar payments, on the other hand, allows urban migrants and their recipient families to better handle their money. In their study about economic M-Pesa's implications, Mbiti and Weil (2015) came to the same result. They conclude that if M-Pesa were more globally implemented, people would send five additional remittances per year, based on a balanced panel of locations in Kenya gathered from a combination of the 2006 and 2009 FinAccess surveys. The decrease in transaction costs is the fundamental reason for the growth in both the quantity and frequency of money transfers. According to Munyegera and Matsumoto (2016), mobile phone-based financial transactions in Ghana are related to a lower transaction, transportation, and time costs. According to the authors, homes with at least one mobile phone user are 20% time more expected than a household without, to receive remittances because of this price decline (Munyegera et al., 2016). Darmon, Chaix, and Torrehave validated these findings at the macroeconomic level (2016). They created a theoretical model that considers both the sender's transfer decision and the recipients' consumption decisions, with and without the option of at least partial resort to mobile payment. They demonstrate that mobile money has a favourable impact on overall remittances and wellbeing (Darmon et al., 2016).

Most research show that mobile money has a beneficial repercussion on remittances. Nevertheless, neither the empirical nor theoretical literature has explored the degree to which new digital financial innovation could better allow formalizing the informal aspect of the remittances market. Yet, the problem stays concerning since the group targeted by mobile financial services is excluded or underserved by the official system, and hence relies mostly on informal activities (informal savings, credit, insurance, and remittances). Batista and Vicente (2013) focused on the impacts of mobile money on the remittance channel in their evaluation of the adoption of mobile money on various outcomes. They conducted a controlled experiment with 2040 random people in 102 rural districts of Mozambique. When comparing the target and control groups at the end of the trial, they find that the readiness to remit through Mkesh has grown. Targeted subjects are 26% more likely than the control group to send money through Mkesh. The authors deduce the Mkesh effect from this data, claiming that it gathers alternative transmission routes at the periphery (Batista et al., 2013). However, as Aron (2018) points out, the authors focused on transfers in an atypical direction (from rural

to urban regions), therefore their findings may not apply to all nations in Sub-Saharan Africa. Within Kenya, a similar trend of change has been observed in remittance flows (Mbiti et al., 2015). Before the launch of M-Pesa, the primary method of remittance was through informal channels such as friends and bus companies. While more than half of respondents said they used informal routes, only 10% said they used banks or MTOs. In 2009, after the introduction of M-Pesa, the mobile money channel became the most widely used, crowding out other channels. However, the authors note that the crowding-out effect is greater for banks and MTOs. In other words, the introduction of M-Pesa has been more detrimental to banks and MTOs than to informal channels. One of the limitations of this study is the fact that the authors simply observed (before and after) the remittance methods used by the respondents. As a result, reasons other than the introduction of mobile money might be to blame for the dwindling use of traditional remittance routes. Similar and more robust results in the case of Madagascar were found. According to a 2015 FinScope consumer study, mobile money usage increased the likelihood of sending (and receiving) money as well as the quantity sent. The authors take their study a step further by looking at how mobile money compares to other channels and if it is complimentary or substitutive. They utilized mobile money to reduce the number of channels used by families to send and receive remittances. They show that mobile money can replace traditional transfer channels after adjusting for potential endogeneity using the instrumental variable technique. However, the predicted parameter's value (which is very near to 1) implies that many families continue to mix and match remittance routes (Bair & Tritah, 2019). Although these studies are based on unique examples in Sub-Saharan Africa, they corroborate the idea that mobile money is posing a threat to established remittance market operators.

2.2 Cryptocurrencies: a necessary evolution or a monetary disruption?

2.2.1 Bitcoin

According to the European Central Bank’s (ECB) paper on virtual currency schemes published in 2012, Bitcoin was the most successful and widespread virtual money scheme, however, it was also the most controversial. It is considered the first instance of the emergence of virtual currencies. Moreover, the European Central Bank regards bitcoin as a convenience (or commodity) and not as a currency. It is, on one hand, a virtual currency of cryptographic currency type and on the other hand, a peer-to-peer

payment system, presented by an individual using Satoshi Nakamoto as a pseudonym, who announces his system in 2008 and publishes the source code in 2009 (ECB, 2012). Merchants are gradually accepting more and more alternative means of payment such as Bitcoins. These merchants are encouraged by transaction fees that are not over 3% of credit card corporations and are independent of the amount of the transaction. In Europe, North America, South America, and Asia, growth in merchant adopting this channel of payment were observed at 328% for Bitpay year over year from 2016 (Luther, 2016) Transaction costs are voluntarily paid by the buyers and not the seller like it is the case for credit card transactions. A bitcoin transaction is irreversible and impossible to cancel. Despite a 500% increase in 2014 of merchants admitting bitcoin, cryptocurrency is not well established in the retail trade and still struggles to gain a steady position in the trade as only 3 out of the 500 biggest online retailers in 2016 were accepting bitcoin (Katz, 2017). This reluctance can be explained by the uncertainty surrounding cryptocurrencies volatility. Unlike with the US dollar, for instance, a regulated, legal tender, no institutions are monitoring to guard against or respond to fluctuations in the value of private, digital currencies. On 28 December 2017 Bitcoin traded at $15,433.73. As of February 9, 2018, more than half of the virtual currency dropped sharply and the demand oscillated between $6,000 and $9,000 varying on the day or night-time. Occasionally fluctuations of 10% or more are also observed every hour. (Adkisson, 2018). On a corporate level, several start-ups have been working for years on building Bitcoin's alternatives to traditional money-transfer methods. Cash transactions would be paid in the local currency and converted into bitcoins before being sent to the destination country. Once there, the bitcoins are converted back into the local currency of the receiver. During the currency exchange, the facilitation organization would take a cut like any traditional provider, and neither customer necessarily knows that bitcoins were involved (Middlebrook, 2014).

2.2.2 Cryptocurrency and its speculative environment

If cryptocurrencies have no intrinsic value (Cheah & Fry, 2015), the cryptocurrency phenomenon is nothing more than a long-term speculative bubble. An increasing body of literature concentrates on calculating the underlying worth of cryptocurrencies. The following are the primary elements that influence its basic value: (1) The cost of production which refers in this case to mining (Garcia, Tessone, & Mavrodiev, 2014),

(Hayes, 2018) , (Corbet, et al., 2019), (Pagnotta & Buraschi, 2018), (Bhambhwani, Delikouras, & Korniotis, 2019); (3) The market size (Fantazzini et al., 2017); (4) The users and their behaviours and more precisely the network of users in a decentralized manner (Abadi & Brunnermeiery, 2018), (Pagnotta & Buraschi, 2018), (Sockin & Xiong, 2020), (Bhambhwani et al., 2019), (Wheatley, Sornette, & Huber, 2018); (5) Transactions fees (Easley, O'Hara, & Basu, 2019); and (6) other financial and economic aspects such as return, volatility, liquidity (Corbet et al., 2019), exchange rates, traded volume (Kristoufek, 2020). Even if the underlying value is non-negative, some signs of bubbles may be seen on the bitcoin market. The price does not fall to zero at the conclusion of the bubble in this situation, but rather to its basic worth (Hayes, 2018). Since their establishment, the dynamics of cryptocurrencies appear to be comparable to the Dotcoms boom of the 2000s (Ofek & Richardson, 2002) The success of cryptocurrencies is compared to that of the World Wide Web because they both have similar innovative features (Folkinshteyn & Lennon, 2015), such as a lead-user via a white paper, a technology that combines several IT innovations, a nature that combines ubiquity, open-source, and decentralization, and the creation of new standards. These traits appear to be factored in the formation of bubbles, comparable to those seen in the DotCom era (Chang et al., 2016). The speculative investment aspect of cryptocurrencies (Baek & Elbeck, 2014), (Yermack, 2017), (Baur, Lee, & Hong, 2015), the participants' intentions (Glaser et al., 2014), and short-term, speculation intention are all presented in a stream of literature (Horra, Fuente, & Perote, 2019).

2.2.3 Methods of detecting the financial bubble

Scholars have made a distinction between "irrational" and "rational" bubbles in the noteworthy bubble literature (Dale, Johnson, & Tang, 2005). Irrational bubbles, on the one hand, are based on diverse expectations and multiple equilibria; on the other hand, homogeneity, rationality, and symmetric information requirements are violated. On the market, there are irrational investment behaviours that trigger the price into deviating from its fundamental value. Bubbles can be created by investment techniques based on optimistic anticipation, fashion (or “fads”) (Shiller, 2005) , and psychological tendencies such as herding behaviour (Vissing-Jorgensen, 2003), (Dale et al., 2005), (Brunnermeier, 2018), (Cheah et al., 2015). Empirical studies reveal that this

psychological influence is manifested in investor optimism or pessimism (Harrison & Kreps, 1978), the Internet Bubble (Ofek et al., 2002), short-sale limitations (Miller, 1977), and high volatility and big volumes (Scheinkman & Xiong, 2003). Rational bubbles, on the other hand, are founded on rational expectations that might lead to mispricing and, as a result, the formation of a bubble. If investors are most likely aware that the current price is not a reflection of the asset's underlying worth, they are still prepared to pay more since they intend to sell at a higher price later (Flood & Hodrick, 1990), (Gürkaynak, 2008), (Hafner, 2018). The "rational intrinsic bubbles" and "rational extrinsic bubbles" are defined by Dale et al. (2005). The former is described by a "systematic and persistent" misevaluation of the fundamental value, which happens during the innovation process when estimating the fundamental value is challenging (Froot & Obstfeld, 1991). When bubbles build based on exogenous occurrences in an uncertain environment (Azariadis, 1981) especially if it is impacted by knowledge asymmetry between traders, they are called "rational extrinsic bubbles." Many scholars explore "rational bubbles" and their detection techniques in various markets, such as the chance of bursting (Blanchard & Watson, 1982).

Several strategies for detecting bubbles in a rational expectation and symmetric information exist, according to (Brunnermeier, 2009) The first is the regression analysis tool (Flood & Garber, 1980), which compares the highly fluctuating behaviour of dividends and stock prices using the unit root test and co-integration test (Diba & Grossman, 1988). They show that in a normal setting, a positive relationship remains between the stationarity of stock prices and the stationarity of dividends, but that this relationship breaks down when a bubble occurs (the bubble process is non-stationary). They use the Dickey-Fuller Test to test the null hypothesis of no bubble, in which dividends and stock prices would be co-integrated. Evans (1991) challenges the notion that the unit root test is an effective method for rejecting alternative theories (existence of bubbles). The ratio dividend/price is also applied while identifying bubbles using the Augmented Dickey-Fuller unit root analysis (Taipalus, 2012), the Phillips-Perron test (Diba et al., 1988), and its extensions such as the Generalized sup ADF test (Phillips, Wu, & Yu, 2011) or the wild bootstrap, which takes heteroskedasticity into account (Phillips & Shi, 2018).

2.2.4 Bubble characteristics of cryptocurrencies

Since the introduction of so-called "cryptocurrencies" like Bitcoin in 2008 (Nakamoto, 2008), experts have struggled to explain their nature. There is evidence in the literature that cryptocurrencies may be used as a currency or as a store of value (Grant, 2014), (Ciaian, Rajcaniova, & Kancs, 2016), (Figuet, 2016), as a commodity such as gold (Selgin, 2013), (Bouri, Shahzad, & Roubaud, 2019) or as an asset like common stocks (Baur et al., 2015), (Glaser et al., 2014), (Yermack, 2017). Godsiff (2015), Umeh (2016) and Gangwal and Longin (2018) claim that cryptocurrencies cause speculative bubbles since they are assets rather than currencies, and because of the quick rise in price and significant volatility. Following this line of thought, subsequent research has attempted to demonstrate the cryptocurrency market's inefficiency (Nadarajah & Chu, 2017), and experimentally uncover some indications of bubbles using various bubble detection methodologies.

Looking at Bitcoin's price graph in Figure VI: The top-4 cryptocurrency pricing in USD, the first peak in late 2013, when Bitcoin's price topped $1,000 for the first time can be noticed. The available literature investigated this first burst. Cheah and Fry (2015) use a battery of detection tests based on the (Johansen & Sornette, 2010) research to show that the December 2013 crash was preceded by a bubble. The same authors examine the December 2013 peak using a second cryptocurrency, Ripple, in addition to Bitcoin, a year later. The authors discover two things: first, that each of the cryptocurrencies mentioned has negative bubbles, and second, that there is indeed a “spillover” from Ripple to Bitcoin (Cheah et al., 2015). MacDonell (2014) assumes the same confirmation about the Bitcoin price drop in December 2013 after analysing the elements that determine the value of Bitcoin. The findings also show that the LPPL model is useful for detecting a cryptocurrency market bubble. Some studies employ the Philipps, Shi, and Yu (PSY) technique (Phillips et al., 2011) and (Phillips et al., 2018) based on unit root analysis to find numerous bubbles (Fantazzini et al., 2016). Between 2011 and 2013, there was an enormous rise in Bitcoin values (Malhotra & Maloo, 2014), as well as three bubbles (Cheung, Roca, & Su, 2015). In 2017, the price of Bitcoin grew at an exponential rate once more (see graph). Corbet et al. (2019) use the same approach as before to discover that Bitcoin and Ether are in a bubble phase

on November 9th, 2017. This second period, which ends in December 2017, shows tremendous price growth, with Bitcoin hitting a high of $19,395.83 in December 2017.

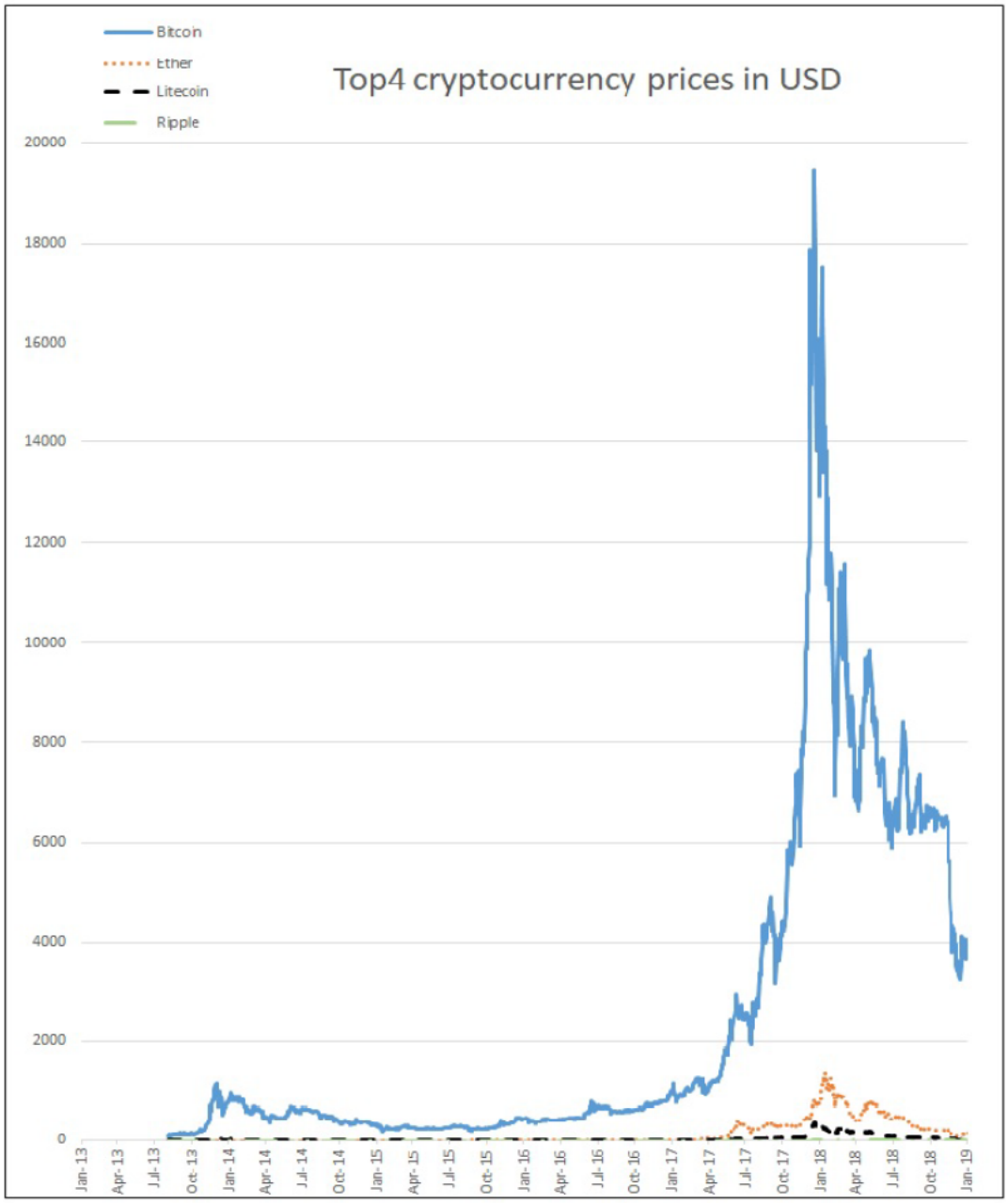


Figure VII The top-4 cryptocurrencies' prices in USD over the period October 2013 to July 2019

Some other researchers studied, more recently, a multiple bubble detection in the course of a larger period, in accord with the presence of a bubble in the cryptocurrency markets (Hafner, 2018), (Vogiazas & Alexiou, 2018), (Bouri et al., 2019), (Wheatley et al., 2019). A portion of the literature contradicts the bubble evidence in 2017 for Bitcoin (Chaim & Laurini, 2018) and for Ripple (Fry, 2018).

Continuous technological advancement in the digital remittance market as well as growth in internet and mobile penetration in developing nations are likely to offer profitable opportunities for industry development. Throughout the literature, there is consistent evidence that traditional payment processes are rapidly evolving to give individuals an innovative method to transfer funds. Cryptocurrencies such as Bitcoin might be the future of digital payment and peer-to-peer international money transfers. However, it is still unclear what the regulations towards the technology are. Unlike traditional channels of transfers such as the SWIFT system that is already established as a trusted regulated standard (in the war against money laundering for instance) cryptocurrency transactions have been labelled as way more volatile, which raises the issue of (cyber) security and the importance for proper financial regulatory reforms. Although blockchain technology is the basis upon which many other systems, more particularly cryptocurrencies, have been created, many have not been able to comprehend the full extent of its capacities, and such questions still remain as to whether it is capable to overtake the industry.

2.3 Theoretical framework: The concept of "Creative destruction"

2.3.1 Definition and evolution of technological disruption

The idea of disruptive innovation originated under Schumpeter in 1942 with the theory of destructive creation and was later popularized by Christensen and Bower, in 1995 in their article "Disruptive Technologies: Catching the Wave" (White, 2017), where they define disruptive innovation as a technology with the potential to create a new market or radically change an existing market. This upheaval in the market is characterized by the appearance of new technology having the same functionalities as an existing technology except that it is "less expensive, easier to use and more practical" (Schuelke-Leech, 2018). Christensen and Bower, therefore, distinguish innovations that create new markets from innovations that are "good enough" to compete with existing technologies. Schuelke-Leech (2018) develops this definition by identifying two orders of disruption, namely disruption localized in a specific market or sector and disruption that is more global. A first-order disruption is characterized by the emergence of a new competitive innovation – since this innovation disrupts the existing market by being less expensive, easier to use, and more practical – which meets the needs of the organization and its third. At this stage of disruption, innovation remains

sectoral and does not affect all industries. The second order of disruption is characterized by a dynamic and non-localized development of a fundamental innovation, which in most cases combines numerous technologies which may or may not be first-order disruptive, and whose application is spreading in different sectors, also affecting social, political, and economic contexts.

2.3.2 Intrinsic vs Extrinsic

The definitions of Christensen, Bower, and Schuelke-Leech only take into account elements extrinsic to innovation, since the disruptive nature is only determined once the technology has been disseminated (Nagy, Schuessler, & Dubinsky, 2016). In no case does this definition shed light on the elements necessary for the premature identification of disruptive innovation, since the analysis focuses only on the behavioural changes in markets. From a managerial point of view, it would be more appropriate to identify the disruptive potential of a technology before it enters the market, to better capture its competitive advantages. This is how Nagy et al. (2016) bring an intrinsic vision to the disruptive characteristics of a technology, by defining it as being “an innovation which modifies the performance measures or the expectations of the consumers of a market by offering radically new functionalities, discontinuous technical standards or a new form of property ". In other words, Nagy et al. identify three characteristics of disruption to innovation, namely:

 radical functionalities, because they allow the innovation to provide its user with the capacity to take on a new behaviour or to achieve a new task that was not possible to accomplish before the appearance of this innovation,

 discontinuous technical standards, because they allow the innovation to be better than the existing technology since the materials of which it is composed are less expensive or it has been designed according to a more efficient production process,

 the ownership of the innovation, since the owner of the innovation, influences the market by establishing prices as well as services around the innovation (changes of ownership can considerably disrupt a market by changes in the characteristics (price, services, …) of the latter).

This definition is interesting in the sense that it identifies the characteristics specific to a disruptive innovation, thus making it possible to identify, compare and classify innovations according to their disruptive characteristics. It also makes it possible to identify the disruptive potential of an innovation before the advent of an upheaval on a market or within an organization. The following figure presents a model for identifying disruptive innovation, from an intrinsic and extrinsic point of view to the technology:

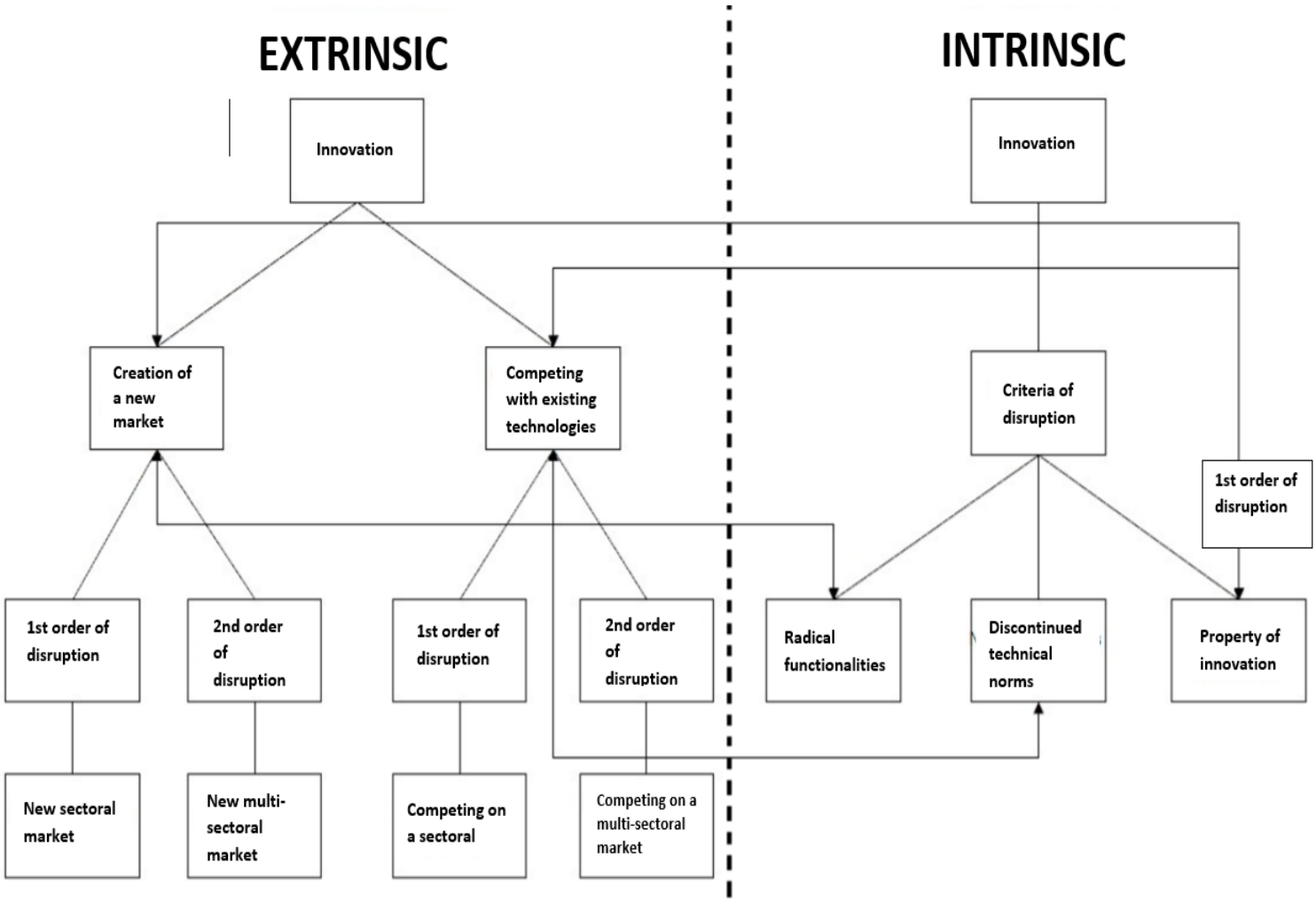


Figure VIII Model of determining creative destruction (Source: Author)

2.4 Chapter summary: an optimistic exploration of this new technology

New digital payment systems are expected to be the next breakthrough in technology, and academics and corporates are increasingly interested in them. Blockchain can be considered as an opportunity for the development of the international payment market

as a distributed and unalterable database that makes transactions more transparent and overall, more efficient. Throughout the literature, the different topics tackled by scholars have opened the door for further research on the technology. The creative destruction theory will be used in this research to better understand how blockchain might affect cross-border money transfers, particularly in terms of services already widely available. Various recent studies have focused on the potential implementation of blockchain technology and cryptocurrencies into global payment and peer-to-peer money transfers. While there has been much research done on the decentralized technology within the context of the banking industry as well as the impact of easier means of fund exchange among the African diaspora, few studies have taken into consideration how the technology can also benefit the “formalisation” of the informal economy by facilitating trade. While facilitating sending and receiving money and paying for goods and services, the technology and its adjacent services could potentially give more visibility to money flows than when remittances go through informal to formal channels in order to fill the gap in the wide pieces of research done on the subject. This will be argued and demonstrated in the following methodology and result section.

Chapter Three: Research Methodology

This section motivates the choice and possible limitations of the research method. It is going to provide a general plan for the methodology in how research data was approached, give a description of the implications involved in each method of data collection as well as an explanation of the methodology used to interpret the data.

3.1 Research Approach

For this investigation, qualitative research and desk research was used. Desk research includes searching for information using secondary sources, such as newspapers, scientific papers, statistical publications, and analytical reports. It is then followed by cross-referencing and data collation (Tisdell, 2009). Qualitative research is used primarily for “exploratory” research. Traditional methods used for such research include interviews, focus groups, and group interviews. Both approaches allowed the researcher to investigate the subject in detail with one individual at a time, and within a small group. This offers insight into the issue and helps generate ideas or theories for qualitative research to identify relevant trends (Cambridge Dictionary, 2017). Desk research was mainly used for “preliminary research”, as a mean to gather and analyse information, that was already available in print (through an organization's annual report) or published online (reports, scientific papers…). However, interviews were the core of this research. Interviews with blockchain technology experts were performed to get a precise view of the external implication of such technology. Multiple financial specialists were contacted, and the researcher focused on independent parties from Fintech organizations to get as much reliable and objective data to analyse as possible. This was done through semi-structured interviews with targeted questions related to the current state of the fintech industry and the approached strategy that is planned towards its development.

For each sub-question, it was important to state a description of the type of research that was used to find the most relevant information in answering them.

 What are the known benefits associated with the implementation of blockchain technology regarding international payments?

To answer this sub-question, the tool that was used is Desk research to get some background information regarding blockchain operations, how it applies to the finance industry, and more specifically the international money payment market. This implied published reports and statistics from important sources while reviewing previous research finding to get a better understanding of the topic that was being studied. It mainly served at analysing collected data about blockchain in general, applied for monetary transfers, and the theoretical advantages that can be taken out of it. These resources were gathered through online Desk Research. A sizable quantity of data was accessible on the internet. The most important aspect for the researcher required to be information specific while retrieving the desired information through the billions of pages available online. Two approaches were used to dig out relevant materials. The first one was to directly browse the explicit information from industrial, marketing, or business sites and extract information from these websites. Next, the researcher explored various search engines for a modulated search. The main concern was to refine the searching processes in a way that results are pertinent and promising. In addition, qualitative field research served as a method for interviews. Specialists in the field of blockchain technology were approached to develop a more compacted and structured understanding of the concept being studied under this sub-question.

 What are the known risks and limitations associated with the implementation of blockchain technology regarding international payments?

Qualitative data was collected from interactions; this put the researcher as a key part of the situation rather than an external observer. Therefore, numerous interactions took place between the researcher and individuals related to banking institutions. This enabled first to project a more appropriate conceptual model on “traditional” inflows and outflows processes from an internal point of view but also to get a more specific aspect of it on to how it applies in a banking context. This has also enabled the researcher to better picture the limitations that a central bank could face considering its current position in the global market in terms of money transfers.

 How has blockchain technology been efficiently implemented into money transfers in other countries around the world?

Although the technology behind the implementation of a blockchain framework is relatively still very new, cryptocurrencies on the other end have been around long

enough to gather the appropriate information and observe the gradual adoption of the tool over the year. Desk research is the main method that was used at this step. The most relevant information gathered to cover this sub-question was through secondary research as current data was compiled and collated to boost the overall reliability of the research. In fact, most banks or financial institutions publish their objectives or latest collaboration regarding “revolutionary” methods to introduce to their clients, stakeholders, and audience in general. Their findings and potential success are something that would allow them to be more competitive in the market therefore, online desk research allowed to find out more about the market and the competitors.

3.2 Research Tools and their Application

All interviews adopted a form of semi-structured approach which allowed the interviewee to communicate relatively freely while allowing the interviewer to make sure that some issues specific to the corporate banking environment were covered. Due to the current global sanitary context of Covid-19, all interviews were performed considering, social distancing specifications. Video facetime, as well as audio phone interviews, were the only options that were adopted for this research. When conducting the interview, a checklist was used to record the answers. Taking notes can restrict the flow of the conversation, especially in less structured interviews. Also, it is difficult to focus on non-verbal aspects of communication and to remember everything that was said, the way it was said. Therefore, the researcher had an additional record – with permission beforehand of course - such as an audio or video recording.

3.3 Sampling

This research mostly followed a qualitative method strategy, which allowed to use purposeful sampling that engages participants who can have detailed and in-depth information on the phenomena being investigated. This can be subjective as it will be determined by the methodological researcher who determines the criteria that each individual will satisfy to be qualified for the sample. (Braun, 2013). The reasoning being this choice relies on the fact that relevant information for this research can only be collected through a specific group of participants specialized in the finance industry but also in an African context, more specifically the Nigerian context. This research

required a certain level of expertise on the subject being studied which is why the researcher only looked to include the individuals who met very narrow and specific criteria; Group sample 1 has been selected mainly because of their expertise in money transfers, foreign currency exchange and their understanding of the current traditional functioning of the international money market. These participants' critical and objective views on new technologies such as blockchain were beneficial towards answering sub-question 2. Groups sample 2 was selected because of their apparent awareness of this new era of diversification of the finance industry (new ways of payment, new investment opportunities, etc). Their knowledge about cryptocurrency operation and blockchain technology, in general, was very necessary to support solving sub-question 1. Each participant was carefully picked from different countries around the globe to have a more balanced flow of responses about the subject at hand. Therefore, the researcher intended to interview as many participants as possible who are involved in both banking and money transfer industries but also specialists in the technological and cryptocurrencies market.

During a two months time span, interviews were performed with:

Participants	***Position***	***Country***
Group sample 1		
Respondent 01	Deputy Director at Central Bank of Nigeria	Nigeria
Respondent 02	FBN Unit head for foreign payment.	Nigeria
Respondent 03	FBN International fund transfer agent	Nigeria
Respondent 04	Citibank International fund transfer agent	Nigeria
Respondent 05	Foreign exchange agency operator	United Kingdom
Respondent 06	Foreign exchange agency operator	France
Group sample 2		

Respondent 07	Founder of Nigeria Bitcoin Community	Nigeria
Respondent 08	Blockchain Developer & NFT Strategist	Nigeria
Respondent 09	Open Source Blockchain Developer	Nigeria
Respondent 10	Law Doctorate (legaltech), Blockchain consultant	France
Respondent 11	Fintech owner, Blockchain expert	United States
Respondent 12	Unified communications Architect, Blockchain speaker	Rwanda
Respondent 13	IT software developer, Cryptocurrency investor	Kenya
Respondent 14	Fintech Venture Partner, Blockchain expert	United Kingdom
Respondent 15	Fintech start-up co-owner	France
Respondent 16	Finance professional, Blockchain expert	Canada

Table 2 Interview details

The selected participants were contacted by provided emails and other contact information published on their public social media profiles. Other public platforms such as LinkedIn were used to fetch out more participants according to specific criteria that could be filtered out on the website (relevant company name, position, year of expertise, etc). The risk for some participants to not reach back was considered, therefore at least 50 bulk emails were sent out to reduce the risk of unanswered queries. Moreover, recommended extra participants (that meet expertise criteria) were asked to each interviewee which also benefited the participation rate.

3.4 Process of Analysis

Data was collected by the researcher during the interviews. For each sub-question concerned, the respondent's answers and the creative destruction theory that was

being researched were used to outline some patterns about the functions and potential benefit of blockchain technology compared to already existing and established money transfer methods. While performing interviews, data were collected through an audio recorder in order not to overlook any details that could have supported the research. As stated in the previous section, data was also retrieved through online desk research with the use of specific keywords and concepts related to blockchain, cryptocurrencies, and the fintech industry evolution. Two types of data were analysed during this research project. First, data was collected through online desk research. Then, qualitative field research data from interviews were analysed in the result section. Information gathered from both methods were combined, to reveal the correlation between them. Online data served as a preliminary base and was processed and analysed using existing sources related to the subject being studied. These sources were filtered to only select information from recognized sources such as governmental websites, company profiles, or even official reports. In addition, figures and models were described as accurately as possible for the concept to be clearly understood. Interviews were processed through audio recording and examined following the research method described in the preceding sections. The analysis was instigated from the respondent's knowledge of the topic and patterns were drawn out from the relatively similar answers formulated.

3.5 Limitations, feasibility & positionality

The main limitation of this research was to get as many experts as possible. This technology not being globally established yet, it was difficult to assess the degree of knowledge "experts" have on it. Therefore, most of the information provided by interview answers were mostly similar to the data retrieved from the desk research. While interviewing, the researcher was able to adapt to the conversation, especially with a semi-structured interview as the discussion never really flowed exactly as premeditated with the questionnaire. The interviewer had to tailor the discussion to the objective of the research and withstand more control over the received data. Desk research is a cost-effective method but also time-consuming. It could have been an entire waste of time if the proper knowledge of how the research is to be performed was not acquired. First, it was crucial to select the appropriate keywords and search terms by focusing on terms from the problem statement and research question. It was

also necessary to examine several different relevant sources that contained useful information. Therefore, using data that are both relevant and recent while considering the reliability of the source. The researcher relied on data from recognized research institutes as much as possible. Moreover, to “delimit” this study, the main cryptocurrencies that were researched were the ones that are either described in the literature review or are particularly trending in terms of usage and performance in the money transfer market. Thus, Bitcoin and Ripple were the main channels considered. The reason is that Bitcoin is probably the most recognized cryptocurrency worldwide (and the first), and Ripple is currently one of the few main platform providers for cross-border payment that is already built for institutions to use. The company is gradually expanding its services to the banking industry, since its token, the XRP has for long been one of the most valuable cryptocurrencies after Bitcoin and Ethereum, the latter being focused and adapted to "smart contract" rather than money transfer. In terms of positionality, the researcher believes that the relatively novel concept of blockchain is both as unpredictable as it is exciting for the world. Having a banking background, the researcher chose to focus on a subject that is not only centred around the African population but also around the African diaspora globally. In terms of innovation, the technology could represent the significant boom the African continent was awaiting to set itself as a model in terms of global financial exchanges which is why the researcher believed that such an opportunity should be investigated as thoroughly as possible and has a strong chance to be successful if implemented correctly. The researcher also acknowledge that its positionality influenced this project at some extent. The researcher has had a short experience in a Nigerian bank and operated in the international banking department where currency exchange was involved. That has shaped the motivation towards developing this report.

3.6 Ethics

The main concern regarding blockchain technology and cryptocurrencies is obviously the "uncertainty" surrounding them. Cryptocurrencies' success is mainly due to speculations; therefore, it is essential to assess the risk of currency fluctuation and analyse if these can be dodged. Moreover, cybersecurity is also at stake here. Most corporations seduced by this new technology have started with tests on a small unit of their organizations to minimize any backlashes. Indeed, as it has been relatively

recently adopted, it is still difficult to assess its real impact on a corporate level and in the long term. In terms of safety and anonymity for the participant of this research, a very low risk is to be predicted as only common knowledge of the financial world were shared.

3.7 Validity, reliability, dependability

Reliability describes the extent to which a result such as a measurement is independent of chance. As for the validity of the research, it describes whether it measured what was initially intended to be measured (Baarda, 2014). The reliability and validity issues were raised as in how many people were required for the result to be reliable enough. In fact, the selected participants are based on purposive sampling, however, the suitable quantity of the sample is steered by data saturation. The researcher evidently did not know beforehand the number of people to interview, and researchers are not transparent enough to know exactly how and when saturation is reached. Practical constraints in terms of time (duration of the course) and resources are therefore highlighted in the discussion section, on how many participants were questioned eventually. According to O'Reilly and Parker in 'Unsatisfactory Saturation' not reaching saturation is not necessarily an invalidation of the findings but rather shows that the subject has not been fully explored, and this should be reported with findings (O'Reilly, 2012). Complete reliability cannot necessarily be achieved especially when interviews are involved. However, to increase the credibility of this research, as many participants as possible were contacted and the questions were as similar as possible for all participants to effectively identify any patterns. Moreover, for the representativeness of the sample to be reliable, various sources of experts outside the financial structure of a bank for instance were also contacted. Those experts were also from various parts of the world, which allowed to draw a global perceptive of the concept being studied. In addition, the interviews were recorded, and a transcript was redacted to avoid useful information being filtered out unintentionally by the researcher. While collecting data from desk research, mostly official sources and scientific information were explained to ensure the reliability of the answers being given and make the research method as valid as possible. The reliability of the information was ensured by only selecting verified sources, especially academic ones.

Chapter Four: Research Findings

The objective of the result chapter is to introduce the findings of the research. The results of both the desk research and of the interviews that were conducted during the field research phase will be described and explained. For each of the sub-questions, a different approach was used and therefore the findings will be demonstrated in different sections, according to the type of research that was implemented. The research population from the interview phase is categorised into two distinct but intertwined categories. The first category of respondents includes traders, financial software developers, cryptocurrency minors, and blockchain experts that are familiar and knowledgeable with the technology. The second category is comprised of banking representatives, money transfer personnel, and exchange rate agents that are experienced with the traditional and current state of the financial money market.

The interview was structured around a collection of questions that elicited responses on the three main topics to focus on:

- Understanding the cross-border money market
- Controlling the cryptocurrency wave
- Institutional challenges to a financial shift

4.1 Understanding the cross-border money transfer market

4.1.1 Wire transfer

Means of transferring economical value have tremendously evolved over the ages. From barter to virtual currency exchange through smartphones, banking institutions have rapidly been recognised as the face of the democratisation of exchange between individuals when it comes to a financial value such as money. A traditional money transfer operation between individuals requires the issuing bank to use codes: The identifier of the receiving bank (called "BIC" or "SWIFT code" standardized at the international level). The beneficiary's current account identifier (called IBAN). Some banks are satisfied with the name and address of the beneficiary, but it is less secure for the issuer because there is no traceability and therefore no recourse in case of fraud. The IBAN is now mandatory for European SEPA transfers. The Society for Worldwide Interbank Financial Telecommunication, more recognized by the acronym

SWIFT, is the world's most secure, standardized, and reliable financial platform for international transactions. The network is used by a majority of international interbank messages. As of 2015, SWIFT connected more than 11,000 financial organizations in more than 200 countries, with over 15 million messages on average that were being exchanged daily (SWIFT, 2016). SWIFT is the entity that sends the payment orders, that correspondent account that the organizations have with each other have to settle. Any organization that needs to exchange banking transactions, requires some type of “banking relationship” to exist. This can be done by being a banking institution or affiliating itself along with another banking institution (“correspondent”) to benefit from those specific business features. SWIFT, therefore, plays an "intermediary" role by linking these broad networks together (Scott, 2012).

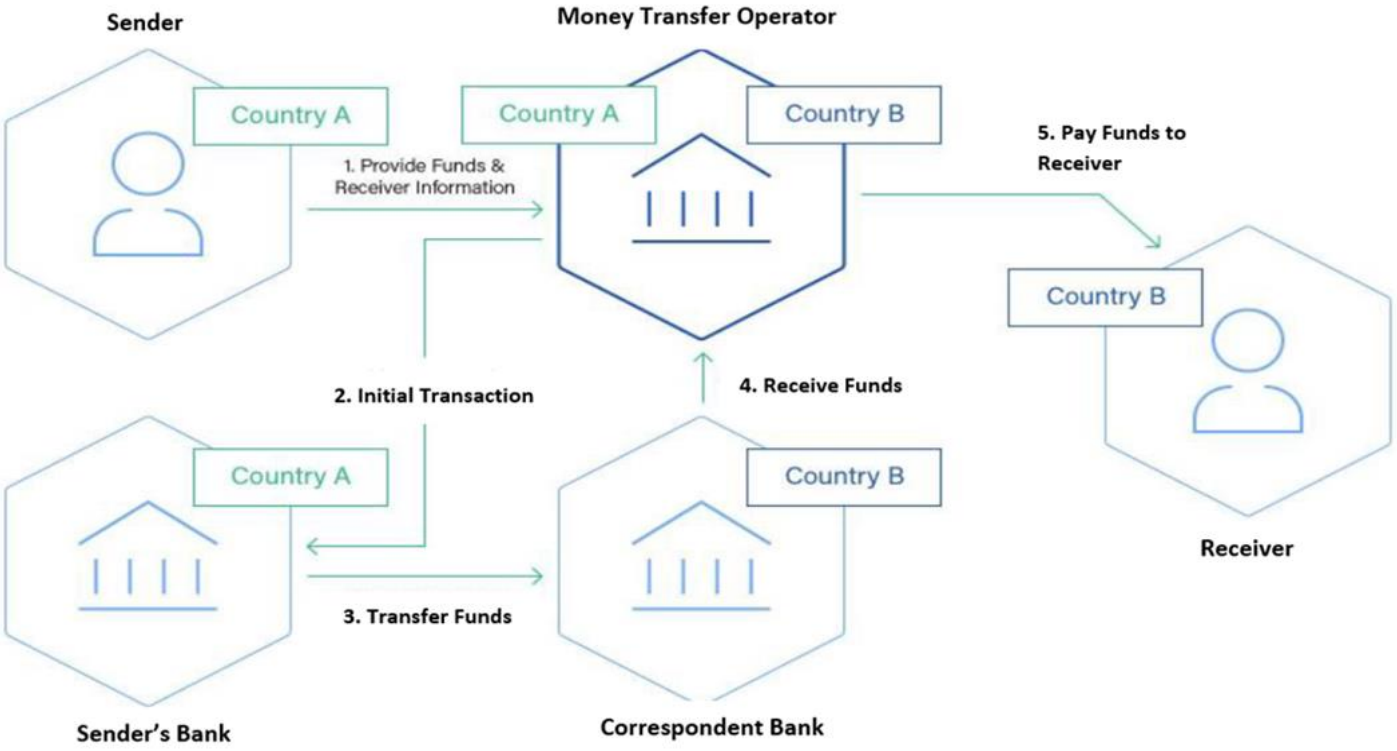


Figure IX Traditional Banking Transfer Operation model (Achanta, 2018)

Interviews with respondents with a position in different Nigerian banks have revealed that central banks have a very central role in the whole SWIFT environment in terms of clearance for each and every financial operation outside the country. They described the Nigerian Central Bank (CBN) as a “necessary medium” that allows every commercial bank in Nigeria to be “settled at the end of the day”.

Banking institutions are the most expensive intermediaries for money transfer abroad between individuals, with an average cost of 10.96% (of the specific amount being sent), whereas organisations such as Western Union Specialists and MoneyGram represented 6.59%. This justified the payment media market opening to non-bank players (digital payment, mobile wallet, etc.) as Fintech organizations are trying to take over alternative niche markets such as the remittance industry (Pazvakavambwa, 2018).

4.1.2 Blockchain in the international payment context

What is blockchain technology?

It is defined by the official website of Blockchain France as the implementation of an information storage and transmission technology that does not have any control organ and is described as a “distributed database”. The user-sent information that is generated from a blockchain system is systematically checked before being grouped at regular time intervals in what can be depicted as “blocks”. They are secured using cryptography, hence forming a string.



Figure X Block "chains" illustration (Blockchain Partner, 2016)

By extension, a system powered by blockchain is a distributed database as it holds a listing of records that is secured from any type of falsification by storage nodes. The technology is thus a distributed and secured register of all operations executed from the time the distributed system started (Blockchain Partner, 2016). A programmable currency or “token” is necessary for any public blockchain to function (Derbali, Jamel, Chenguel, & Jouirou, 2019). Bitcoin is a good illustration of a virtual currency or cryptocurrency. Every transaction happening within a blockchain network, among users is grouped into blocks. Each one of these blocks is authenticated by every node

operating on the network. They are called the "miners» and operate based on techniques that derive from one type of blockchain to another. Such a technique is known as "Proof-of-Work» in the bitcoin blockchain and involves solving algorithmic questions. As soon as a block is validated, it is then time-stamped and attached to the block chain. The receiver as well as the rest of the network then have full visibility of the transaction that occurred (Derbali et al., 2019). According to responses from all the participants' experts on the technology, the decentralized nature of the blockchain, combined with its transparency and secure features, guarantees much larger applications than the financial and monetary domain. The areas of exploitation are vast: insurance and banking industry, health and pharmaceutical, international trade, energy, agribusiness, distribution, real estate automobile and aeronautics, vote ... etc. To put it bluntly, blockchain has the potential to replace the majority of centralized-based trusted third parties (banking, land registry, notaries, trades, etc.) thanks to distributed computer systems (Chen, 2018). A blockchain platform can be implemented by any organisation by building a network through Application Programming Interface or API that would be executed either by external providers or by simply downloading an already established one (e.g., from Blockchain.info). This computer programming tool offers the necessary resource to power application software and innovative solutions such as a blockchain platform. When implemented properly, a performing API would facilitate the development of a computer program by preparing all the building blocks, which are ultimately put together by the programmer (Bhattacharya, Tanwar, Shah, & Ladha, 2019). According to respondent 15, who is a software developer, depending on the underlying technology i.e., Ethereum, Bitcoin, or Ripple, an organisation would have to download and integrate into the respective network (using the token attached to it, etc). If a bank or a fintech organisation was to implement its very own internal API, it would have to develop, alongside it, a cryptocurrency to run it. “They are two ways to deploy an application and that is to either use cloud-based hosting or to use physical servers which are way more expensive to buy and maintain”. Banks like any other private institution are maintaining their very own private server for any of their core functions.

How does it apply to international money transfers?

CEO of Blockchain Partner Clair Balva summarizes, in a 2017 TED Talk, the concept as an algorithm that would allow all users to decide consensually on the state of the

records to institute. This is because every node that is part of the network is going to have access to the entire copy of the full database or the ledger, and any alterations will have to be accordingly verified by the other parties on the network to validate the modification request. It is therefore required to have consensus among the nodes, to decide upon the state of the ledger so it can be validated by the parties (Achanta, 2018) This mean that direct transfers transaction can be executed instantly and with no risk of manipulation during cross-border payment, as no correspondent banks or intermediaries are involved in the process. The fundamental notion of distributed ledger allows for organisations such as banking institutions to have a bilateral, transparent, and irreversible transfer of value, arbitrated by the settlement agency. One of the proposed and most basic mechanisms for cross-border money transfer on a blockchain network, that was developed during interviews is to transfer value into the cryptocurrency from fiat then convert it back to the final currency.

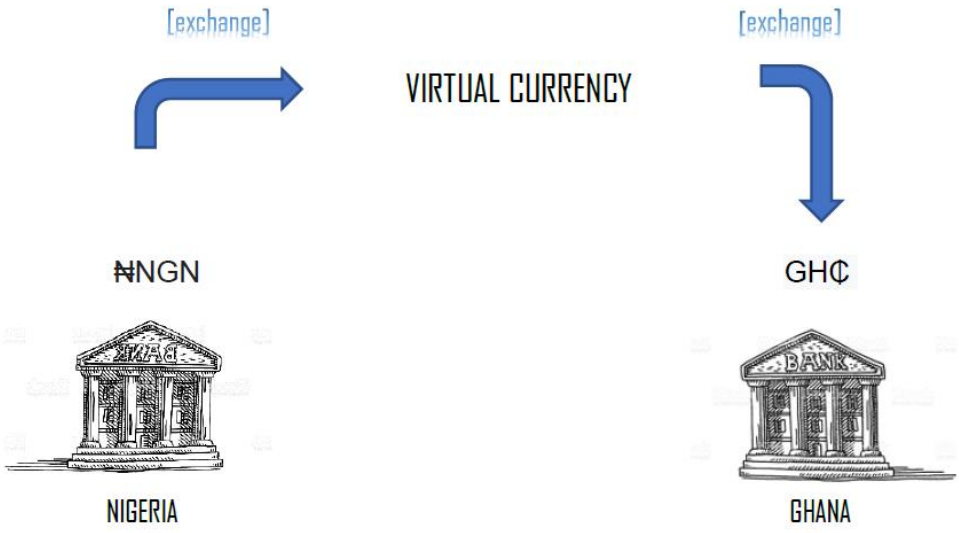


Figure XI Illustration of a cross-Border Transfer in a Blockchain setting (Source: Author)

Interviews also highlighted that depending on the type of platform implemented, this method would differ from one cryptocurrency to another. As described in the literature review, Bitcoin transaction, for instance, relies on independent “miners” for any transaction to be validated. Respondent 13 describes this process as “extremely complex because banks would probably need to have specialists in cryptocurrency

mining". For any banking institution to apply this type of process, it would need to identify a blockchain platform that it will use to move funds using its own internal subsidiaries and/or identify locations where it can easily do foreign transfers while considering a common token to adopt and find a consensus protocol to agree upon. Numerous companies are available on the market and are offering blockchain APIs for developers and enterprises, such as bitcoin transaction API, Tierion, or even Coinbase. However, these types of providers are, according to experts not suitable for a banking institution due to security (cases of start-ups being hacked) and transparency reasons (Applikey, 2018). Santander UK, the Spanish banking giant's British subsidiary, has become the latest financial institution to shut payments to cryptocurrency exchange Binance for instance. This decision was taken following the Financial Conduct Authority's (FCA) warning about a gradual rise in crypto fraud targeting Santander UK's customers. According to the FCA, 2.3 million people, or more than 4% of individuals in the United Kingdom, hold cryptocurrencies. The FCA opted on banning Binance Markets Limited (BML) — Binance's U.K. entity — declaring that the organisation is no longer authorized to operate in the country (Khatri, 2021).

While the core technology of blockchain itself makes it technically and virtually impossible to alter, the issue of software vulnerability to hacking was raised during interviews. Respondent 12 insisted on the fact that "unalterable data isn't equal to unhackable" as many might assume. Users must be mindful of identity theft or weak practices during operations that give hackers access to data. Respondent 14 also highlighted in the interview that Bitcoin transactions or any other cryptocurrencies transaction were irreversible and final. This statement was backed by other interviewees and some online research. In fact, the risk of getting scammed is relatively high, as any transaction made with Bitcoin can only be refunded by the person receiving the funds (Cohen, 2015). This means that it is crucial to trade with companies and people that are trustworthy or that have a well-established reputation. For their part, companies must maintain control of payment requests with their customers. Although Bitcoin will not let money be sent to an invalid address as it is able to detect typing errors, additional services exist and are currently being developed to provide more choice and protection for the consumer. A few organisations are trying to fraud-related risks by developing trusted solutions for consumers and businesses. The Ripple protocol, for instance, is recognized and established in the market as it has

already been implemented by a couple of major banks. The network relies on what can be described as “gateways validators” (55 validator nodes in total). The company’s consensus mechanisms are driven by private nodes owners that have a significant level of control over the network (Britto, 2018). Despite the more centralized feature of the protocol, it gives organisations that choose to join the network, higher leverage, which is essentially what banks are keen for. To understand the actual “pros & cons” related to the implementation of a blockchain network within a financial institution, the researcher first gathered information related to the use of cryptocurrencies in the global market and assessed its “reliability” and latent limitations that could affect a potential blockchain initiative.

4.1.3 Cost benefits and advantages in a cross-border payment environment

It is already established that converting one currency to another to transfer it to another peer can represent a heavy burden in terms of cost. The costliest corridors are found mostly in Southern Africa, with charges as high as 20%. The less costly corridors, on the other hand, had average rates of less than 3.6% (WorldBank, 2020) The cheaper options against banks globally refer to MTOs such as traditional money transfer offices (Western Union). These very popular options for migrants are, however, being revealed as not necessarily being the cheapest options available. This was highlighted during the interview with respondent 6 who claimed that “none of these major money transfer companies…Money Gram, Western, etc actually clearly indicate the collection of exchange fees before initiating a transaction on their website”. Only a footnote informs the consumer who sees it of the collection of exchange fees, without indicating the amount. Given the preponderant market shares of money transfer companies and the average level of exchange fees, it was revealed that the share of hidden exchange fees represents nearly €110 million per year. Exchange fees represent on average 26% of the fees charged by transfer companies: “The actual price of the transfer is actually twice as high as what is indicated to you!”. Exchange rate fees are 2.5 times higher than for online companies, and even 7 times higher than the exchange fees charged by banks in some instances (Cassel, 2018). The technology of blockchain involving cryptocurrencies in its process and operation allows for a more transparent

activity especially when it comes to hidden fees for customers with actual transaction fees close to null.

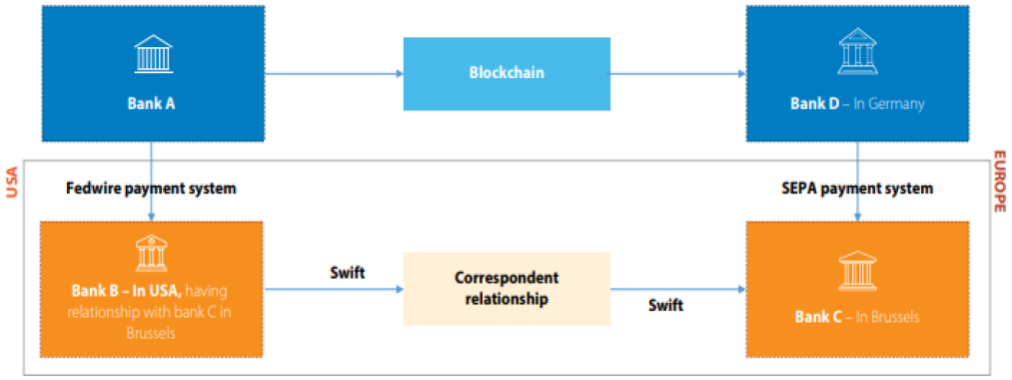


Figure XII Benefit of blockchain when leveraged for cross-border money transfers (Achanta, 2018)

As depicted in the figure above, the following benefits are brought through blockchain:

 Any third party such as middlemen, central agencies, or corresponding banks are cut off from the processing of the payment. Transaction only concerns the parties that have agreed on a mutual arrangement, therefore ensuring a certain level of trust among the members inside the network (Achanta, 2018)

 The costs are reduced, and the charges are minimized along the payment chain. As SWIFT charges for the message processing that are routed through it, those charges add to the processing cost of corresponding banks for all activities related to the receiving, collating, and netting payment messages before those are retransmitted for confirmation (or denied) from the respective banks (Achanta, 2018).

 Standardisations challenges are minimized as a result of no message being transmitted (Faden, 2017) Turnaround time for settlement is consequently reduced because of the exclusion of central agencies initially processing messages (Oanda , 2018). In addition, since traditional manual processes (or still very much paper-based in a lot of LMIC) are more prone to human error, and frequently require the use of a third-party mediator, they are inefficient and can be time-consuming, Blockchain allows for more streamlined processes by executing them more rapidly and thus more efficiently (Francis, 2020). Transactional data and documentation are detailed on the blockchain, which excludes the need for conventional documents to be exchanged. Since it is not necessary to synchronize multiple ledgers, posting and processing are likely much quicker.

 The central bank does not need to guarantee intraday liquidity as all the nodes of the network would have a copy (distributed ledger) of the balance maintained in the settlement account with other banks. It basically means that the balance is properly maintained (Shrivastava, Le, & Sharma, 2020). Plus, the technology allows instantaneous traceability because blockchain generates an audit trail that allows documenting an asset at every stage of the transaction (traceability of the operation but not the parties involved). In sectors in which consumers care about environmental issues or human rights concerning the manufacture of a product, or in sectors plagued by counterfeiting and fraud, this blockchain audit trail serves as evidence. With blockchain, provenance data can be shared directly with customers (Agbezoutsi, Urien, & Dandjinou, 2021). Outside of the money transfer market, data from the traceability detail is helpful towards exposing weak points in a supply chain, such as when goods need to be located when lost during transit (Agrawal, Kumara, Pal, Wang, & Chen, 2021).

 A distributed ledger allows more transparency in payments as both receiver and sender are the nodes inside the network (Achanta, 2018). Without the blockchain, each company must maintain a split and independent database. Because of the distributed ledger used by the blockchain, every transaction taking place as well as the data generated from them are identically stored in several places. All network participants with access permission can see the same information at the same time, which sets up complete transparency. All transactions are recorded in an unmodifiable manner and are time-stamped. This allows members of the network to have a visual of the complete history of an operation and virtually cuts out the possibility of fraud (Achanta, 2018).

 It is impossible to modify any data from a transaction as all details are encrypted and hashed. In addition, data protections and privacy can be addressed with the use of private blockchain networks only accessible by the parties that are concerned by the agreement. It is nearly impossible for an external party to hack the underlying hashed transaction in a block (Morgan, 2016). The technology represents reinforced security especially when data is considered sensitive. The technology can dramatically alter the way critical information is perceived thanks to unalterable and end-to-end encrypted records, blockchain facilitates the pre-emption of unauthorized activity and the prevention of fraudulent activities. On a blockchain system, confidentiality concerns may be solved by making private personal data anonymous and restricting

access through permission requests. As data is kept on a network of multiple computers and not just a single server, it becomes automatically tougher for hackers to attempts a breach (Hilary, 2019).

4.2 Controlling the cryptocurrency wave

4.2.1 Countering the cryptocurrency issues

Since entering the market in 2009, bitcoin has facilitated low-cost and transparent peer-to-peer transactions (Jangwal, 2018). Today, the cryptocurrency that has brought blockchain technology into the light still has a lot to prove in the hopes that it be generally more accepted. Indeed, bitcoin, which is not considered to be a legal tender, has strong intrinsic risks for consumers - high volatility, proven risk of fraud - compared to the requirements of the fight against money laundering. More specifically, the financing of terrorism, because of the anonymity of the holders. This runs up against the fundamental principle of customer identification in the financial field. While desk research on this question was mainly targeting the volatile nature of cryptocurrencies, interviews, however, revealed other drawbacks such as the actual performance of a cryptocurrency against fiat currencies. Virtual currencies are known for their high volatility and unpredictable fluctuation (EBA, 2014). Speculative bubbles cause cryptocurrencies like Bitcoin to heavily lose value in matter of days. A few reasons among others are that the value of a speculative asset cannot reach zero, and Bitcoin (among other cryptocurrencies) does not have a market fundamental price to fall upon, so its actual value is relatively subjective (investors are either overpaying or underpaying…). Plus, cryptocurrencies are not supposed to be owned by any entity, therefore they do not have regulations, which ultimately leads to price market manipulation and important swings in price from market players (Adkisson, 2018). Furthermore, another major risk associated with cryptocurrency transactions is the exchange rate fluctuation (associated with volatility). Using Bitcoin for an international transfer would require converting two times. A first time from the original currency to Bitcoin then another time from Bitcoin to the foreign currency. This indicates that the value of the money is being lost twice in the process while increasing the risks twice more. For huge sums of money, this would represent a real “gamble” for financial institutions performing those transactions. The very one goal of saving cost on transactions is therefore undermined. However, according to respondent 14,

speculation and exchange rate risks are mitigated by the fact that a blockchain transaction using cryptocurrency takes place immediately compared to fiat currency transactions that take days. Therefore, exchange rate fluctuation “has more chance to affect an amount that is sent within 3 days than a cryptocurrency transaction within seconds”. Efforts to further moderate those risks were also mentioned, like the creation of “stabilized” cryptocurrencies such as Stablecoin or others that are even pegged to the US dollars like Tether for instance.

4.2.2 Bitcoin or Ripple?

To the interview question “Which cryptocurrency do you think is more appropriate to use for a financial institution such as a bank?” the majority of respondents answered Ripple, but also expressed nuances. Bitcoin is totally decentralized, which means that everyone around the globe is free to buy or sell it since it is not under the control of any bank or governmental entity. According to the founder of the Nigerian Bitcoin community during the interview, banks desire to remain in “control” over their operations, and although stating the convenience of joining an already established network such as Ripple, he highlighted the fact that Ripple is not the most “conventional” blockchain application. The centralized aspect of the Ripple currency XRP, which is not to confuse with the actual company Ripple Lab, that owns more than 50% of the XRP goes theoretically, against the very “function” of the blockchain system that eliminates any organ control over the cryptocurrency or its exchange inside the network (William-Grut, 2018). Nevertheless, Ripple Lab is working toward a more decentralized protocol development. In May 2017, the company released its decentralization strategy to extend the number of validator nodes on its ledger. They also discussed adding third-party validating nodes while deleting one Ripple running node for every two third-party nodes until the majority of the trustworthy nodes on the XRP ledger are operated by no single entity. (Moskov, 2020). RippleNet is the company’s decentralized global network of banks and payments, which has over 100 members (Meijer, 2018). Ripple possesses several different platforms to offer to organisations, each having specific characteristics that are distributed depending on the organisation’s need, size, and whether it is willing to use the XRP currency. XCurrent – one of Ripple’s famous platforms - must be distinguished from the XRP cryptocurrency developed by Ripple since 2012. The XRP is an additional tool provided

by Ripple whose sole function is to reduce the fees of banking institutions for international transfers. Now, many neo-investors believe in putting their money into Ripple's global technology when they invest in the XRP. Partly because of this confusion, the XRP experienced the largest growth in the cryptocurrency industry in 2017 with 36,000% growth (Wong, 2018). The company Ripple is regularly accused of maintaining this vagueness, especially since the public's appeal for its XRP brings him a lot of money. Indeed, it owns more than half of the chips in circulation and the speculation makes it a virtually wealthy firm worth more than $25 billion in 2018 (Brown, 2018). P4man, a highly respected blogger specializing in cryptocurrency, explained in mid-2017 that "the XRP looks more like a PayPal account than a transaction system without trusted third parties like Bitcoin stating “it's hard to find a rational reason the existence of the XRP within the Ripple protocol, except that it allows Ripple to make money. A lot of money" (Raymond, 2018).

4.3 Institutional challenges to a technological shift

4.3.1 The limitation of the Nigerian banking system

All the banks and public financial establishments in Nigeria are heavily regulated by the Central Bank of Nigeria (CBN). The SWIFT protocol that is backed by CBN put banks through long processes while transferring foreign currencies. All international transactions made to any of the Nigerian banks around the world are initially processed through SWIFT to the head office of that bank. Even the transactions channelled from the banks' foreign subsidiaries take a day to get to the countries’ head office. After this transaction is processed by the head office, it then takes an extra day to be sent to the corresponding banks and another working day before that same transaction gets to the beneficiary’s account. Therefore, it takes at least T+3 working days on average for a regular bank to complete an international transaction as there is currently no product available that allows direct transfers even between subsidiaries (Olusa, 2017). This affects customers in various ways, but more specifically in terms of costs that are not neglectable considering all the parties involved in one transaction. Respondent 02 and 03 (independently) explained that for an individual in the Gambia to transfer 5000GMD to Guinea, from one FirstBank of Nigeria (FBN) branch to another, for instance, this would cost him/her a SWIFT fee of 25USD plus an additional local bank fee of 1000GMD (≅20USD). This cost is higher for transactions over 5000GMD. This means

that for approximately a little more than 100USD worth of transfers, nearly half of the value is lost in the transaction fee. Respondent 02 asserts that “a shared network where transactions would just flow across the subsidiaries and the head office would greatly benefit FBN Group in terms of processing efficiency and cost leveraging”. Interviews with the foreign services department’s head and fund officers at FBN have highlighted the main limitations that affect the bank towards potentially implementing a blockchain platform. Indeed, security and compliance issues were the main points brought up. The security aspect concerned the fear of having an open ledger exposed to other parties on the network while performing confidential transactions. Other concerns targeted the regulations from CBN like the fact that every single bank in the country is being mandated to be part of the SWIFT network. FBN is part of a highly regulated environment that hinders the organisation from looking into contentious alternatives. Authorisation from the Central bank - upon verification that it is convenient and “safe” to implement – will always be required which might be a complex approval to get as it directly faces already established and trusted entities that are not prepared to be shacked. Nevertheless, to some extent, it is possible to address the challenges that surround privacy and data protection by using a private or premised blockchain where it is not feasible for any party to jump anonymously on the network and become a node. An agreement such as this one will necessitate the parties to enrol into a bilateral agreement and access transactions using a private key amidst the trusted parties of the network. Also, the level of difficulty to hack an underlying hashed transaction in a block is not neglectable, which mitigates the risks a little more (Achanta, 2018).

4.3.2 A hesitant consideration from public institutions and regulator

The Central Bank of Nigeria is the first in the African Sub-Saharan region to successfully launch on October 25th, 2021, a blockchain-powered digital currency: E-Naira. The e-naira, the new digital currency of Nigeria, claims to allow simple, free, and secure payment, under the control of the Central Bank. This will exist alongside cash, without replacing them. But this virtual currency should greatly facilitate payments, especially for individuals who do not necessarily have access to conventional banking systems in Nigeria (Esoimeme, 2021). Nigerians can now simply download the eNaira app and fund their mobile wallets via their current bank accounts. To access the

services, users need to convert Naira to eNaira. Once they have eNaira in their digital wallet, they can make transfers to other people's eNaira wallets, pay bills, or possibly convert the e-money back to cash (AFP, 2020). Besides, Nigerian authorities have historically been opposed to unregulated and decentralized cryptocurrencies like bitcoin being used in the country. The Central Bank ordered in February 2021 for all licensed banks and financial institutions to close all accounts that transact or operate on cryptocurrency exchanges (Gigazine , 2021). For some years, CBN has been concerned about the impact of cryptocurrencies on its economy, arguing that they are used for the financing of terrorism and money laundering. Ultimately the aim for the CBN to finally consider developing such a project is also to counter the influence of bitcoin or other popular cryptocurrencies which are totally beyond the control of state institutions or global regulators. Nigeria is currently the third-largest user of virtual currencies around the globe after the United States and Russia (BBC, 2021). For many, cryptocurrencies represent a safe haven in the face of the recent years' continuous depreciation of the naira which also facilitates for them the reception of money from the diaspora or to bring their savings outside Nigeria (Africanews, 2021). Nevertheless, digital currencies that are regulated by central banks, will still not help solve exchange rate problems. The eNaira being pegged to the Naira at the official exchange rate, it will most likely face the same purchasing power issues that pushed Nigerians towards monetary alternatives (Crowe, 2021).

4.4 Chapter summary: blockchain as an opportunity worth exploring

The evidence gathered has shown the different benefits that blockchain technology has the potential to give to the international money market for users of money transfer services. Expatriates outside of Nigeria have seen the development of money transfer options proliferate over the decades. Though, it seems like blockchain technology could represent a technological advancement never seen before that might be effective enough to take over the current setup available. This eventuality will be discussed in the next chapter.

Chapter Five: Discussion

In this section, the findings described in the result chapter are going to be discussed and reflected against the theory explained in the literature review. The discussion section will help have a contextualise view of the results in regard to the other studies performed on similar topics and will conclude with a synthesis of the answers from the findings to the research questions

5.1 The existing implementations: Global banks and blockchain technology

A report from IBM revealed that 15% of banks were going to be using blockchain in 2017. Moreover, they expect about two-thirds of financial institutions to be applying the technology within just four years (IBM, 2016) For this section, the company's website and newspapers were explored in order to retrieve instances of the latest updates regarding institutions considering the adoption of blockchain technology into their internal operational structure. A list of the main global blockchain technology cases applied in money transfer was gathered and described below:

 In June 2017, Japan's SBI Remit and Thailand's Siam Commercial Bank collaborate to launch the first blockchain-powered payment service via Ripple's blockchain platform (Jangwal, 2018). The aim is to considerably speed up transactions while tackling costs and efficiency of transfers between both countries. Transfers are estimated around $250 million annually which is explained by the important population of Thai citizens (40, 000) living in Japan (Campbell, 2017).

 Standard Chartered (Singapore) uses a blockchain solution to allow real-time, cross-border payments with Axis Bank (India) and Rakbank (United Arab Emirates). These financial organisations adopted the RippleNet solution to power live, rapid and transparent transfers for their business partners and assist in corporate transactions from Standard Chartered to Axis Bank and enable retail remittance payments from RAKBANK to Axis Bank receivers (Meijer, 2018). This region is a strategic hub for the banks due to the large number of corporates that ship their product to Singapore after manufacturing them in India (Transaction worth $15 billion), but also because of the rising retail remittances between India and the UAE explained by the significant Indian

workforce in the UAE. This represents nearly $12.6 billion worth of salary sent from the UAE to India every year (Ripple, 2017).

 Santander UK announced mid-2016 the launch of a new app to be rolled out as a staff pilot using a Blockchain technology underlying app supported by Ripple (Santander, 2016). Once downloaded, the app would permit users to have to complete their profile information then be able to start making transfers. Payments can securely be confirmed using Touch ID through Apple Pay. The company staff was able to transfer between £10 and £10,000 from pounds to euro and dollar. CEO of Ripple followed up by announcing on Twitter, that Santander would be rolling out its mobile app to customers the following quarter after a successful pilot (Clerey, 2019).

 The world's 11th largest bank Crédit Agricole announced that it was going to test for six months one of Ripple's services, xCurrent. This will essentially take place between regional banks Swiss bank Crédit Agricole Next Bank and Crédit Agricole des Savoie (Tyagi, 2018). The Software allows banks to communicate in real-time to confirm the details of payment and to confirm delivery once it has been paid. The Ripple blockchain tracks real-time transaction flows and its registry is advertised as tamper-proof. This experiment focuses on wage transfers in Swiss francs of 90,000 cross-border customers working in Switzerland. The goal is to reduce delays before a transfer, which would take minutes instead of days (Groupe Crédit Agricole, 2018)

 R3 (technology software company) has been working on developing an international payment system based on distributed ledger technology (Corda DLT platform) with more than a hundred financial institutions including banks worldwide. The 22 organizations already involved in this project include KB Kookmin Bank, Barclays, HSBC, Commerzbank, KEB Hana Bank, US Bank, CIBC, and Natixis among others (R3, 2017).

 More recently implementation of a blockchain initiative can be mentioned with UK fintech performing a blockchain settlement test. Fnality, Adhara, and Nivaura, along with banks Santander and Natwest, have collaborated on a proof-of-concept involving the issuing of a security token on a public blockchain. The transaction's payment leg was handled using a new distributed ledger technology (DLT)-enabled payments system. The group used the public Ethereum blockchain and the Fnality Payment System to undertake the first cross-chain pilot debt transaction (FnPS). The goal of

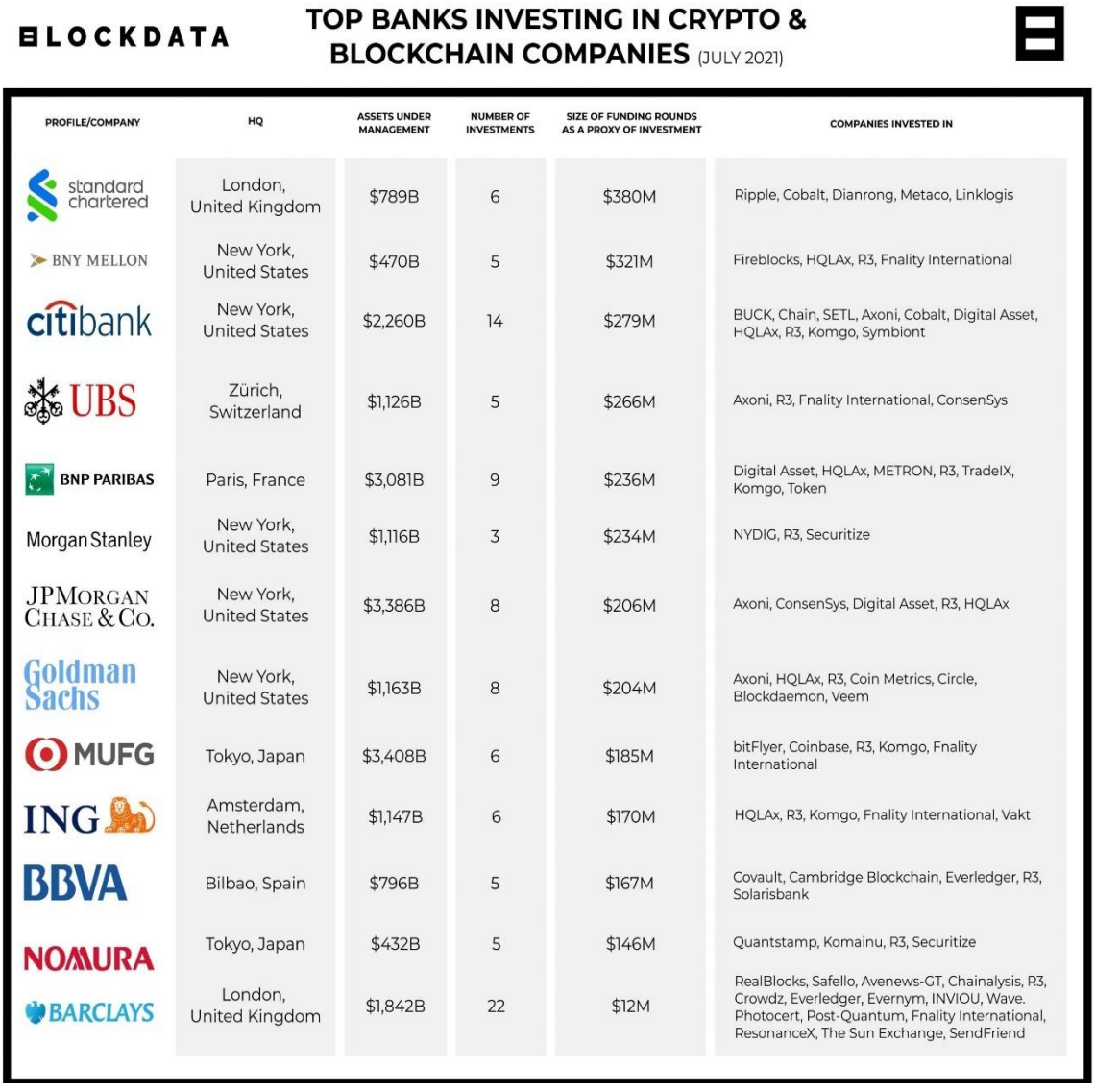
this test was to show how DLT can provide near-instant settlements in financial markets and payments. Fnality, a global financial consortium, is employing blockchain technology to build a network of distributed payment systems. It claims that the test puts it one step closer to launching FnPS in 2022, which would allow wholesale payments to be made in real-time with near-instant settlement in a central bank-backed digital currency. The partnership was formed with Adhara, (a firm specializing in software development of real-time worldwide payment solutions and multi-currency liquidity management) to help with the payment leg by establishing the TestNet ecosystem. Fnality describes this ecosystem as a primary functioning demonstration of how its DLT-based payment systems might aid with end-to-end repurchase agreements intraday liquidity savings, and intraday FX trades between banks (Pugh, 2022).

 Minor start-ups are also gaining ground in this industry: San Francisco-based Blockchain start-up Wyre for example is a cross-border payments organization that claims to be the fastest money transfer platform in the sector. Their solution allows businesses to send payments across borders at a competitive foreign exchange rate (Jangwal, 2018).

 On a smaller scale, The Nigerian fintech software organisation, Appzone Group is said to be one of the leading firms in the industry in sub-Saharan Africa. They launched the first blockchain platform in the region, called Zone. The project was set up for payment processing to encourage local and intra-continental settlement in both fiat currencies and virtual currencies. Zone forms the basis of Appzone's intention to develop Africa's very first network of decentralized payment. This network should allow the processing of interbank transactions entirely between banks without an intermediate party being necessary. This involves a complete erasure of centralized electronic financial transaction controls that traditionally operate as single points of contact among financial organisations (Unukaso, 2021).

Most of these major (financial) organizations use the Ripple network to drive their payment platform and are still in the testing phase of their collaboration with the company. While Bitcoin is mostly famous among individuals for strict peer-to-peer exchange, Ripple is largely dominating the corporate sector when it comes to providing solutions for more efficient cross-border transactions with blockchain technology. Ripple even introduced the Global Payments Steering which is said to be the earliest

instance of an interbank group for international payments; a group comprising giants such as Banco Royal Bank of Canada, Santander, Bank of America Merrill Lynch, Standard Chartered, Westpac, and UniCredit (Manning, 2017). Representing more than $2,000 billion, the cryptocurrency market is indeed booming and is attracting more and more financial companies. According to a recent report by BlockData, a blockchain market intelligence company, 55 of the world's top 100 banking institutions are exposed in some way to this new technology. This means that banks or their subsidiaries have invested directly or indirectly in decentralized cryptocurrency and ledger technology companies (Blockdata, 2021).



BLOCKDATA

TOP BANKS INVESTING IN CRYPTO & BLOCKCHAIN COMPANIES (JULY 2021)

PROFILE/COMPANY	HQ	ASSETS UNDER MANAGEMENT	NUMBER OF INVESTMENTS	SIZE OF FUNDING ROUNDS AS A PROXY OF INVESTMENT	COMPANIES INVESTED IN
standard chartered	London, United Kingdom	$789B	6	$380M	Ripple, Cobalt, Dianrong, Metaco, Linklogis
BNY MELLON	New York, United States	$470B	5	$321M	Fireblocks, HQLAx, R3, Fnality International
citibank	New York, United States	$2,260B	14	$279M	BUCK, Chain, SETL, Axoni, Cobalt, Digital Asset, HQLAx, R3, Komgo, Symbiont
UBS	Zürich, Switzerland	$1,126B	5	$266M	Axoni, R3, Fnality International, ConsenSys
BNP PARIBAS	Paris, France	$3,081B	9	$236M	Digital Asset, HQLAx, METRON, R3, TradeIX, Komgo, Token
Morgan Stanley	New York, United States	$1,116B	3	$234M	NYDIG, R3, Securitize
JPMORGAN CHASE & CO.	New York, United States	$3,386B	8	$206M	Axoni, ConsenSys, Digital Asset, R3, HQLAx
Goldman Sachs	New York, United States	$1,163B	8	$204M	Axoni, HQLAx, R3, Coin Metrics, Circle, Blockdaemon, Veem
MUFG	Tokyo, Japan	$3,408B	6	$185M	bitFlyer, Coinbase, R3, Komgo, Fnality International
ING	Amsterdam, Netherlands	$1,147B	6	$170M	HQLAx, R3, Komgo, Fnality International, Vakt
BBVA	Bilbao, Spain	$796B	5	$167M	Covault, Cambridge Blockchain, Everledger, R3, Solarisbank
NOMURA	Tokyo, Japan	$432B	5	$146M	Quantstamp, Komainu, R3, Securitize
BARCLAYS	London, United Kingdom	$1,842B	22	$12M	RealBlocks, Safello, Avenews-GT, Chainalysis, R3, Crowdz, Everledger, Evernym, INVIOU, Wave. Photocert, Post-Quantum, Fnality International, ResonanceX, The Sun Exchange, SendFriend

Figure XIII Top Banks investing in Crypto & Blockchain companies (Blockdata, 2021)

5.2 Blockchain: An entirely too perfect technology?

5.2.1 The scalability of a blockchain system

Scalability implies the ability for a system to continue operating normally when the number of users increases by an order of magnitude. We can also talk about extensibility, which is the ability to scale up (Hill, 1990). When it comes to cryptocurrencies and blockchain systems, scalability is a real issue. Indeed, these decentralized systems are not very scalable by nature, in the sense that an increase in load will generally reduce their theoretical decentralization and therefore their security. Every blockchain system is subject to a trade-off between its decentralization and its capacity. Decentralization corresponds to the distribution of nodes on the peer-to-peer network that supports the blockchain: the greater the diversity of these nodes, the more difficult it is for an attacker to compromise the system. Decentralization is therefore closely linked to the ability to run a node (Khan, Jung, & Hashmani, 2021). This decentralization is particularly essential at the level of validators (the famous miners in the case of Bitcoin). Indeed, a high concentration of these validators is detrimental to the proper functioning of the chain. If a consortium of actors manages to control more than half of the validation power (computing power or tokens), then the security of the chain can be impaired, for example by a so-called "51%" double-spend attack or by active censorship of certain transactions (Sayeed & Marco-Gisbert, 2020). The capacity of a chain indicates how many transactions it can process in a given time frame. The load is the same for each node in the network to ensure the robustness of the system. Therefore, at some level, this capacity comes into direct conflict with decentralization: the more transactions a node has to process, the more resources to maintain it (computing, bandwidth, storage) must be high if it wants to continue (Khan et al., 2021).

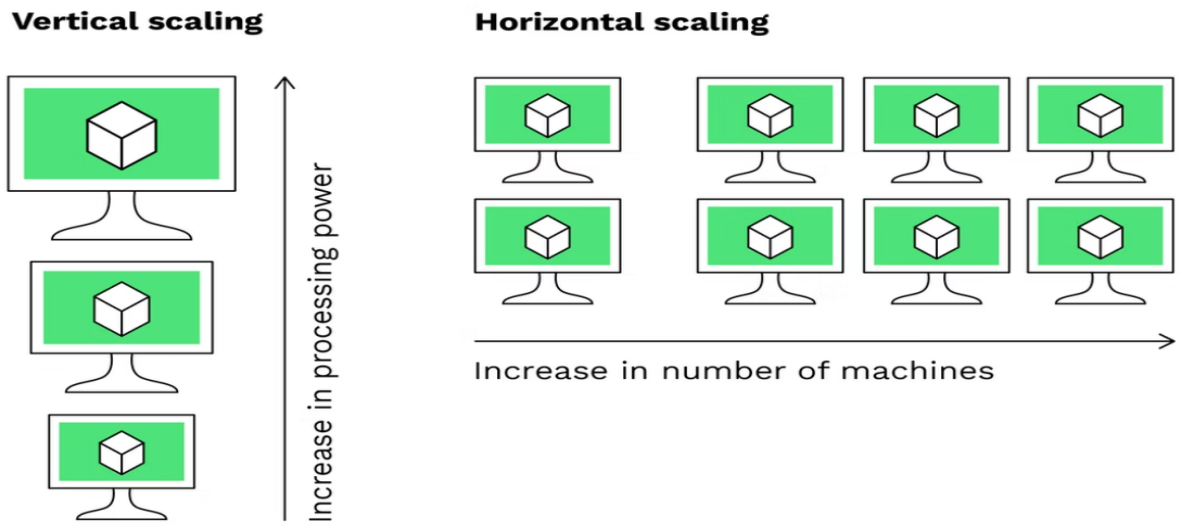


Figure XIV Scalability in a network (Bitpanda , 2022)

Hence the existence of the trade-off between decentralization and capacity, a trade-off which generally manifests itself by a limit present in the protocol making it possible to artificially limit the transactional capacity of the system: For Bitcoin (BTC), this is a block weight limit which is currently 4 million units of weight. This artificial limit makes it possible in practice to obtain blocks of up to 1.3 MB on average. Bitcoin can thus process just over 10 simple transactions per second (Prasad, 2021). This compromise has a direct consequence on the economic functioning of blockchain systems. Thus, the networks of the two most popular crypto-currencies, Bitcoin and Ethereum, regularly experience congestion. This is particularly the case during speculative booms which attract newcomers eager to make a quick profit and push traders to make more trades. We can cite the rise in the price of bitcoin to $20,000 (Roberts, 2020) or the cryptokitties event on Ethereum in December 2017 (Tepper, 2017). These congestions have consequences on the economic model of blockchains. Since space in a block is limited, validators choose the transactions with the most fees. The user is then faced with the following dilemma: either pay high fees to have their transaction confirmed quickly or wait for the network congestion to decrease. By bid effect, leads to an overall increase in transaction costs and confirmation times (Khan et al., 2021). From early December 2017 to mid-January 2018, for example, more than 100,000 transactions remained unconfirmed simultaneously on the Bitcoin network (Partz, 2020). The scalability issue was widely mentioned during the interviews as one of the issues with a more global usage of the blockchain system. Nevertheless, there are a few basic methods to increase the scalability of a blockchain system:

- Optimization of the software infrastructure so that the load is minimal. The developers of Bitcoin Core, the benchmark implementation of Bitcoin, are constantly working towards this goal (Berne, 2018).
- The increase in hardware performance that occurs naturally in the economy: for a given level of performance, the cost of the corresponding computer hardware is lower and lower. Sometimes referred to as Moore's Law (Berne, 2018).

Additionally, some promising blockchains without any concern for scalability have positioned themselves in the most capitalized digital assets. We can cite the Solana, or Cardano which pose as an alternative to Ethereum (even though the Ethereum network hopes to overcome its scalability problems with its 2.0 version). Cardano desires to establish itself as a payment solution, like VISA and Mastercard (that have already overcome these issues and are widely accepted), in order to become a standard in the crypto ecosystem for everything related to payment (Wageneer, 2021). If we refer to the documentation on the official Cardano website, it is evident that its creators present their blockchain as a “third-generation blockchain”. Still, according to the official Cardano website, Bitcoin would therefore be a first-generation blockchain, which makes it possible to store value (bitcoin) and transfer it to other wallets without a trusted third party. This generation of blockchain did not include any smart contracts and suffered from scalability problems. Then would come the second generation of blockchain embodied by Ethereum, which is based on a system of smart contracts, but also presumably suffers from scalability problems. Cardano wants to address scalability issues in several ways: On the one hand, compressing the data, so that they take up less space and therefore become less heavy. This will allow fewer data to be processed by the nodes and by the network as the more the blockchain grows, the more its weight increases (Wageneer, 2021). On October 10, 2021, the Bitcoin blockchain weighed around 360 GB (Prasad, 2021); On the other hand, the team behind Cardano turned to the Ouroboros Hydra protocol, which is an in-house developed solution. This protocol is based on a concept that is also found on Ethereum: second layer solutions (or layers 2). They make it possible to deport the workload from the main network to another chain (Wageneer, 2021). Cardano also relies on the RINA (Recursive Internetwork Architecture) communication protocol. The RINA Protocol involves separating the nodes from each other, encapsulating them in subnets, and having them communicate only when necessary. By relying on this communication

protocol, the nodes do not continuously communicate with each other, as is the case for the Bitcoin blockchain, which is based on the peer-to-peer communication protocol. This makes it possible to lighten the bandwidth of the network, by preventing it from having to synchronize the entire blockchain (Sharma, 2022).

5.2.2 The matter of Anti Money Laundering and the fundamentals of the Know Your Customers process

Field research has shown that Blockchain truly is unmatched and incorruptible in terms of its core functionality. So much so that, more and more organisations are adopting its framework every day to integrate it into their own structure. However, a few external issues have been raised during interviews that could explain even better the slow acceptance of the technology.

An Anti-Money Laundering (AML) questionnaire is the regulatory procedure that consists of an information sheet that banks send to each other to obtain information on existing national anti-money laundering procedures. A bank A asks a bank B if the State in which it exercises its financial activity has complied with the national laws enforcing AML. The information requested relates to the existence of a so-called Know your customers (KYC) procedure, which consists of identifying a bank's customers in the context of national and international financial transactions (Benarroch, 2018). The initial goal of KYC requirements is to prevent banks to be utilized by criminal groups for money laundering. It also helps banks to better understand their clients and their financial operations, allowing them to manage their risks and overall, better service them (Ansari, 2021). This explains the reluctance of financial institutions and officials to fully integrate blockchain processes using cryptocurrencies. Interviews with banking officials have revealed that due to the anonymity of transactions, the "untraceability" of financial flow’s sources (demonstrated through the findings on blockchain technology’s characteristics), and very little developed regulation, cryptocurrency is a tool of choice for fraudsters. Transactions take place online on platforms that allow exchange against other cryptocurrencies or a fiat currency. The value of cryptocurrencies on these platforms is determined by supply and demand and transactions are made from one address linked to an electronic wallet to another. These wallets are managed by the holder or by a third party, but no identity is linked to a wallet address or a transaction. Each transaction remains irreversible and visible to all. In other words, with

cryptocurrency, money can pass through several accounts without the identity of the account holder being known. In addition, "peer-to-peer" trading platforms allow for a direct transfer, without an intermediary, and bypass the traditional banking system where large transactions are subject to control. Thus, the impossibility of knowing who is behind a transaction leaves a multitude of doors open to fraud and in particular to money laundering (Chandler, 2019). In practice, payment in cryptocurrency allows the purchase on the dark web of illicit services or goods such as narcotics, weapons, bank card details, etc. Yet, several techniques make it possible to obscure the transactions and therefore to launder the funds. Among the most common, we can mention “swapping”, which allows changing one cryptocurrency into another, or even “mixing”, which allows you to anonymize the operation. Lastly, individuals can exchange these untraceable cryptocurrency operations. into fiat currency without ever being identified or linked to previous transactions (Lexie, 2021). According to the OECD, this is an area that requires special attention and constant adaptation by financial authorities to regulate and regulate this new system.

5.2.3 A solution to the informal financial sector?

The literature above has shown that access to convenient and alternative ways to transfer funds is crucial for expatriated populations trying to send money back home. However, a gap was identified in terms of researching approaches to reduce the informal ways to achieve these transactions. In fact, the “formalization” of the informal economy can be supported by the growing usage of mobile money. If channelled appropriately, it can in turn positively influence economic changes by diversifying production and goods which pushes for the local market to be more dynamic. Ultimately, mobile money services can in the long run promote improved tax payments and public services, and that would subsequently strengthen governance and infrastructure, and encourage international trade by way of an enhanced supply of financial services (Ngaba, 2021). Nevertheless, regulation of informal funds transfers from migrants abroad is not so simple when it comes to cryptocurrency transactions as it is important to understand first why individuals choose informal routes: the primary reason being the high cost of transactions from traditional routes. Blockchain-based operations promise to make remittance transactions cheaper, faster, and more convenient, while facilitating them to reach areas that are presently, underserved, or

totally excluded by their local official financial system in some parts of Nigeria. Data is still limited on the question but as part of an emerging trend within the financial services industry to innovate in terms of the solutions already available, it is legitimate to assume that if all the advantages brought about by a blockchain initiative are effectively put into place, individuals using informal routes may go back to more conventional ways at least for convenience purposes. Officials do have an additional role to play because the lack of regulation and volatility of cryptocurrencies do not prevent migrants from trying these new channels if they provide the necessary initial benefits. These informal payments are not visible and therefore have an impact on both the balance of payments and the credit rating of countries, therefore it is crucial for public financial institutions to start looking into potentially using this new technology in their processes to provide customers with convenience while still being able to track transactions.

5.3 Traditional money transfer versus Blockchain-powered money transfer

As previously mentioned, what makes cryptocurrencies “unique” and different is their decentralised features not controlled by any entity. Fiat currencies like the US dollar, issued by the US Treasury Department and distributed by banks, constantly need to be supplied for the people to use. Cryptocurrencies on the other hand do not belong to anyone and do not rely on any governmental institution (Waggoner, 2021). Also, while considering the idea of money storage to the bank, at some point one must trust that the bank is capable of safeguarding that money and making it available for fund withdrawal at all times. In contrast, virtual currencies were created so people would not have to put their trust in any central organisation. To make this possible it uses blockchain where every single transaction is recorded and publicly displayed for anyone to see. As Bitcoin’s existence does not rest on a governmental entity, it could hypothetically be transferred across the globe more easily than fiat currency (Waggoner, 2021). However, this is only in theory as the cryptocurrency has encountered a few challenges that retain it from being adopted as the worldwide standard. The question to ask now is whether or not cryptocurrencies are genuinely more effective for money transfers. Findings from the research have shown that blockchain and cryptocurrencies operation when implemented correctly can provide so many benefits to the industry that it could potentially disrupt the entire financial money market. The theory of creative destruction relies on the principle that a technology «less

expensive, easier to use, and more practical" can represent a real threat to the already established industry. Although the development of blockchain has not technically created a new market, it still represents a first-order disruption capable of competing within a sectoral market with already existing technologies. Nevertheless, it is still important to keep in mind that compared to current money transfer services, cryptocurrencies such as Bitcoin remains indirectly more complex, slower, and more expensive to “process” for businesses (scalability, mining cost, etc), which represent a triple disadvantage in contrast to traditional procedures that banks and wire services provide. Processing large amounts, for instance, requires a significant quantity of computer power and slows down the entire process during transactions (although the Ripple protocol has higher capabilities and is cheaper). At the moment, bitcoin is far from being a superior option for fiat-to-fiat money transfers. For consumer payments, it is simply still considered too unwieldy. However, along with blockchain technology and the birth of newly adapted virtual currencies, it is steadily working behind the scenes to trigger a revolution in the international money transfer market (Waggoner, 2021).

5.4 Actual erasure or late integration: Central bank digital currencies

“SWIFT is here to stay” is the statement that was claimed by most participants during interviews. Although it has become crucial to develop innovative financial solutions for the transfer of funds, the issue for banking institutions and central banks remains the same: Control. The decentralized aspect of blockchain and this new age of technological advancement are, however, putting experts in a consensus position: traditional banking institutions have no choice but to jump in the wagon. Around the globe, central banks are gradually considering creating digital versions of their own currencies, CBDCs, in the face of the growth of payments made online and to compete with cryptocurrencies that go beyond the control of governments or official regulators (Africanews, 2021). China has become the first major economy to introduce, in 2020, the test version of a digital currency. At least five nations since then have released their virtual currencies, according to the American think tank Atlantic Council (Tran, 2021). A central bank digital currency is essentially a digital version of an equally valuable paper currency, that is the national fiat currency (Bhawan, 2021). This means that CBDC works differently from the cryptocurrencies as it is regulated by the Central

Bank, which controls its value (Intermediary). Although CBDCs, like Bitcoin, operate on a blockchain ledger – meaning all transactions and ownership records are stored in a decentralized computer database – only the Central Bank can mint, issue, distribute or destroy the country's CBDC. In contrast, most cryptographic "currencies", can be created by any computer, anywhere in the world, based on an algorithm. Therefore, users of CBDCs will also have to give up some degree of privacy in order to use them, as the digital currency does not offer anonymity like most cryptocurrencies. Indeed, they will have to provide a bank verification number or a national identification number to access the currency, which will allow the central bank to follow their transactions (Birch, 2021).

5.5 Chapter conclusion: a solution to cross-border remittances

Through the findings gathered in the result section and the additional interpretation in the discussion chapter, we have a better understanding of blockchain technology in a money transfer environment and assess its strength and limitation for individuals involved in the remittance market to and from Nigeria. Answering the below sub-questions will allow to better comprehend the extent to which blockchain technology is suitable for the finance market and synthesise this study.

1. What are the cost-efficient characteristics of a blockchain environment in a cross-border financial transaction?

Section 4.1.3 in the result chapter developed on the encouraging characteristics that blockchain has to offer. Among other points cited, the main advantages attributed to the technology are a reduction in the cost of the overall transaction because of a few reasons: the elimination of costly intermediary parties involved in the money transfer operation. This makes the overall operation faster and more efficient, which in turn impacts the end price consumers will have to pay. The usage of cryptocurrency in operations to bypass the exchange rate fee of fiat currencies also plays a role in cost reductions. Because of its transparent nature described in the chapters above, Blockchain is frequently referred to as a "trustless" system, not because trade partners lack trust for one another, but because it is just unnecessary. This trust is based on the enhanced security of the blockchain, its increased transparency, and the traceability of its transaction. Outside of the trust issue, additional corporate benefits are accessible through blockchain, including cost reductions due to its optimal speed of operation,

automation, and therefore efficiency. By drastically reducing risks of errors and paperwork, the technology substantially makes transaction and overhead costs decline and even eliminates the necessity to have transactions verified by third parties or intermediaries.

2. What are the main risks and limitations associated with the implementation of blockchain technology regarding international payments?

The fundamental aspect of blockchain technology has not yet shown a true risk of utilisation. The few challenges that were mentioned mostly involved the cryptocurrencies needed for the implementation of the technology. Volatility and vulnerability to the speculative market are some of the most talked-about aspects of virtual currencies. These matters were countered with the development of stable coins and CBDCs from public institutions that are pegged to national fiat currencies. The latter initiative allowing to find solutions to the AML questions and permitting to have good visibility into the parties involved in a cryptocurrency transaction. Finally, the scalability issue was one limitation that was mentioned about a cryptocurrency-powered platform used for foreign currency exchange. It is important to remember that we are only at the dawn of the development of cryptocurrencies. It is still something relatively new and the market is very clearly still too immature to perform like established parties like VISA. That is because corporate management does not yet realize how to integrate blockchain into the processes of their organization, which means that there is a lack of trained blockchain specialists willing to fill the gap in expertise. This partly explains why a legal framework around virtual currency is essential but extremely difficult. This also slows the global acceptance of the technology despite the promising expectation it claims to offer (decentralization, transparency, etc.) and the opportunities that it will bring on to the international remittance market. Very few Fintech have found a solution towards the scalability of the technology. The main unknown we have right now is whether these issues will be solved by improving the way existing crypto-assets work or by creating something new that will replace what we know currently.

3. How has blockchain technology been efficiently implemented into money transfers in other countries around the world?

Banks have slowly been overshadowed by MTOs and other Fintech businesses as an option for cross-border transfer. The consideration of implementing a blockchain framework could potentially put them back in the competition in order for them to even be seen as an option by peer-to-peer transfer customers. In recent years, a growing number of financial entities have decided to give a chance to the blockchain. The propagation of CBDC from central banks and public institutions is a confirmation that virtual currencies are ready to be democratised across the globe. The multiple instances described in section 5.1 show that blockchain is truly being considered as the next breakthrough in technology for money transfers in the banking industry but also the Fintech industry with new start-ups beginning to be the face of innovation.

Chapter Six: Recommendation and Conclusion

6.1 Desk research or Field research

This research required both the implementation of desk research by gathering data from reliable (mostly online) sources and also field research, which followed with the support of interviews from experts in the financial field and blockchain technology. All sub-questions required the use of desk research to be analysed, while two had interviews to support them. During the implementation phase, 10 experts on Blockchain technology and cryptocurrencies were approached. The first set of questions related to the actual description of the technology as well as its implementation in a conceptual context, which is here the money transfer market from one country to another, were relatively similar to the data collected through desk research. As expected, blockchain is a subject - although still “in discovery”- widely talked about. Several pieces of research are being done around it since the rise in popularity of Bitcoin. Therefore, most answers from respondents coincided with what is so far globally known about blockchain technology. The last section of the interview with money exchange experts as well as interviews with banking fund officers was mostly focused on the limitation part of the overall process of blockchain implementation. These sessions provided a different perspective than the theoretical studies found online. Blockchain experts also had various specific limitations to mentioned, which allowed to complete the desk research section that might not have considered some of these limitations. Banking personnel such as Access Bank’s fund officer and FirstBank’s department heads delivered a more “contextualised” approach considering first the banks' position in Nigeria but also the aspect of the regulation that differs from location to location towards the use of cryptocurrencies in financial transactions.

6.2 A critical review of research’s implementation

Several limitations were identified during the execution phase of this research project. Firstly, the number of interviews actually implemented was fewer than originally planned. This can be attributed to the short time available to find as many financial experts as possible. Indeed, the complexity of the subject being studied was

underestimated and experts were contacted rather late while carrying out this research. Moreover, some of the respondents ended up not taking part, as a result of a tight schedule and/or lack of reliable information concerning the matter. A few of the financial consultants initially approached had a rather vague idea of what blockchain represented and were not able to argue a structured explanation of the technology. That resulted in fewer participants being enrolled in the interview process. Thus, although the interviewees provided information linked to the theory researched during the desk research phase, a higher number of answers would have probably improved the reliability of the overall investigation. The semi-structured method used for the interviews, might not have been the better method as questions were very often "thrown" randomly depending on the answers received. The questions' order for instance was therefore altered from one interview to another. Sauders demonstrate in his book "Research method for Business Students" that unstructured interview might be more appropriate for this type of exploratory research.

	Exploratory	Descriptive	Explanatory
Structured		✓✓	✓
Semi-structured	✓		✓✓
Unstructured	✓✓		

✓✓ = more frequent, ✓ = less frequent.

Figure XV Uses of different types of interviews (Saunders, 2014)

Questions were also probably not detailed enough or specifically targeted to dig out the true potential of this technology but rather they were reflected from the theory already researched. Therefore, potentially new information could have been processed through the interview sessions. In that regard, in-depth interviews would have been a more suitable option to identify detailed perceptions or opinions from the interviewee. New information was retrieved from one interview to another but also between interviews, hence, it might have been more pertinent to adjust questions from one interview to another. Moreover, most interviews were done through Zoom because of the different locations of the respondent but also because of the current pandemic context, a face-to-face interview would have provided a more accurate screening of the interviewees' responses by capturing their body language for example. Lastly, the approach used to record the data was undermined by the researcher's reliability on audio recorder devices. Because notes were not taken while the respondents were

being interviewed and some of these audios stopped working at some point, evidence was consequently not able to be provided for a few interviews. Finally, blockchain technology is highly dependent on complex IT knowledge. Therefore, it is extremely difficult to fully explore the subject without touching on the technological aspects.

6.3 Research conclusion

The blockchain allows financial institutions to upgrade ineffective processes that irritate consumers nowadays. Transactions are costly, but they are made cheaper by eliminating third-party banking costs through blockchain. The money sending process is slow, but the technology allows minute lengths transactions. Customers must wait a certain period of time for confirmation of their payment to be successful, while blockchain indisputably confirms distribution every time. Blockchain technology describes a decentralized financial ledger available to all parties in a selected network for the exchange of messages, but mostly cryptocurrencies that hold this technology. It is an open ledger, that remains incorruptible by the use of cryptography and a global network of powerful processors "verifying" transactions for profit.

The technology capable of being applied in several areas is being targeted by financial institutions that have just recently tried to take advantage of it. The international money transfer market is one of the sectors where it is projected to develop the most especially as remittances are predicted to pick back up. The alleged benefit associated with the implementation of this technology are numerous and can be summarized as follow:

- Low cost (cuts out intermediary banking cost)
- Transparency in transactions due to distributed characteristics
- Faster speed of transfer (real-time transactions)
- Less need for cash reserves at correspondent banks
- Storage of information in a secured and immutable way
- Traceability of transactions (decreased risk of fraud)
- Banks would no longer require clearing and settlement systems

However, as previously mentioned, this technology is rather recent and considered relatively uncertain for many parties. Not necessarily because of the concept and technology per se but rather because of the cryptocurrencies that are involved in the

process. They have been confirmed to be highly volatile; especially Bitcoin the most famous and established among them. Moreover, regulatory and compliance issues are raised by organisations trying to implement blockchain. Challenges are mainly related to “trust” issues towards this technology and the parties to be part of the network. Most financial institutions are still not ready to risk implementing an uncertain technology without some form of green light from central bodies such as the government and central banks. Lastly, after considering the data gathered to unveil the potentials of this technology, the possibilities are multiple for financial institutions. The options available are either to invest and use its internal capabilities into building its very own private platform, for which it would need expertise on the precise mechanism of the technology and the use of cryptocurrency. It would therefore have to consider adopting a virtual currency (Bitcoin, Litcoin, etc) or even create its very own token. Cloud computing provides organisations with processing power, storage, and other resources to help them execute their tasks. Alternatively, Fintech could purchase a private server to implement a blockchain API based on Open-sourced API of providers such as Ripple. Otherwise, the bank can join an already established network such as RippleNet, where it would not need to investigate the technical side of blockchain but rather just adapt the company’s various available solutions to its very own context. By doing that they would integrate Ripple’s technology into their internal function and would let the intermediate organisation drive transactions for it. Either way, if banks, MTOs, or any financial organisation are looking towards implementing this type of technology, they need to first consider the network to join and/or to build and consider the different parties to play a role in that network but also the significant computing power and resources required. The full potential of Blockchain technology to transform the remittances industry has yet to be grasped at the moment, owing to the need to harmonize legal and regulatory frameworks between sending and receiving nations, particularly in the context of domestic and international regulations aimed at preventing money laundering and terrorist financing. Banking institutions, fintech, financial start-ups, or even governmental entities will still undeniably have to take smart initiatives if they want to innovate towards blockchain technology and compete in this fast-changing market.

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Appendix 1 : Interview Questions

Groupe Sample 1 :

- Could you briefly explain what take place in a typical fiat currency transfer in an international transfer?
- What are your thoughts on cryptocurrency?
- What are the main differences in regulations between fiat currencies and cryptocurrencies at least in Nigeria?
- How do you describe blockchain technology?
- What are the different domains that could benefit its implementation?
- In a money transfer environment, what would be the main characteristic of a blockchain technology?
- Most banking transaction (international transfers) being done through SWIFT protocol hence using third parties and corresponding banks, what do you think would be the main concern about giving up SWIFT?
- How would it be managed to transfer money without using any third party?
- Do you necessarily need to use a cryptocurrency in a blockchain technology process?
- If yes, which cryptocurrency do you think would be most appropriate to use for a financial institution such as bank or a fintech?
- What would be the ideal position of a fintech organization in a blockchain network?
- Considering everything you explained, what would you think would be the main limitation(s)? what would stop a financial organisation to implement this type of technology?
- “Volatility” and “Speculation” over cryptocurrencies are some of the negative aspects that are often quoted, how could this risk be reduced?
- What do you think would be the role of governing public institutions or central banks in implementation and regulation over the technology?
- What would be the precaution public institution could carry out to control a potential deployment of the technology?

Group Sample 2:

- Could you briefly explain what take place in a typical fiat currency transfer in an international transfer?
- What are your thoughts on cryptocurrency?
- What are the main differences in regulations between fiat currencies and cryptocurrencies at least in Nigeria?
- Have you ever heard of the blockchain technology?
- Most banking transaction (international transfers) being done through SWIFT protocol hence using third parties and corresponding banks, what do you think would be the main concern about giving up SWIFT?
- Considering your understanding of a decentralized technology, what would you think would be the main limitation(s)? what would stop a financial organisation to implement this type of technology?
- "Volatility" and "Speculation" over cryptocurrencies are some of the negative aspects that are often quoted, how could this risk be reduced?
- What do you think would be the role of governing public institutions or central banks in implementation and regulation over the technology?
- What would be the precaution public institution could carry out to control a potential deployment of the technology?

Appendix 2: Participant Information Sheet

18/04/2021

Dear Sir or Madam

My name is ***Aicha Bah*** and I am a masters student in Management in Governance at the Wits School of Governance in Johannesburg. As part of my studies, I have to undertake a research project, and I am conducting a study on the implementation of blockchain technology into cross-border money transfer. The aim of this research project is to study new technological opportunities, public financial institution could theoretically deploy to radically change the remittance market, especially on the African continent.

As part of this project I would like to invite you to take part in an interview. This activity will involve a telephonic or online interview and will take around 60 minutes. If a follow up interview is required, I will seek your consent again before setting up the interview. With your permission, I would also like to record the interview using a digital or audio device. The recording will be used for purposes of this research only and will be stored on a password protected computer.

You will not receive any direct benefits from participating in this study, and there are no disadvantages or penalties for not participating. You may withdraw at any time or not answer any question if you do not want to. The interview will be completely confidential and anonymous as I will not be asking for your name or any identifying information, and the information you give to me will be held securely on a password protected computer and not disclosed to anyone else. I will be using a pseudonym (false name) to represent your participation, in my final research report. If you experience any distress or discomfort, we will stop the interview or resume another time.

If you have any questions afterwards about this research, feel free to contact me on the details listed below. This study will be written up as a research report. If you wish to receive a summary of this report, I will be happy to send it to you upon request. If you have any queries, concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (non-medical), telephone + 27(0)11 717 1408, email Shaun.Schoeman@wits.ac.za

Yours sincerely,

Researcher: Aicha Bah, 2397325@students.wits.ac.za , +27 6 76590463

Supervisor: Dr. John Khumalo, john.khumalo@wits.ac.za , +27 11 717 3493

Appendix 3: Informed Consent Form

Title of project

Write title here Blockchain technology and international money transfer.

University – University of the Witwatersrand, Johannesburg

Name of researcher – Aicha Bah Student No. 2397325

I, ……., agree to participate in this research project. The research has been explained to me and I understand what my participation will involve. I agree to the following:

(Please circle the relevant options below).

I agree that my participation will remain anonymous	YES	NO
I agree that the researcher may use anonymous quotes in his / her research report	YES	NO
I agree that the interview may be audio recorded	YES	NO
I agree that the information I provide may be used anonymously after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained.	YES	NO

…… (signature)
…… (name of participant)
…… (date)

…… (signature)
…… (name of person seeking consent)
…… (date)