Research Journal of Finance and Accounting
ISSN 2222-1697 (Paper) ISSN 2222-2847 (Online)
Vol.13, No.16, 2022

A Critical Analysis of the Core Determinants of Central Bank Digital Currency in Zambia

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Abstract
In this study, we analyze the main determinant of a Central Bank Digital Currency (CBDC) in Zambia using a critical literature review. There are many determinants of Central Bank Digital Currency but this critical literature review only focuses on the main ones namely, how the introduction of a CBDC can improve the efficiency of payments systems platforms, make a stronger national defense against AML/CFT, ensure non-discriminatory access to domestic financial services and whether the introduction of a CBDC can mitigate the high cost of currency processing in Zambia. The methodology follows a critical review of CBDC literature from central Banks that have already launched, performing proof of concepts or piloting CBDCs in their jurisdictions. The literature also considers publications and working papers from global standards setting organizations such as the IMF, World Bank, WEF, ITU, ECB and many others. The study focuses on the Zambian jurisdiction and reviewed whether these main determinants may warrant the introduction of a CBDC in Zambia.
Keywords: Central Bank Digital Currencies (CBDC), Payments Efficiency, Financial Inclusion, AML/CFT, Cost of Currency processing, Zambia
DOI: 10.7176/RJFA/13-16-01
Publication date: August 31st 2022

1. Introduction

This study has looked at the history of currency and payment systems platforms in the pre and post-independence era in Zambia. It brings out the major risks posed by virtual currencies on the payments systems landscape and highlights the value and the properties that a Central Bank Digital Currency (CBDC) brings to mitigate the risks of these growing virtual currencies risks (BOZ, 2017). The study was beneficial to the government of the Republic of Zambia, the ministry of finance, the monetary authorities, financial regulators, Technology regulators and financial conduct authorities in Zambia and the sub-Saharan region. Furthermore, the research brought out potential benefits of a CBDC and evaluated how CBDC can bring about innovation in the payment systems landscape, lower the cost of cross border payments, increase financial inclusion and provide insights on how to safeguard, ensure stability, a secure, stable and sound financial system and to foster sustainable economic development in the country (BOZ, 2020). The study also looked at other major prevailing determinants for introducing a CBDC in Zambia and how it can improve the efficiency of payments systems, make a stronger national defense against AML/CFT, demonstrate whether a CBDC can ensure non-discriminatory access to domestic financial services and how they can mitigate the high costs associated with processing cash in circulation.

2. Growing Usage of Virtual Currencies in Zambia

Cryptocurrencies sometimes referred to as Virtual currencies or crypto assets and are a form of Financial Technology (FinTech) innovation and digital asset that has the potential to disrupt the way financial services currently operate globally (BIS, 2019). These VC's are already having an impact on the worldwide financial systems as a payments system platform and their unique properties make them function as a form of electronic money and forms of digital assets which can be used for payments and investments. They bring about secure, always available, peer-to-peer and decentralized payment methods that have some distinct advantages over the traditional methods of payments (Auer, Raphael; Böhme, Rainer, 2021). According to the financial stability board, FinTech is defined as the financial technology that is applied to financial services, resulting in new business models, applications, processes, products and services with an associated disruptive effect on financial markets and institutions (FSB, 2019). This definition emphasizes the focus on technology-driven innovations that could potentially reshape how the financial services industry operates in developing countries and Zambia in particular as it evolves into several platforms as depicted in Figure 1.1. Given the wide range of innovations across financial services, the existing regulatory architecture should be assessed to determine and evaluate the cost of processing currency as a determinant for a CBDC.

These VC's poses a great risk to the money supply and the currency in circulation. There is a problem because these virtual currencies are not recognized as legal tender by the monetary authorities and still not yet legal tender in the country and the Central Bank of Zambia has to date just issued a cautionary statement advising citizens to trade and transact in virtual currencies at their own risk (BOZ, 2018). This problem of virtual assets continues to grow as the assets are actively traded but not issued by the monetary authority, not regulated and supervised and are obtained by mining, peer-to-peer exchange which is a process by which new virtual currencies are entered into circulation using high end computing resources. This problem distorts monetary policies, financial stability and money supply losing kwacha to virtual currencies and risk of suffocating of the kwacha by growing illegal market which also poses the risk of money laundering and terrorism financing. This problem can be addressed by adopting some form of centralized currency in form of a CBDC that will deal with the risk of suffocating the kwacha and could facilitate instant, inclusive, interoperable and secure and trusted payment platforms that will be regulated, supervised and monitored (FSB, 2020). Figure 1.1 below shows the growing landscape of financial technologies in Zambia including virtual platforms.

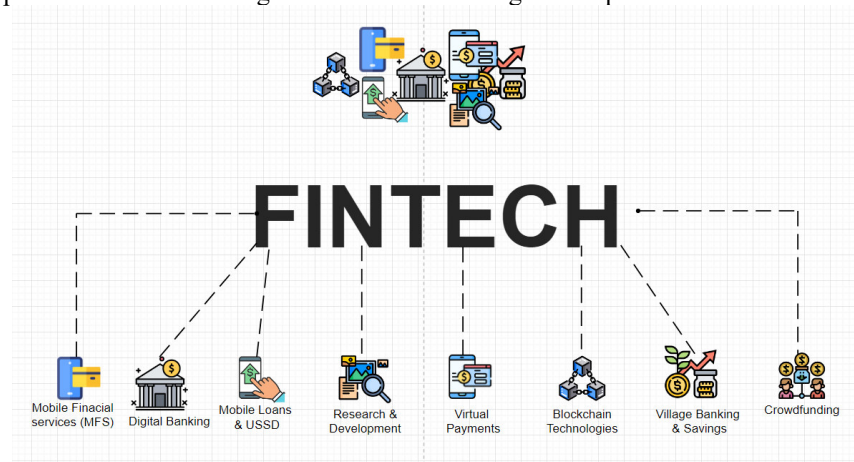

Figure 1.1: Zambia's Financial Technologies Ecosystem 2021 (Source: Authors Construct)

2.1 Zambian Virtual Currency Landscape

There is growing evidence from global cryptocurrency platforms (ChainAlysis, 2021) shows that there is a lot of virtual currencies trading and activity going on in the SADC region, particularly Zambia and citizens are currently trading in these virtual currencies peer-to-peer using several online platforms such as https://paxful.com/ https://www.remitano.com, https://www.coinmama.com, https://www.localbitcoins.com and many other available global online platforms according to (CryptoCompare, 2021). Regrettably, the illiteracy surrounding the virtual currency is not just affecting the general public because it also affects those who are assigned with the responsibility of regulating the financial services landscape and those fighting cybercrime which may have its origins in the use or misapplication of virtual currencies. The regulators are currently playing catch up and only issuing cautioning statements to the citizens on the risks of using virtual currencies instead of exploring through research and development in order to get the most out of this technology. The digital financial services DFS and the specific virtual currency platforms form part of the overall financial services infrastructure in Zambia which is under the regulation of the ICT and telecommunications regulator called Zambia Information and Communications Authority (ZICTA). The communications platforms are composed of the terrestrial networks owned by Internet Service Providers (ISP's) and connect base stations and communications towers in different locations around the country. This is an essential and fundamental underlying infrastructure that facilitates and allows for the use of virtual assets or currencies as a medium of exchange. Figure 1.2 below shows the trading of virtual assets in the Zambian jurisdiction on live online platforms such as localcitcoin.com.

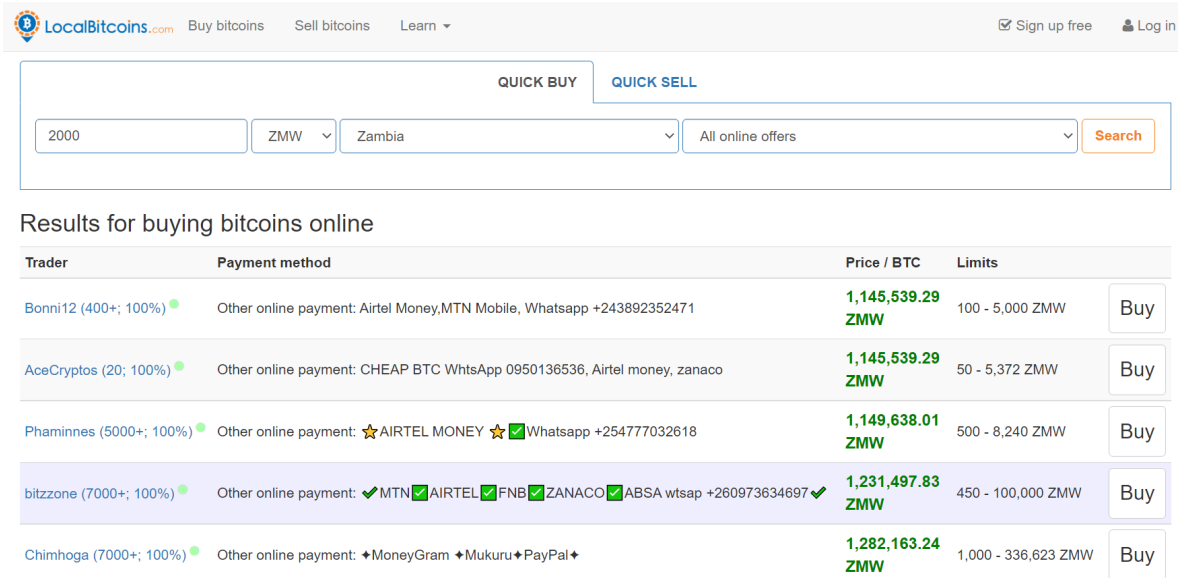

Figure 1.2: Evidence of Virtual Asset Trading (Source: (Localbitcoins, 2021))

2.2 Payment Systems Providers in Zambia

Research by the Bank for international settlement Reviewed that the Bank of Zambia is responsible for the designation and licensing of Payment Systems, Payment System Participants and payment system businesses in the Zambian jurisdiction (BIS.Org, 2019). Table 1.1 below shows the landscape of the designated payment system entities in the country and the type of payment system platform used. The country has 18 commercial banks that utilize various payment systems platforms such as the high value payments using Real-Time Gross Settlement System (RTGS) locally called the Zambia Interbank Payment and Settlement System (ZIPS). Other payment systems platforms used the commercial banks in Zambia include the Cheque Image Clearing (CIC), Direct Debit and Credit Clearing (DDACC) via the Zambia Electronic Clearing House (ZECHL), the point of sale (POS) and the electronic fund's transfer. The table also shows the growing number of low value payments provided by the non-bank financial institutions (NBFI), payment systems providers (PSP), financial services providers and now financial technologies (Fintech) service providers. The table also shows that there is currently no regulations for virtual currencies that are being traded online. Further research by the BIS also recommends that any CBDC consideration should interoperate with other existing digital and mobile financial services such as the platforms in table 1.1 below.

Table 1.1: Payment Systems Provider Platforms and state of Regulation (Source: Authors Construct)

Item #	# of Payment Systems Providers	Type of Business	Type of Payment Systems Platform	Location	Regulated/ Framework
1	3	Mobile Network Operators (MNO)	Mobile Financial Services (Mobile Payment Services and Money Transmission Services)	Local	Yes
2	18	Commercial Banks	CIC, DDACC & ZIPSS/RTGS	Local and Internatio nal	Yes
3	48	NBFI, PSP, FSP, FinTech	E-money Issuer and Money Transfer Services	Local	Yes
4	12	NBFI, PSP, FSP, FinTech	Mobile Payment Services and Money Transmission Services	Local	Yes
5	Not Known (Online)	Virtual currencies and Virtual currencies service providers	Virtual currencies Transmission and Virtual Assets Service Providers (VASP)	Internatio nal and Online	No

2.3 Motivations for Isuing Central Bank Digital Currency

Research by (Reuters, 2019); (Taskinsoy, 2019) points out some of the advantages of issuing CBDC and the following as some of the motivation for issuing CBDC in any jurisdiction. These motivations differ depending on the status of an economy being higher income country (HICs), developing country or a low-Income Countries (LIC) and below are the motivations for Central Bank Digital Currency (CBDC).

1. To make the payment system landscape more efficient and resilient.
2. To retain monetary sovereignty for any jurisdiction and to mitigate the risk of privately issued virtual currencies and global stable coins adoption and improved distribution of government-to-peer (G2P) direct payments to households such as welfare or social cash transfers.
3. To make a stronger national defense against AML/CFT and other semi-anonymous nature of virtual currency transactions. The defense is against a host of infamous activities and illicit activities, such as money laundering, terrorism financing, illegal arms dealing, human, child, sex trafficking, and tax evasion from the authorities.
4. Ensure non-discriminatory access to domestic financial services and facilitate access for all citizens in a selected jurisdiction.
5. The high cost of currency, physical currency processing approximated an average of 21% of the Central Banks' Budgets (BIS, 2019).
6. Improving monetary policy effectiveness to implement targeted policy or tap more granular payment data to enhance macroeconomic projections.
7. Enhancing monetary policy transmission by an interest bearing CBDC and improving monetary policy effectiveness, supervisory policies, access granular real-time payments with interest-bearing CBDC, breaking the policy rate zero lower bound.
8. To enhance financial inclusion and financial digitization to facilitate fast, instant efficient and tracible payments platforms.
9. Improving traction of local currency as means of payments in jurisdictions that are attempting to reduce dollarization.
10. Distributing fiscal stimulus distributing to the unbanked including incorporating helicopter or hot money features to increase spending velocity. This provides efficient transmission of social benefits, welfare and all other social services for the citizens that are provided by the government.

This study focused on four main motivations which are summarized in Figure 2.1 below and the literature review focused on these four motivations.

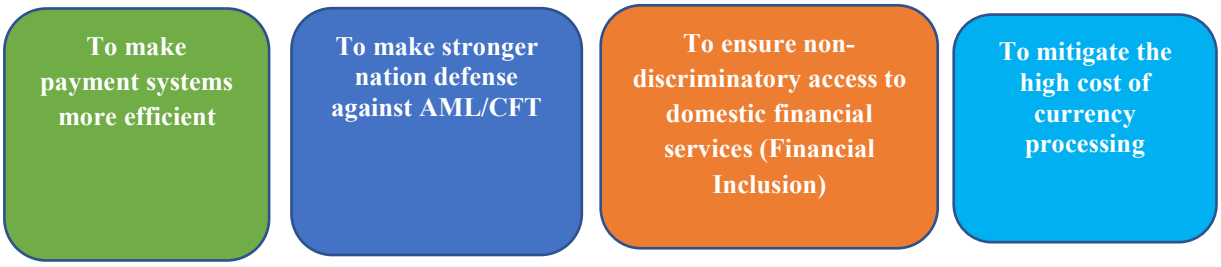

Figure 2.1: Summary Motivation of the Study (Source: Authors Construct).

3. Main Deternimamnts of issuing CBDC

3.1 Payment Systems Efficiency

The Bank of international settlements (BIS, 2017), describes a payment system as any financial system that is used to settle financial transactions through the transfer of monetary value from one party to another. This includes transfers between institutions, instruments, people, rules, procedures, standards, and technologies that make the exchange of value possible. BIS further reviews that payment systems need to be efficient, secure and reliable as they act as a lifeblood of modern monetary economies, payment systems are the financial markets circulation system. An economic modeling journal on the optimal online-payment security system and the role of liability sharing (Berg & Kim, 2022), further reviews that payment systems need to exhibit strong properties of security, reliability, immutability, scalability, anonymity, acceptability, customer base, flexibility, convertibility, efficiency, ease of integration with applications and ease of use. Emerging economies such as Zambia can make use of CBDC as payment systems platforms to allow for an efficient, secure and reliable payment system for enhanced economic development and to reduce the cost of exchanging goods and services. Economic efficiency also implies an economic state in which every resource is optimally allocated to serve each individual or entity in the best way while minimizing waste and inefficiency. When an economy is economically efficient, any changes made to assist one entity would harm another. An efficient system infrastructure is also a very important and

essential tool for the effective implementation of monetary policy, and the smooth functioning of money and capital markets. For an economy to attain an efficient payment system platform, needs specific business policies which need improvement by monitoring and measuring different aspects of payment systems, payment conversions, successful transactions, fraud, and provided actionable data that can be used to make targeted changes in the payment systems ecosystem (BIS, 2017). The study further highlights the following key performance indicators measuring efficiency including payments conversion rates, conversion rates by the financial services providers (FSP), conversion rates by the payment methods and card type, reported fraud rates on all DFS and mobile financial services and measuring of downtime of payment systems platforms.

3.2 CBDC to provide a stronger defence against AML/CFT

Global bodies such as the Financial Action Task Force (FATF) also agree that these new technologies, products, and related services have the potential to spur financial innovation and efficiency and improve financial inclusion, but they also create new opportunities for criminals and terrorists to launder their proceeds or finance their illicit activities (FATF, 2014); (FATF, 2019). Consistent with the risk-based approach which underpins the FATF Standards, understanding and responding to identified money laundering and terrorist financing (ML/TF) risks is at the heart of what the FATF does. However, FATF recently provided direction on the treatment of crypto assets by amending their global recommendation on new technologies (FATF, 2019). These amended recommendations now require jurisdictions around the world to regulate cryptocurrencies and cryptocurrency service providers (CASPs) for anti-money laundering and combatting the financing of terrorism (AML/CFT) and member countries and affiliates including Zambia should comply. FAFT also reviews that cryptocurrencies may create conditions for regulatory arbitrage while posing risks to the financial sector and all its participants that operate in a highly regulated environment, which assists in ensuring a sound and safe financial system.

Cryptocurrencies are still operating within a regulatory vacuum as no globally harmonized approach or position has been reached yet as many regulators around the globe have not yet sufficiently addressed the phenomenon of crypto assets and have not yet settled on a collective approach. Further, cryptocurrencies are mainly operating in unregulated environments and currently, there is no specific regulations in the region and Zambia in particular. Many financial regulators including the Central Bank of Zambia (BOZ) are currently playing catch up and only issuing cautioning statements (BOZ, 2018); (SEC, 2018) to citizens on the risk of these cryptocurrencies instead of exploring exhaustive research and development to get the most out of these technologies. Globally, central banks have raised concerns of the cryptocurrencies' spillover effects to the formal financial services industry and the eventual effects of these currencies on guiding monetary policies and how to repair and mitigate these eventual risks (SARB, 2014); (Borri & Shakhnov, 2019); (Kosc, Sakowski , & Ślepaczuk, 2019). Meanwhile, the technology keeps growing, AML/CFT concerns also keep increasing and the technology aware generation is actively using it and the various activities associated with this innovation can no longer remain outside of the regulatory perimeter. Consequently, some countries have issued communications declaring restrictions or a downright ban on the use of crypto assets. Figure 3.1 below depicts the development challenges, the macroeconomic challenges and the cross CBDC border challenges and how these could affect the weaker capacity to address AML/CFT risks.

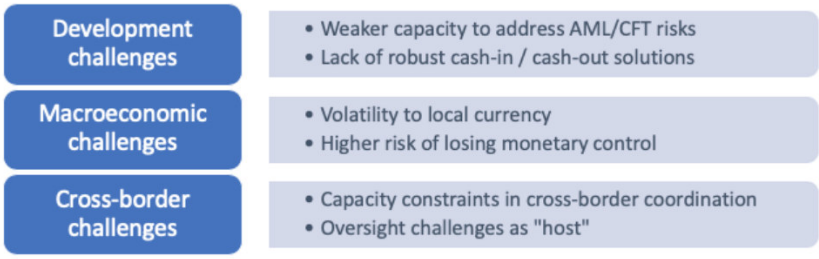

Figure 3.1: CAML/CFT Challenges to CBDC (Source: VoxEU)

3.3 Non-discriminatory access to Domestic Financial Services (Financial Inclusion)

Some publications by the Alliance for Financial Inclusion, digital financial services working group (DFSWG, 2019) access to domestic financial services is also commonly known as financial inclusion as the availability and equality of opportunities to access financial services by citizens. It also refers to a process by which individuals, households, firms and businesses can access appropriate, affordable, and timely financial products and services for an improved quality of life. These services include banking, loan, mobile micro loans, equity, and insurance products which every individual should have an opportunity to access. According to the top-level findings on the Zambian Finscope survey of 2020 (FinScope, 2020), access to financial services through financial inclusion increased by 10.1 percentage points to 69.4% from 59.3% in 2015. This increase was mainly attributed to the growth in the use of mobile financial services and other mobile financial platforms. Further research on the

implementation of Central Bank Digital Currency lessons learnt and key insights reviews that any CBDC initiative should supplement all the other digital financial services that have contributed to financial inclusion (Morales-Resendiz, Raúl; Ponce, Jorge; Picardo, Pablo; Chen, Bobby; Velasco, Andrés; Guiborg, Gabriela; Sanz, León, 2021). CDBC should incorporate open standards, open protocols and application programmable interfaces (API) to allow interoperability with other digital and mobile financial services to meet the financial inclusion agenda.

The thesis further reviews that financial inclusion can be measured in three dimensions including the access to financial services, the usage of financial services and the quality of the products and the service delivery that are offered in a market. The study postulates that the degree of financial inclusion is determined by three dimensions mainly the usage of digital financial services, the barriers and the access to digital financial systems. Another study from the World bank (Douglas & Claudia Ruiz, 2017) also reviews that to effectively measure financial inclusion, jurisdictions should qualify the number of automated teller machines per specific number of adults, the number of bank branches per specific number of adults, the deposit accounts with commercial banks per specific number of adults, the borrowers from commercial banks per specific number of adults and sometimes consider the digital insurance transactions in a specific area. All these measures may be inherited by a central bank digital currency making financial inclusion a compelling motivation to issue CBDC.

3.4 CBDC to mitigate the High Cost of Currency Processing

Literature from the Reserve bank of South Africa (SARB, 2021) estimates that the cost of handling currency makes up about 0.3% of the total GDP in the country. The accumulative cost of processing fiat currency in circulation (CiC) also includes the actual cost of printing the currency, currency management and the cost of cash processing machines such as the BPS M7, DLR7000 high-speed banknote processing machine, BPS, C5 and C4 desktop processing machines, glory FS-300 and FS-120 machines, Kisan smart K3 machines and Nota packs. The process also includes the costs associated to currency recycling that makes use of currency shredding machines such as online bracketing (OBS) machines that perform the mutilated and soiled notes management and reissuing back for public circulation. The cumulative cost of cash processing is therefore associated with the simple model (Ramos , Garratt, & Arauz, 2021) that assumes that we let the total cash in circulation (CiC) include all the costs of processing fiat currency. Figure 1.8 below shows a summary of the complete currency processing cycle from the Bank of Zambia.

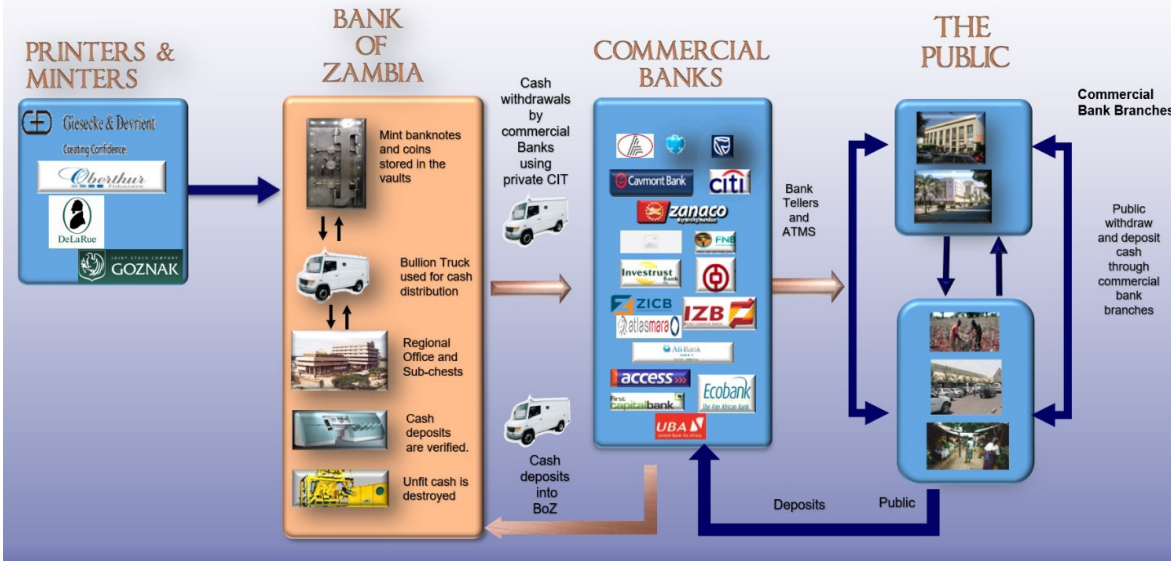

Figure 3.2: Cost of Processing Cash (Source: (BoZ,2020))

Despite some considerable improvements in the process in the recent past and sometimes accelerated by the need to prevent the person-to-person transmission of COVID-19, several mobile financial services have been adopted to reduce the use of cash. This cumulative cost is mainly attributed to the following costs that are associated with processing fiat currency from printing and minting, distribution through commercial Banks, day to day use by all economic agents and the recycling of soiled or unfit notes. Below is the summary currency circle:

1. The cost of printing currency including the recurring cost of cash templates, security features to prevent counterfeit notes
2. The cost of currency management that makes use of BPS M7 high-speed banknote processing machines, DLR7000 high-speed banknote processing machines, BPS, C4 desktop banknote processing machine, currency desktop sorters, currency glory FS-300 and FS-120 machines and kisan smart K3 machines

3. The costs of currency distribution that uses armored bulletproof cash trucks
4. Cost of Security services for Transporting cash to all sub chests
5. The cost of currency electronic management and Security systems including connectivity and maintenance to sub chests, technology, ICT and CCTV Equipment at main sites and sub chested
6. The cost of human capital for cash processing the whole cash cycle
7. The cost of currency recycling of removing soiled notes from circulation, currency shredding machines, online Bricketing System (OBS) and equipment and the soiled notes management and reissuing

4. Central Bank Digital Currency Model

The literature reviewed that there are several models for CBDC including the single-tier, two-tier and the hybrid setups. The single-tier setup has no hierarchy of distribution of CBDC and it is more suitable for the direct model, where the central bank issues digital currencies to all its users, the financial institutions and citizens, after conducting the KYC and AML checks before onboarding. This study adopted the two-tier model proposed by the Bank for International settlement in which the CBDC is issued from the Central Bank using the commercial banks as the second tier and may take the form of a retail, a wholesale and interoperable cross border multiple Central Bank Digital Currency (mCBDC). This model was ideal for this study because the study looks at the CBDC determinants that apply a two-tier CBDC model (BIS, 2021), which cements the benefits of tiered architectures for the distribution of retail CBDC through commercial banks, financial services providers and payment service providers alike. The two-tier model is a simplified abstraction of reality that incorporates the central Bank and all the financial institutions, banks, non-bank financial institutions (NBFIs), payment systems providers (PSPs) and all other financial services providers (FSPs). These in turn service the individuals, households and organizations that could have a CBDC account with FSPs. The model assumes that the CBDC can coexist with cash and serve as legal tender and be used as the medium of exchange, a unit of account and store of value for all agents in the Zambian financial landscape. The study adopted the framework of (Lagos & Wright, 2005) which has the same structure of a centralized market (CM) and a decentralized market (DM) and considered other theoretical investigations on the impact of CBDC in order to firm up on the two-tier model. The study also assumes that Zambia already has a competitive banking industry comprised of 18 commercial Banks (BOZ, 2021) and a growing number of NBFI, payment systems providers (PSP) and financial technologies (Fintech) organizations that are providing various payment systems platforms in the country. The access to a CBDC does not imply that the central bank provides retail services to all holders of CBDC, and for simplicity, the study assumes that only banks and NBFIs can trade CBDC directly with the central bank, while households and firms use a new type of electronic money issuance from NBFI, which can be assumed as a CBDC exchange that can be used to buy and sell CBDC in exchange for deposits. This is an alternative where individuals, households and firms can directly trade CBDC with the central bank but this is not the main responsibility of the central bank and the heavy lifting should be left to the commercial players for the central bank to concentrate on its main mandate (BIS, 2021). Figure 2.4 below shows the two-tier CBDC model and how the variables interact with each other. The main variables in this model include cash in circulation (CiC), internet penetration (IP), mobile subscription rates (MS), narrow money (M0,M1), broad money (M2,M3) and the nominal exchange rate (NER) for cross border transactions.

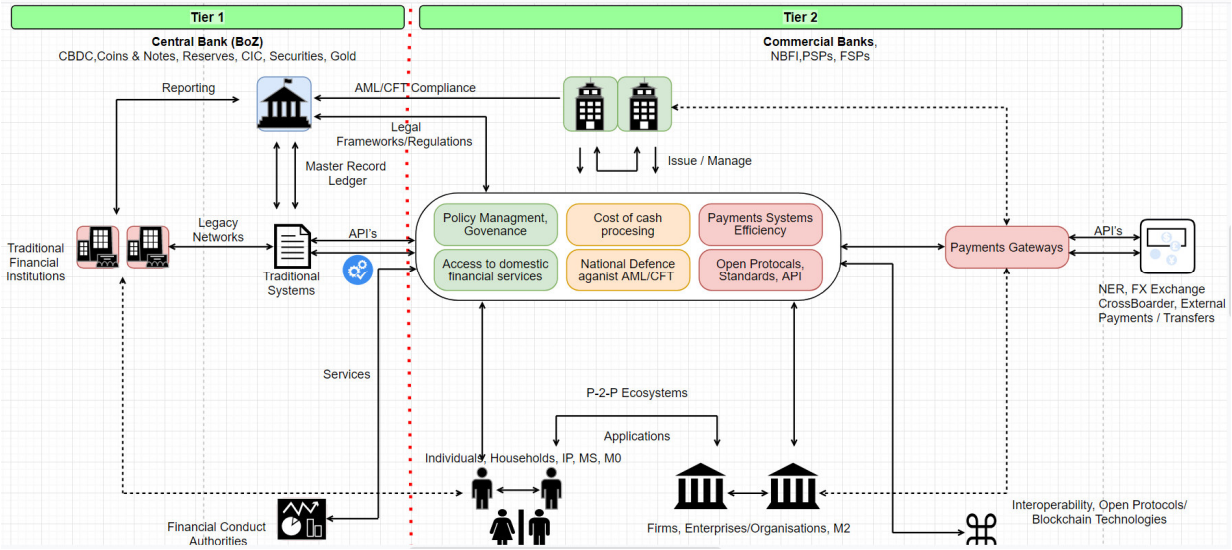

Figure 3.4: Two-tier CBDC Model (Source: Authors Construct)

To simplify the exposition, the study assumes that banks and NBFIs do not themselves use the services of

CBDC exchanges, given their direct access to the central bank and their ability to transact in wholesale debt markets to acquire eligible collateral. CBDC account holders can trade CBDC among themselves, in exchange for assets which might include bank deposits, goods and services. Banks, in addition to having CBDC accounts are also likely to minimize CBDC holdings, have access to reserve accounts at the central bank, and no other economic agents have access to reserve accounts.

Research further shows that there is a growing body of literature studies on CBDC determinants and their implications for payment systems, monetary policy implementation, and financial stability across the globe. Most notable is the study on the dynamic stochastic general equilibrium (DSGE) model which was used to study the impact of Central Bank Digital Currencies (CBDCs) on the financial sector (Gross & Schiller, 2021),(Kumhof & Noone, 2021). Another study by (Barrdear, John; Kumhof, Michael, 2021) estimates that CBDC issuance could increase GDP by as much as 3%, mostly by lowering the real interest rates of developing economies like Zambia. Other recent papers have studied the implications of an interest-bearing CBDC in micro-founded models of money and banking. This is a model where banks' deposits in form of CBDC yield interest and act as an incentive for the public to use formal banking services and increase the much-needed financial inclusion and hence making the banking sector perfectly competitive (Todd & Sanches, 2018). The model also shows that a CBDC crowds out bank intermediation according to literature by (Brunnermeiera & Niepelt, 2019) which further argues that if the central bank can channel funds back to the commercial banks, CBDC does not necessarily disintermediate banks as the interest-bearing CBDC may incentivize individuals keeping the CBDC in commercial banks, unlike individual electronic wallets which should have limits on the amounts of CBDC they should hold to avoid the risk of disintermediation. In another model with a monopoly bank, (Andolfatto, 2020) reviews that a CBDC could lead to more financial inclusion, a higher deposit rate, and more bank deposits. (Chiu, Davoodalhosseini, Jiang, & Zhu, 2019), further show that a CBDC could limit banks' market power, increasing the deposit rate, bank deposits, and bank lending. Quantitatively, the lending and output can be increased up to 3.55% and 0.50%, respectively. In a model where independence of a central bank and scarcity of assets backing bank deposits are considered, (Williamson S. , 2019) derives conditions under which an interest-bearing CBDC can increase social welfare in a narrow banking arrangement. It is further argued by (Dong & Xiao, 2021), that some forms of CBDC can help implement a negative interest rate which can boost economic activity for a developing economy like Zambia by encouraging banks and other entities to lend or invest excess funds rather than pay penalties on funds in bank accounts. Literature from another paper by (Monnet & Keister, 2020) rightly argues that a CBDC can lead to less bank risk-taking and higher output and welfare and that CBDC can provide the central bank with more information about the state of the commercial banks, thereby increasing the effectiveness of the regulatory policy and improving financial stability.

5. Conclusion

The study conducted a critical analytical review of the main determinant of Central Bank Digital Currency in Zambia. The literature reviewed determinates of issuing CBDC that are driven by the need for efficient payment systems platforms, stronger national defense against AML/CFT, non-discriminatory access to domestic financial services and for the CBDC to mitigate the high cost of processing cash. The research further showed that a decision to issue CBDC in a developing economy like Zambia could depend on these determinants. This critical literature review considered published literature from working series papers from global standards-setting organizations including the IMF, World Bank, WEF, ITU, ECB and many other international organizations. These determinants are applied to a developing jurisdiction like Zambia to ascertain the feasibility of a Central Bank Digital currency.

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