Financial Studies

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Contents

EFFECT OF CORRUPTION IN PUBLIC PROCUREMENT ON TAX REVENUE IN KENYA: A LITERATURE REVIEW

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Abstract

Taxation is one of the main ways through which a country finances her budget. This study focused on Value Added Tax (VAT) and it focused on the suppliers who take part in public procurement and, thus, are required to remit VAT for their goods. The objective of the study was to determine the effect of corruption in public corruption on tax revenue in Kenya. The study followed a desktop research design. The paper suggested that as long as there is corruption by procurement officials and other public officials, the government should consider doing away with charging VAT on its procurement goods and services and instead concentrate on buying goods at the recommended retail or wholesale price, arguing that any tax levied on their supplies ends up making the government not only lose the intended tax levy but also some extra money from its own funds.

Keywords: Kenya, Public procurement system, bribery, kickback, taxation, VAT

JEL Classification: G38; H72

1. Introduction

In order to fund the provision of public goods and services and to maintain the social and economic well-being of its residents, a government must compel its citizens to pay a tax (Kwabe, 2020). The

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amount of money obtained by taxing is referred to as tax revenue (Macharia, 2014). Taxation is a key weapon used by governments to promote economic growth and development. It enables a country to implement macroeconomic goals in the domains of monetary and fiscal policy resulting in a forced transfer of funds from people and organizations to the government (Macharia, 2014).

Most countries use taxation as one of the methods of financing their expenditure. It is a major contributor towards a country's revenue. There are many types of taxes which the government can impose on its citizens, and these include income tax, corporate tax, customs tax, sales tax, and Value Added Tax (VAT) among others. In an attempt to boost the productivity of the tax revenue, the Kenyan government has made significant investments in the enhancement of the tax system through the modernization of tax legislation and automation of tax administration. This has born fruits as evident from the fact that the country saw ordinary revenue increased gradually over time, going from Ksh. 682 billion in 2011/12 financial year to Ksh. 1.56 trillion in 2020/21 financial year. Despite the absolute growth, the growth rate has been decreasing over the years (RoK, 2022).

Government spending is greatly influenced by government revenue. Because of this, governments are eager to cut their recurrent expenditure, raise tax revenues, or take on additional debt in order to fund both recurring and non-recurrent expenses (Kithinji, 2019). This study will mainly focus on VAT which was introduced in Kenya in 1990 to replace sales tax because the latter was perceived to be retrogressive and did not provide for the deduction of input tax on businesses (GoK, 2022). Although there are many players in business who by law are bound to pay this type of tax to the government, this study will focus on the suppliers who participate in public procurement and who by extension are supposed to remit VAT for taxable supplies.

In Kenya, the procurement industry is still important since it has a big impact on people's lives and takes up a lot of budgetary resources. In the words of Manyara (2016), procurement in Kenya accounts for 45% of the total budget. The common practice in Kenya is that when a government entity procures goods and/or services from a supplier, the supplier is required by law to pay tax. The supplier acquires goods at their cost price and then adds his/her markup so as to determine the selling price of his goods. Then, in order to determine the price at which s/he should sell the goods to the public procuring

entity, s/he adds 16% VAT to cover the tax which the government will tax on the sale of the goods.

The paper objective was to determine the effect of corruption in public corruption on tax revenue in Kenya. The structure of the paper entails examining the status of corruption in Kenya, her effectiveness in achieving tax targets, and the empirical review of literature related to the topic. The paper also presents a discussion and general observations, and conclusions and recommendations.

2. Situation on Corruption and Tax Revenue in Kenya

2.1. Corruption

In Kenya, corruption is rampant and a major issue in all spheres of the economy (Mutangili, 2019). The country has continued to register a worrying trend as far as her Corruption Performance Index (CPI) ranking over the last ten years is concerned. Table 1 below shows Kenya's CPI over the last ten years.

Table 1

Kenya's CPI Over the Last Ten Years

Year	Rank	Score/100 /180
2022	123	32
2021	128	30
2020	124	31
2019	137	28
2018	144	27
2017	143	28
2016	145	26
2015	139	25
2014	145	25
2013	136	27

Source: Statista (2022)

Kenya's CPI greatest score in the last ten years is 32, (in 2020) which is the highest score ever. Kenya's score was 28, 27, 28, 31, and 30, correspondingly, according to the 5-year trend study from 2017 to 2021. The country's CPI fluctuated between 25 and 28 from 2012 to 2019, which is a blatant sign that corruption is out of control there. The average grade for Sub-Saharan Africa is 33, and the average rating

worldwide is 43 (Transparency International, 2022). All these statistics point to one thing, corruption is high in Kenya, and the vice has spread its roots far and wide, public procurement being no exception.

Studies have indicated that there is a lot of corruption that occurs in the event of public procurement. It is one of the government operations that is most susceptible to fraud and corruption, according to EACC (2015*)*. Often, this vice is initiated by procurement officers although sometimes Finance officers' shadows also appear on the shared cut. Corruption has been known to take forms. According to a report by Hawkins, Gravier and Powley (2013), comparing public and private sector procurement ethics and strategy in the US State Department, fraudulent practices typically occur during the supplier selection and contract administration stages and involve internal control activities, monitoring, and setting.

From Kimanzi's (2019) point of view, unethical behaviour is highly preferred in public organizations, and it typically occurs during the selection process, as seen by pressure from management to give contracts to particular vendors. The research claims that there is extensive price-inflating collusion between procurement workers and suppliers. There have even been several instances when procurement officials have insisted on only doing business with specific suppliers. Additionally, procurement officers may collude with suppliers to influence tender awards, suppliers may manipulate tender prices in their favour, and they may accept gifts and kickbacks from suppliers to influence bid decisions. This unethical or fraudulent behaviour may also include procurement officers accepting gifts and special treatment from suppliers to contractors, including expensive tours and lunches (Mkaliloto, 2015; Manyara, 2016).

Manyara (2016) argues that it is important to recognize the true costs of corruption in Kenya's public procurement system. According to EACC (2015) estimates, bribery and kickbacks in government contracts increase the overall cost of the deal by 10% to 20%. The majority of companies (53%) use bribes to obtain contracts, and 6–10% of the tender values are used for illicit payments. According to Manyara (2016), estimates of the losses brought about by procurement malpractice fall somewhere between 10 and 25 per cent of contract value and this is often due to poor processes. In this study, corruption will be looked at in two aspects: kickbacks and bribes made in advance so as to secure a contract or tender.

In most cases, procurement fraud involves top leaders or procurement staff who have personal ties to the seller. Bids are tampered with by using unreliable sellers, sometimes the sellers' costs or fees are increased by as much as between 40 to 100% over the stipulated prices market prices. Of concern is the realization that top organization leadership or buying staff are inactive partners of suppliers; and that money from bribes or kickbacks is typically estimated to account for 15 to 25% of each contract that is awarded (Manyara, 2016). This assertion is supported by Narasimhan (2012), who noted that although most kickbacks take the form of a 15 to 20 per cent cash payment of the granted contract, they can also take many other forms, such as the extension of additional personal favours to the buyer in order to be chosen.

According to the Inter-American Center of Tax Administrations (CIAT, 2019), people pay bribes to avoid paying taxes, for example through tax loopholes created in exchange for unlawful kickbacks-commissions, hence the most corrupt governments get less tax revenue. One of corruption's most harmful repercussions, in addition to the direct economic cost of revenue loss, is the erosion of faith in institutions, which undermines the strategy of promoting voluntary compliance with tax duties.

Despite the stringent laws in public procurement, it is believed that there would still be more corruption in public institutions than in private organizations (Mohamood, 2015). This could probably be because the perpetrators feel that those organizations don't belong to anyone, hence they don't feel answerable to anybody. In most cases, the supplier or contractor is typically granted a contract over market value, and the procurement staff receives money, materials, or other benefits in exchange for awarding the contract. A supplier may offer a variety of goods or services to a company during the inspection stage, including raw materials, goods manufacturing, transportation, logistics, independent sales and distribution of products, warehousing, consulting, or other substandard services that are still approved because procurement staff conspired with the vendor (Nyanguthii and Oyugi, 2013).

2.2. Government Taxation

Kenya's tax system has several difficulties that negatively affect revenue collection. For instance, despite the significant investment made by the government to modernize the tax system, Kenya's

revenue yield is still below the intended East African Community (EAC) objective of 25% of the Gross Domestic Product (GDP) necessary for the EAC Monetary Union. This pattern brought to light the fundamental problems with the tax system, such as rising tax expenditures, the complexity of taxing expanding economies, international tax disputes, and poor taxpayer compliance (GoK, 2022).

There are two most relevant tax policies on which the arguments in this study are based. These are administrative efficiency, and economic growth and efficiency. By administrative efficiency, it means that the cost of compliance by taxpayers and the administration cost to the Revenue Authority should be kept at a minimum level as much as possible. By economic growth and efficiency, it means that the tax system should be coherent with other Government policies and support sustainable economic development (GoK, 2022).

This paper aims to review the scholarly literature on the effect of corruption in public procurement on tax revenues. This review is based on Agency theory by Jensen and Meckling (1976). This theory tries to expose the problem that exists between principals and their agents. The theory argues that there exists a conflict of interest between the principals and the agents. Under this theory, the principals expect agents to act in the best interests of the agents. In the context of this study, the principal is the government while the agents are public procurement officers and other officers involved in the procurement process. It is perceived that if the procurement officers act professionally, corruption would be a thing of the past and in that case, the government will not lose money even if it charged VAT on its procurement.

2.3. Empirical Literature

Aghion et al. (2016) voiced the link between taxes and growth and the relationship between taxation and corruption, taxation has a deterrent effect on business owners, but public infrastructure has a favourable impact on them. The key finding of their model was that there is an inverted U connection between taxation and growth, with corruption lowering the optimal taxation level. This finding is crucial to the idea that taxes are bad for growth.

Baum et al. (2017) conducted research on taxes, compliance, and corruption. The IMF-compiled dataset for 147 countries covering the years 1995–2014 served as the study's foundation for analysis. The development of sizable taxpayer offices enhances tax compliance

by reducing the perception of corruption, hence improving revenue. It was found that corruption is negatively related to overall tax revenue and most of its components.

According to research done by Piff et al. (2012) on the factors influencing ethical standards in the United States of America (USA), upper-class people behave more illegally than those of lower social classes, and their immoral views encourage unethical activity in public sector procurement.

To examine corruption perception and attitude towards taxation in Africa, using data from the Afrobarometer polls conducted in 36 African nations between 2011 and 2015, Boly (2021) looked at how attitudes about paying taxes were affected by perceived corruption as a proxy for the quality of government. The study produced enough evidence to support the hypothesis that reported attitudes about taxes were negatively impacted significantly by perceived corruption in the president's office. The paper claims that enhancing public opinion of the president's office's governance effectiveness can aid in fostering more favourable views about taxes, leading to an increase in tax collections.

The Impact of tax administration and revenue on economic growth in Nigeria was examined by Ogbonna and Appah (2016). In order to get pertinent information, the investigation led to the collecting of primary and secondary sources. To determine if there was a correlation between the dependent and independent variables, 50 employees were chosen as a sample. According to the findings, there is a significant correlation between per capita income and personal income tax revenue, corporate income tax revenue and Nigeria's GDP, per capita income and VAT revenue, per capita income and petroleum profit tax revenue, and Nigeria's GDP. Therefore, the study draws the conclusion that, throughout the study period, tax administration and revenue did have an impact on Nigeria's economic growth.

Kwabe (2020) became interested in researching how taxes affect Nigeria's economic development. The goal of the research was to determine how Nigeria's actual gross domestic product will be affected by the petroleum profit tax and corporate income tax. The study used an ex-post factor research methodology, and the ARDL (Auto Regressive Distributed Lag Model) was used to analyse the data. For the time span covered by the analysis, the petroleum profits tax was determined to have a long-term, substantial positive connection with gross domestic product.

The effects of corruption on tax compliance and taxation In Pakistan were assessed by Khan, Safdar and Elahi (2021). The study's goal was to examine the impact of corruption on tax compliance, tax revenues, and the impact of corruption in various tax categories in Pakistan from 1984 to 2018. The findings indicated that while corruption lowers all tax receipts, some taxes are more negatively impacted. According to the study, stronger governance, a larger proportion of direct taxes, and more female labour force participation all lower corruption while public investment raises it. The results suggest that in order to lessen the likelihood of rent-seeking, the government must restrict the use of administrative power to obstruct economic activity.

The relationship between tax revenues, the impacts of corruption, and governance in West African Economic and Monetary Union (WAEMU) countries was analysed by Dramane (2022). On a panel of seven nations from 1996 to 2017, the study developed an econometric model utilizing three pertinent methods: the fixed effects technique, fixed effects with sample heteroscedasticity correction, and the instrumental variables approach. The results demonstrate that in WAEMU nations, good governance has a favourable impact on tax collections whereas corruption prevents tax revenues from rising.

In Sub-Saharan Africa, Jahnke and Weisser (2019) investigated how small corruption affects tax morale. The study gathered enough evidence from micro-level data from the Afrobarometer to demonstrate that petty corruption degrades tax morale and that the effect is more pronounced in nations and regions where fewer people are affected by petty corruption and loses significance if extortion of bribes is particularly pervasive. By using a mediation analysis, the study showed that petty corruption not only has a direct impact on tax morale but also undermines trust in tax officials and hence has an indirect impact on tax morale.

Hamoonga (2018) studied how Zambia's economy was affected by corruption in the country's public procurement system. The study's major goal was to determine how corruption in the procurement process affected a country like Zambia's economy. Data for the survey study were gathered by questionnaires given to 165 respondents and 8 interviews, who were senior officers, junior officers, and other departmental support workers. According to the study, corruption in the procurement process raises consumer prices, decreases investment, donor agency commitments, and foreign direct investment, affects

governments' capacity to cover budgetary expenses, and slows down economic progress.

Chariye (2016) investigated how much tax morale among corporate organizations in Addis Ababa, Ethiopia, was impacted by corruption. 500 company profit taxpayers who were chosen using a stratified random selection approach for this study were surveyed. The pertinent data were gathered using a structured questionnaire and then analysed using the Probit model. According to the study, corruption and tax morale are inversely associated. According to the report, most public officials take bribes and indulge in corruption, which makes the public believe that their taxes are not being used wisely and that they are not protected by the laws intended to combat corruption.

In Mogadishu, Somalia, Mohamed, Ebar and Ramli (2022) looked at how corruption and governance affected tax income. The findings showed that the regulatory burden and lack of political stability have a major impact on the tax revenue of public sector firms.

Mutangili (2019) conducted comparative research using Kenya and Tanzania as the benchmarks for comparison to highlight integrity in public procurement and combat corruption. The study employed a desk study review technique, reviewing pertinent empirical literature to find key themes. The study came to the further conclusion that while laws and institutions are crucial since they establish requirements for behaviour and set penalties for disobeying them, they are insufficient on their own.

In a study on corruption in the public procurement process in Kenya, Nyambariga (2016) found that suppliers in public institutions fuel procurement fraud by giving bribes to the officers in charge of the selection and tendering committees in order to gain preference in contracts worth millions of shillings.

Zallé (2022) found satisfaction in researching the connections between reliance on natural resources, corruption, and the collection of tax money. The study's goal was to examine the dynamic relationships between reliance on natural resources, corruption, and the collection of tax revenue on a global scale. A technique called cross-section augmented autoregressive distributed lag (CS-ARDL), which takes into consideration temporal dynamics, cross-sectional heterogeneity, and cross-sectional dependency, was employed to accomplish this goal. The study's conclusions demonstrated that, in contrast to overall tax income, lowering corruption encourages the mobilization of non-resource tax revenue. The study did note, however,

that tax revenue mobilization might occasionally be a source of corruption and rent evasion from natural resources. To prevent exploitative and rent-seeking conduct, tax administration mechanisms must be reinforced.

According to EACC (2022), corruption skews economic judgment, discourages investment, erodes competitiveness, and ultimately impairs economic growth. Kenya's underdevelopment, poor public service delivery, sloppy project implementation, widening of the gap between the affluent and the poor, and significant loss of public monies are all consequences of corruption.

While acknowledging that corruption has a significant negative impact on the amount of tax revenue that is collected in a nation, Transparency International (2010) quickly notes that the current understanding of the relationship between corruption and tax revenue is incomplete because there is a lack of data on how taxes affect corruption. Few studies, if any, have attempted to investigate the relationship between kickbacks as a type of corruption and its overall impact on tax revenue collection.

In 2019, Kithinji (2019) examined how taxes affected Kenyan government spending. The study's goal was to determine how taxes affected Kenyan government spending. In order to ascertain the impact of tax revenue on government spending and the connection between tax revenue and government spending in Kenya, this study used a causal research approach. The National Bureau of Statistics was contacted for secondary data covering the years 2004/05 to 2010/2011. Descriptive statistics and a regression model were used to evaluate the data. The study found that government revenue greatly affects government spending, and it was advised that for the government to be able to cover both recurring and non-recurrent expenses, it should either lower its recurrent spending, boost tax revenues, or borrow more.

In a study on taxation and revenue stability in Kenya, Muraya (2013) regressed revenue instability against revenue diversification, revenue capacity, and economic base instability and found that, while exogenous variables had an impact on revenue instability in the long run, only economic base instability had a significant impact. Muraya concluded that there was no short-run relationship between revenue instability and the independent variables.

Macharia (2014) was interested in how tax evasion affected Kenya's tax receipts. Investigating how taxes are avoided, examining

the consequences of tax evasion on tax revenues, identifying controls for tax evasion, and determining whether there is a connection between tax evasion and rates of tax in Kenya were the major goals of the study. The Kenya Revenue Authority's investigation of 50 tax evaders was the focus of the research. The analysis clearly showed that overall tax evasions had a negative but considerable impact on Kenya's tax collection.

Manyara (2016) conducted a study on the corruption in Kenya's public procurement system, concentrating on the Ministry of Devolution and Planning. The study's goals were to identify the causes of corruption and determine the degree to which it influences Kenya's public procurement system. Using a proportional stratified sampling technique, a sample of 41 workers was chosen and permitted to take part in the survey. According to the study, corruption was significantly influenced by collaboration, payment, pressure from management and society, social position, and protection.

3. Discussion and general observations

From the aforementioned literature, it is evident that there is a lot of corruption which goes on in public procurement. The fact that procurement officials charge as high as 40% kickback is indicative of how the vice has gained root and that many suppliers are competing to get an opportunity to supply to the government. It is also regrettable that some suppliers themselves participate in the corruption by inflating the actual selling price up to twofold.

Going by the fact that the procured goods and/or services are already overpriced by a percentage which is greater than the VAT charged on them (to meet the cost of the cut and maybe the sellers' abnormal profit margin), it follows that the government incurs a net loss. For instance, let us assume a supplier acquires goods at their cost price and then adds his usual markup so as to determine the selling price of his goods. Then, to determine the price at which s/he should sell the goods to the public procuring entity, s/he adds 16% VAT to cover the tax which the government will tax on the sale of the goods. For instance, if the supplier intends to sell goods for KES.100, he needs to include 16% that he will be required to pay the government as VAT, making the selling price KES. 116.

In a case where the accountant, procurement officer or any corrupt other public officer demands a certain percentage as a

kickback, this is also often considered when the supplier is calculating the selling price of the commodity, and this is usually a percentage of the value of goods procured (which in itself consists of the selling price inclusive of VAT). Using the illustration above, KES. 116 forms a basis on which kickbacks are calculated since, to the procurement officers, the organization will pay for the good at this price. Assuming a minimum kickback of 15% as documented by Manyara (2016), this means the price will be inflated by KES. 17.40. Hence the government will buy the goods at KES. 133.40. The actual VAT to be deducted at 16% will be calculated at this inflated price, yielding KES. 21.34. Notice that the government has paid an inflated price of KES. 133.40, and it will receive a tax of KES. 20.62. clearly, there is a loss of KES. 12.06 (KES. 33.40 less KES. 21.34). This loss can be mitigated if the government buys the goods at the recommended or prevailing retail price since in most cases the price is readily available and known in the public domain.

Worth noting is the fact that the loss gets bigger when the percentage of kickback increases, or when the supplier decides to charge abnormal profit margin since he knows the procurement officer is also unfairly benefiting from the sale. Moreover, the government loses more in situations where the procuring entity pays for procurement items but either fails to remit tax or pays after a long period of time. For example, it was brought to the limelight in 2023 that some 11 cash-strapped public universities in Kenya owed the government over KES. 9 billion in tax arrears, accumulated over several years, and this led to the freezing of their accounts for some time and the request for tax exemption. This money was in essence 16% VAT for some goods and services procured and which the government paid for, but the tax was and has not been realized.

4. Conclusions and recommendations

Judging from the findings of this study, it is recommended that, as long as there is corruption by procurement officials and other public officials, the government should stop charging VAT on its procurement goods and services and instead concentrate on buying goods at the recommended retail or wholesale price. Since such prices are always in the public domain, it will be a bit difficult for procurement officers and suppliers to collude and inflate prices.

Further, there is no reason for the government to pay for a unit of goods at a price inclusive of VAT, and then require the officers to deduct VAT at source since this may also result in delayed remittance of the VAT back to the government. It is worth noting that, delayed remittance back to the government makes money not only to lose value but also delay some projects which could have otherwise been immediately funded with the money. This means that government projects can be started and completed earlier (*ceteris paribus*) since the time lapse between when it pays for procured items and when it collects VAT will be eliminated altogether.

It is also recommended that, by doing away with taxation on public procurement, a country will not only eliminate the complexity of taxing but also eliminate rising tax expenditures resulting from audit. Hence, the government is likely to improve the principle of convenience and the principle of administrative efficiency of tax. It breaks the principle of Convenience (because it adds VAT to the cost of goods and then it gets deducted by the same source hence double work). It also breaks the principle of administrative efficiency in the sense that, in the event of the government paying VAT on the inflated price, it fails to produce the highest possible yield at the lowest possible cost both to the tax authorities and the taxpayer.

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THE IMPACT OF CENTRAL BANK DIGITAL CURRENCY ON DIGITAL FINANCIAL INCLUSION: EVIDENCE FROM NIGERIA

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Abstract

Financial inclusion continues to be a significant challenge in Nigeria since many Nigerians are excluded from the financial ecosystem. This article investigates the impact of the Central Bank Digital Currency (CBDC) on digital financial inclusion using a quantitative research design and data collected from Nigerians. This was a correlational quantitative research study using a survey questionnaire distributed to 500 members of the Nigerian public using the eNaira. The results indicate that CBDC has a positive impact on digital financial inclusion; it facilitates improved access to financial services, reduces transaction costs, increases the number of banked members of the population, and enhances the efficiency of digital payments. This study concludes that CBDC is essential to improving financial inclusion in Nigeria. Based on these findings, it is recommended that policymakers in Nigeria continue to promote and prioritize the adoption of CBDC. Therefore, future research could explore the impact of CBDC on other aspects of financial inclusion beyond those explored in this study. For example, the research could be conducted to examine how CBDC impacts access to credit or explore the potential impact of CBDC on financial stability and monetary policy.

Keywords: financial technology, financial access, monetary policy, technological innovation

JEL Classification: E58; G38

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1. Introduction

Technological advancements in the financial sector have led to digital breakthroughs, such as mobile money, FinTechs, stablecoins, cryptocurrencies, and Central Bank Digital Currency (CBDC) (Ozili, 2022a). The rise in digital payment innovations has accelerated the cashless movement, particularly in developing and emerging economies (Ozili, 2023). The increasing volume of CBDCs is attributed to the growth in blockchain-enabled distributed ledger technology and the dominance of cryptocurrency (Alliance for Financial Inclusion, 2022; Ozili, 2022a). CBDCs offer several benefits, including enhancing the effectiveness of monetary policies, promoting a cashless society, and enabling financial inclusion (Banet & Lebeau, 2022; Cooper et al., 2019; Ozili, 2023). Central banks worldwide recognize the potential of CBDCs to boost national economies through financial inclusion (Auer et al., 2021). Therefore, CBDCs represent a powerful tool for financial inclusion demonstrating the evolution of digital technology. Financial inclusion is the distribution of financial services by numerous providers, the majority of which are in the private sector, to reach everyone who can utilise them (Kama & Adigun, 2013)

Financial inclusion remains a major challenge in Nigeria. In this developing nation, the bulk of the money in the economy stays outside the banking system due to a lack of financial inclusion (Kama & Adigun, 2013). Many adults in Nigeria remain excluded from digital payment ecosystems thus solely depending on cash for their financial needs. Most of the citizens in Nigeria are comfortable living their lives with no relationship with the banking system. Nigeria is one of the countries in Sub-Saharan Africa with many unbanked population (Ekong & Ekong, 2022). Approximately 60% of the Nigerian population is not part of the banking system (Global Finance, 2021). All these demonstrate the need to establish solutions that will foster financial inclusion in the country.

The purpose of this research study was to investigate the impact of CBDCs on digital financial inclusion in Nigeria. Particularly, to explore the extent to which CBDC can serve as a solution promoting financial inclusion in this emerging economy. This means that understanding the role played by CBDC towards financial improvement in Nigeria encompasses exploring its impact on financial inclusion. This is even more significant because there remain many gaps in the literature towards financial inclusion in Nigeria (Ekong & Ekong, 2022;

Ozili, 2022b). For instance, it is essential to investigate the role of digital finances regarding the promotion of financial inclusion. This is because there is a lack of adequate recent literature on the role of digital financing in combatting financial exclusion in Nigeria. Additionally, empirical investigation regarding the impact of digital currency on financial inclusion remains scanty concerning developing economies such as Nigeria. For this reason, this research paper aimed at making several contributions to the literature in this field. The first contribution is to the literature on financial inclusion in developing nations. This study utilized Nigeria to illustrate the severity of the problem of a lack of financial inclusion in developing nations and its impact on the economy. The second contribution is the use of digital currency in promoting financial inclusion. The study achieves this by exploring the role of CBDC as a digital currency applied to promote financial inclusion. Accordingly, the research question that was addressed in this study was, what is the impact of CBDC on digital financial inclusion in Nigeria?

The structure of the remainder of this research paper is as follows. The second section of the paper is the literature review which conducted a critical evaluation of the existing research on CBDC and its role in promoting financial inclusion in Nigeria. The study's research methodology is highlighted in the third section illustrating the key methods used to conduct this study. The next section is results which entailed the presentation of quantitative data gathered to test the research hypotheses. This section also includes a discussion of the research findings. The study's primary findings and important suggestions based on its findings are summarized in the conclusion section of the research paper.

2. Literature review

2.1 Theoretical underpinnings

The dissatisfaction theory of financial inclusion forms the foundation of this research study. This theory advances that financial exclusion takes place the moment that people show dissatisfaction with the actions of financial institutions toward them as customers. When customers experience frustration, they may opt to exit the financial system altogether. As a result, they may be more likely to trust the central bank than financial institutions, as the former offers an alternative to accessing the financial system without having to interact

directly with financial institutions. This is because the central bank provides people with the opportunity to access the financial system without the need to deal directly with financial institutions. Thus, the issuance of CBDC is one of the ways that the central bank can provide this alternative. However, careful consideration must be given to the potential risks and challenges associated with CBDCs to ensure that their benefits are maximized while minimizing any potential harm. In the case of Nigeria, the central bank has recently issued the eNaira as a means of providing Nigerians with an alternative way of accessing the financial system. According to Ozili (2023), the eNaira represents a significant step forward in the quest for financial inclusion in Nigeria. Thus, the dissatisfaction theory of financial inclusion offers a useful framework for understanding the challenges facing financial institutions in their efforts to reach underserved populations. The issuance of CBDCs like the eNaira represents a promising way forward in the quest for greater financial inclusion.

2.2 CBDC, definition, and implementation in Nigeria

There are several different CBDC definitions illustrated in the literature. (Auer et al., 2021; Bitter, 2020; Bordo & Levin, 2017; Cooper et al. 2019; Ozili, 2022b). According to Auer et al. (2021), CBDC is a form of digital money usually dominated by the national unit of account having a direct liability to the central bank. On the other hand, Ozili (2022a) defines CBDC as digital currency issued by a central bank and is a liability of the central bank that issued it. Further, Bitter (2020) defines CBDC as an interesting bearing issued centrally and existing as an account-based digital format of the liability of the central bank accessed by the general public. Bordo and Levin (2017) define CBDC as the monetary value stored electronically representing a liability to the central bank. Contrariwise, Ekong and Ekong (2022) define CBDC as government-backed cryptocurrencies issued by central banks and accepted for financial settlements. In further reviewing the definitions of CBDC, this also includes that of Kumhof and Noone (2018) as electronic central bank money with more access than reserves demonstrating greater functionality for retail transactions compared to cash with a separate operational structure in comparison to other forms of central bank money.

While the above definitions of CBDC lack consistency, there are several common emerging characteristics. For instance, the above CBDC definitions demonstrate it to be a digital currency that is a liability

to the central bank. Auer et al. (2021) indicate that CBDC as the digital liability of the central bank can become a new instrument for settlement between financial institutions. At the same time, CBDCs can become a central bank liability by serving as digital cash accessible to all. Additionally, CBDC as a liability to the central bank tends to differ from cash in terms of physical attributes despite having the same function as cash towards making payments. This is because CBDC is a currency issued by a central bank. Further, these definitions show that CBDC is an emerging regulated alternative offered by central banks to private cryptocurrencies and stablecoins. Cooper et al. (2019) explain that based on this aspect of the use of CBDC it serves as a tool for signalling national digitalizing efforts in tandem with peers. Thus, CBDC is a currency that is created and regulated by a national monetary authority. The definitions also demonstrate that CBDC serves as a store of value that transfers purchase power from the present day into the future. Further, the above definitions indicate that CBDC is a unit of account that can be utilized to value goods and foster price comparisons between items (Alliance for Financial Inclusion, 2022). To add, the definitions indicate that CBDC is exchangeable as a payment instrument.

The digital nature of CBDC reveals some of its key characteristics. One of these characteristics is that CBDC is programmable thus unlocking automation (Banet & Lebeau, 2022). Another digital trait of CBDC is it is electronic therefore allowing for transparency as its electronic nature makes it traceable (Alliance for Financial Inclusion, 2022). Another trait of CBDC is it is an essential digital component of the central bank. This is according to Auer et al. (2021) who perceive CBDCs as digital extensions of the existing form of central bank money and central bank settlement account. CBDCs offer the digital means for legally tended financial transactions and they alleviate the volatility risk linked to other untended cryptos (Ekong & Ekong, 2022).

The literature further delves into the nature of CBDC by reviewing its categories and nature. For instance, Auer et al. (2021) explain that CBDCs exist as account-based or token-based. The account-based CBDC refer to those relying on some element of identification while the token-based mean that the CBDC enable anonymity in payments. Further, CBDCs can exist in the form of DLT or as conventional technological infrastructures (Ozili, 2022a). The application of CBDC can be for wholesale purposes by financial

institutions or retail use by households and businesses (Alliance for Financial Inclusion, 2022).

A historical analysis of CBDC reveals that the idea of extending central bank money as digital currency available to the public is not something new. Auer et al. (2021) opine that a proposal was made in 1987 on deposited currency meant to improve payments and reduce the considerable reliance on deposit insurance. Over the past few years, several central banks worked on internal projects to gain a better understanding of the technology of cryptocurrencies and the potential use of DLT on government-issued digital currencies. A trace of this reveals the central banks of Canada, Netherlands, Singapore, and the UK. However, the findings of the internal projects were not conclusive because they demonstrated that DLT lacked maturity for use as a major central bank payment system. Restored faith in digital currency took place in 2016 following several central banks launching related research projects to be utilized for while reasons (Auer et al., 2021).

A review of CBDC technologies reveals the centralized nature of CBDC. According to Auer et al (2021), CBDCs have decentralization enabled through DLT. DLT entails permissionless technology such as Bitcoin and other forms of cryptocurrencies (Alliance for Financial Inclusion, 2022). This includes the permissioned variant encompassing a network of known and vetted validators that are jointly augmented into a ledger.

There is some literature developed concerning CBDC implementation in Nigeria (Ekong & Ekong, 2022; Ozili, 2023). Ozili (2023) reveals that Nigeria launched its first CBDC commonly referred to as the eNaira on the 25th of September 2021. eNaira has similar features to the paper Naira. However, this digital currency provides additional payment possibilities for citizens. For this reason, the eNaira CBDC serves as an efficient payment tool. According to Ekong and Ekong (2022) launching the eNaira has enabled Nigeria to gain international recognition. Additionally, eNaira provides users with several other benefits including increased financial inclusion. Other benefits of this CBDC include enhanced efficiency of payments, improved monetary policy effectiveness, implemented targeted social interventions, improved tax collection, and fostering cheaper and faster remittance inflows (Auer et al., 2021; Ozili, 2023). The study by Ozili (2023) explores the use of eNaira in the country and makes findings that it is most popular in the northern states of Nigeria compared to the southern states.

2.3 Financial inclusion and the situation in Nigeria

The review of the literature reveals that there are several definitions of financial inclusion (Allen et al., 2022; Auer et al. 2021; Demirgüç-Kunt et al. 2015; Ozili, 2018). For instance, Demirgüç-Kunt et al (2015) define financial inclusion as access to and application of formal financial services to improve the welfare of citizens in a country. Allen et al. (2022) define financial inclusion as the application of formal financial services. The definition of financial inclusion by Ozili (2018) is the provision of affordable financial services to people. Conversely, Auer et al. (2021) define financial inclusion as how individuals and businesses can access useful and affordable financial products and services to meet their needs such as payments, transactions, savings, credit, and insurance. Based on the above definitions, financial inclusion is the ability of people to have access to transactions that serve as the initial step towards financial inclusion. This is because such a transaction allows them to store and send money and receive payments.

Extant literature explores the benefits of financial inclusion (Kama & Adigun, 2013; Ozili, 2023). Thus, financial inclusion through improved access to financial services brings about considerable benefits such as the creation of a large depository of savings, investment, and investable funds, and the establishment of global wealth generation. Kama and Adigun (2013) elucidate that access to financial services by low-income earners enables considerable capital accumulation, credit development, and a rise in investment. One key reason for this growth is, low-income earners tend to constitute the largest proportion of the population and for this reason, they control a large section of the idle funds in the economy. Ozili (2023) finds that financial inclusion is beneficial because it enables persons and businesses to have access to affordable formal and financial services which results in the improvement of their welfare. According to Ozili et al. (2021), financial inclusion is beneficial to Nigeria because it can result in economic advantages because of the access to formal financial services which enables Nigerians to invest in education and entrepreneurial services. Adeola and Evans (2017) reiterate this by explaining, financial inclusion in Nigeria can fasten economic diversification, bringing about economic gains, and facilitating considerable prosperity in the country. Consequently, financial inclusion has the benefits of reducing poverty and increasing income. Kama and Adigun (2013) indicate that financial inclusion is essential in

providing access to people around the population excluded from financial services.

However, the benefits of financial inclusion are only achievable when it is done correctly. This is according to Ozili (2022b) who explains that any improper implementation of financial inclusion can expose the poor to risk within the formal financial system. For instance, the risks regarding the utilization of financial products and services. Thus, these are risks that worsen the well-being of the poorest while increasing income inequality. Therefore, despite the benefits provided by financial inclusion, there remain challenges to its attainment. Ozil (2022b) indicates that on the demand side, the challenges of financial inclusion include the lack of awareness concerning present financial services, superstitious and religious beliefs regarding banking, increasing financial illiteracy, and high transaction costs. Conversely, the challenges on the supply side are such as the unwillingness of banks to facilitate financial inclusion programs, minimum bank penetration, and the unwillingness of banks to incur the social cost of the bank-led financial inclusion program.

In Nigeria, financial inclusion is a major challenge (Ozili, 2023; Ozili, 2021). Ozili (2021) explains that financial inclusion is a growing concern in Nigeria. This is because the country demonstrates less inclusion when compared to more developed African countries such as South Africa. Most Nigerians live outside of the financial system. According to the Central Bank of Nigeria (2021), the currency outside of the banking system in Nigeria has grown considerably between 2015 and 2020 increasing from 1.46 trillion to 2.3 trillion Naira respectively. The absence of financial inclusion in Nigeria is worse in certain regions of the economy and the rural areas in comparison to the urban areas. Kama and Adigun (2013) point out, rural Nigeria shows disproportionate exclusion from financial services. Further, the North region demonstrates the highest percentage of the unbanked population (Kama & Adigun, 2013). At the same time, this region also shows the least number of bank branches.

Several challenges have contributed to the high rate of financial exclusion in Nigeria. One of these challenges is the lack of financial sophistication among rural dwellers because of limited financial literacy. According to Kama and Adigun (2013) most of the approximately 40 million financially excluded Nigerians lack knowledge regarding the services and benefits of financial services. The high rate of poverty is also a challenge towards financial inclusion. Additionally,

the uncompetitive wage levels, especially within the public sector, continue to be a hindrance to financial inclusion in Nigeria. The inability of many Nigerians to save because of inflation is yet a challenge undermining financial inclusion. Ozili (2021) explain that political interference is also a challenge to financial inclusion in Nigeria. For instance, lawmakers have blocked some attempts by the financial system regulator, the Central Bank of Nigeria to implement certain financial inclusion policies. The outcome is a country that cannot attain its financial inclusion goals. The high cost of doing business is also a challenge towards the attainment of financial inclusion in Nigeria. Some of the reasons for this high cost of doing business are high energy costs, lack of a national database with customers' financial history, and insufficient credit bureaus. Thus, this is a development that causes a rise in the interest rates on loans and transaction costs. Additionally, corruption exists as a major challenge to financial inclusion in Nigeria. For instance, there have been cases of misappropriation of the public funds allocated for financial inclusion programs and activities. This is a development that took place in the 1990s a time when Nigeria was facing the banking crisis which significantly eroded the confidence of the populace in banks (Kama & Adigun, 2013). Excessive spending by the political class aggravated this issue resulting in a high level of currency that was not within the banking system.

Thus, this review of the literature reveals past efforts for financial inclusion in Nigeria (Kama & Adigun, 2013). Before the recent efforts towards the promotion of financial inclusion, the Nigerian economy was mainly a cash-based one with a substantial proportion of the narrow money stock existing in the form of current that circulated outside of the banking system. According to Kama and Adigun (2013), an estimated 54 million Nigerians lack financial services and tend to receive services via informal institutions, or they are completely unbanked. For those who are formally banked majority use the products and services of the deposit money banks as salaried workers or as businesspeople while the remainder of the formally served to utilize the services of other formal financial institutions such as microfinance institutions and finance houses. Over the years, the Nigerian government and several monetary authorities have implemented various policies to deepen financial inclusion in the economy. These policies have encompassed the involvement of several institutions including the establishment of community and

microfinance banks (Kama & Adigun, 2013). The significance of these goals is to improve access for the financially excluded to formal financial services. However, the Nigerian government's recent attempt at financial inclusion is the use of CBDC. According to Ozili (2023), the central bank of Nigeria believes that the eNaira is the digital currency that will broaden financial inclusion benefiting Nigerians.

The adoption of modern electronic payment channels and cashless policy played an integral role towards Nigeria's development of its CBDC, eNaira. The basis of the development of this policy is the following three key objectives (Kama & Adigun, 2013). The first objective is to develop and modernize the payment system. The second objective is reducing banking costs to drive financial inclusion. The final objective is to improve the effectiveness of the monetary policy. Thus, the expectation was that the policy would drive financial inclusion through the implicit assumption that reducing banking costs and developing a more efficient payment system would encourage more people and businesses to adopt formal financial services and platforms.

2.4 CBDC facilitates financial inclusion

Financial inclusion is one of the main drivers and advantages of issuing CBDC. Thus, several studies in CBDC literature predict a relationship between CBDC and financial inclusion (Auer et al., 2021; Foster et al., 2021; Ozili, 2021). Auer et al. (2021) observe that central banks continue to show interest in CBDCs as a new form of innovation towards financial inclusion. Ozili (2021) demonstrates that the use of CBDC in the promotion of financial inclusion has grown considerably. This promotion encompasses the digitalization of value chains within the economy, therefore, improving the efficiency of digital payments while reducing the related transaction cost and enhancing access to digital financial services. The study conducted by Foster et al. (2021) also demonstrates the role played by CBDC towards financial inclusion. According to the findings of this study, CBDC is essential in accelerating financial inclusion among members of the excluded populations. This is by providing these people access to central bank currency enabling the very poorest to avoid high costs charged by banks. Ozili (2023) opines that CBDC increases financial inclusion in Nigeria because it provides low transaction costs for users.

In further reviewing the impact of CBDC towards financial inclusion, the literature demonstrates that the quest for digital currency

serves as a drive towards the redesign of the financial system that is citizen-friendly and inclusive. For instance, Yuhelson et al. (2020) elucidate that the use of digital currency via authorized e-cash works to widen the entrance and capacity for persons in financially included activities. The findings of Foster et al. (2021) opine that a CBDC accelerates financial inclusion in the excluded populations by providing people with access to central bank currency. This enables the poorest to avoid the high costs charged by banks and mobile money providers. Engert and Fung (2017) postulate that financial inclusion is essential for adopting CBDC as it regards emerging economies. Thus, most emerging countries are interested in CBDC because of the financial inclusion benefit. Barontini and Holden (2019), indicate that central banks are issuing CBDCs as a way of broadening financial inclusion goals. Maniff (2020) indicate that CBDC results in financial inclusion by modernizing payment systems via new and increasingly efficient technologies serving as additional functionality. Further, Maniff (2020) opine that an increase in financial inclusion can occur by providing a viable solution to the frictions experienced in cross-border payments.

Additionally, the findings of Murakami et al. (2022) opine that CBDC has the advantage of financial inclusion for underserved adults and the unbanked population, improving cross-border payments, and fostering fiscal transfers. Armas et al. (2022) reiterate the CBDCs' contribution to making financial services more accessible to the unbanked population. According to this study, CBDC helps the unbanked to access digital payment instruments through the following ways: payment in public transport, payment of wages within the informal sector, fund transfers without reliance on the banking system, and extending the accessibility of digital payments to the government. Barr et al. (2020) affirm that the CBDC enables financial inclusion through the expansion of access to financial services. The findings of Allen et al. (2022) reveal that CBDC facilitates financial inclusion by reducing transaction fees and the cost related to financial services. Similar findings are made by Zuluaga (2021) who opines that CBDCs are instrumental in the reduction of high fees, therefore, becoming appealing to the unbanked persons. Negrea and Scarlat (2022) confirm these results by indicating that CBDC is instrumental in serving unbanked adults in instances where there is a lack of traditional infrastructure. This is instrumental in enhancing the population's access to capital. The study by Banet and Lebeau (2022) further confirms the relationship between financial inclusion and CBDC.

Didenko and Buckley (2021) in their study indicate that a well-developed CBDC provides a viable solution to the challenges of financial inclusion. Despite this, more research should be conducted to develop specific knowledge towards a well-designed CBDC.

As a result, central banks recognise the significance of digital payments towards financial inclusion this has led them to engage more in the expansion of their regulatory toolbox in a bid to address the outstanding payment needs of people through leveraging digital payment innovation. Banet and Lebeau (2022) opine, CBDC fosters financial inclusion if the condition on its fixed use cost and its interest rate remains high enough. This increase in financial inclusion occurs in two ways. The first is when the CBDC fixed cost remains low resulting in the currency becoming attractive to agents in the middle of the income distribution. This includes agents that have uniquely held paper money. The second way is when the fixed cost is high and wealthier agents adopt CBDC (Banet & Lebeau, 2022). Therefore, this results in financial inclusion by poaching deposits away from banks to increase the deposit rate. Consequently, this makes deposits to become attractive to the wealthiest paper money holders.

The study conducted by Ozili (2023) provides better insight into the impact of CBDC on financial inclusion within the context of Nigeria. Thus, this study illustrates that eNaira has contributed to financial inclusion in Nigeria in several ways. One of these ways is providing an easy process for account opening. The eNaira contributes to financial inclusion by offering lower costs for financial products and services. Additionally, the eNaira illustrates the role of CBDC towards financial inclusion in Nigeria because it eliminates any unexplained bank charges that result in financial exclusion. Further eNaira enables financial inclusion because it allows for digital access to several financial services within the financial system. Ozili (2022), also explores the impact of CBDC on the increase in financial inclusion in Nigeria. The scholar makes the argument that CBDC will cause the digitalization of the value chains in Nigeria which will improve access to vital digital financial services. Thus, this will cause the growth of the digital economy in the country. At the same time, this has the impact of enhancing the efficiency of digital payments while providing low transaction costs for those using CBDC. However, attaining financial inclusion using CBDC should be done following careful design. Maniff (2020) opines that CBDC can experience challenges in increasing financial inclusion in case the design of the currency conflicts with other

objectives for creating it. Additionally, CBDC, which is created for financial inclusion needs to complement cash.

2.5 Hypothesis development and conceptual framework

Based on the research objectives of this study and the discussion in the reviewed literature the following research hypotheses were developed as possible answers to the research questions of this study as shown below. The independent variable in this case is CBDC while the dependent variables are access to financial services, reduced transaction costs, increased number of banked people, and improved efficiency of digital payments. These dependent variables illustrate the key elements of financial inclusion enabled through CBDC.

H1: CBDC facilitates digital financial inclusion by improving access to financial services.

H2: CBDC facilitates digital financial inclusion by reducing transaction costs.

H3: CBDC facilitates digital financial inclusion by increasing the number of banked members of the population.

H4: CBDC facilitates financial inclusion by improving the efficiency of digital payments.

Figure 1

Conceptual Framework and Hypotheses
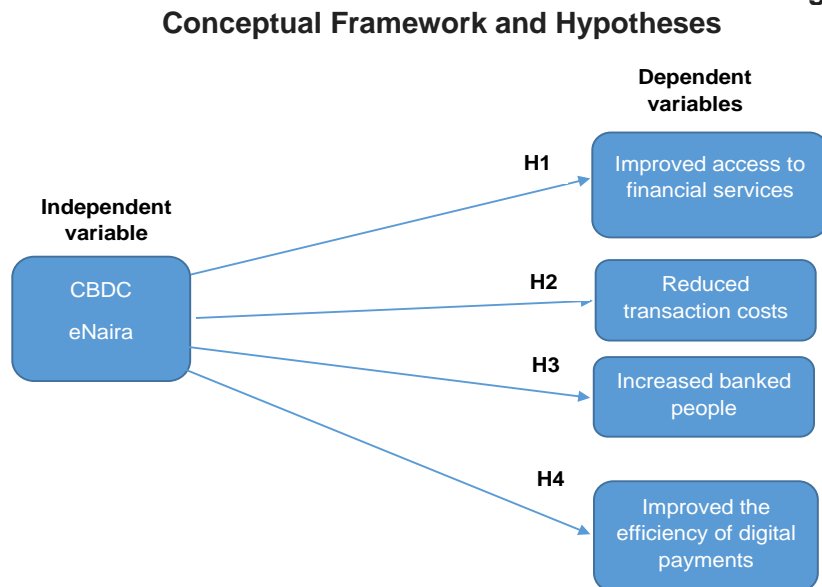
Source: Author's

3. Methodology

3.1 Research design

The study utilized quantitative research design. Apuke (2017) explains that a quantitative research design entails the quantification and analysis of variables to obtain results. It entails the use of numerical data and statistical techniques to analyse that data to answer questions like *who*, *how much*, *what*, *where*, *when*, and *how many*. This research study applied the correlational research design. Correlational research attempts to determine the extent of a relationship between two or more variables using statistical data (Curtis et al. 2016). In this type of design, relationships between and among several facts are sought and interpreted. For this study, this meant that every variable that was presented in the individual hypotheses was observed by testing the causal relationship of the independent and dependent variables. Mohajan (2020) explains that the quantitative research design consists of systematic observation and description of the key characteristics of events or objects to discover the relationships between an independent variable and the dependent variable in a given population.

3.2 Sample and sampling

A research sample is a finite part or subset of participants drawn from the target population Martínez-Mesa et al. (2016). The sample of this research study was users of the eNaira in Nigeria. This included 500 members of the public in Nigeria using the eNaira. The sample comprised individual Nigerians as well as small and medium enterprises owners who used eNaira for their personal and business transactions.

Stratified sampling was utilized for the selection of the research participants. This is a sampling technique involving the division of a population into subpopulations followed by the application of random sampling methods to each of them (Singh & Masuku, 2014). Some of the subpopulations that were formed during this study were based on age, gender, monthly income, employment status, and geographic location. Each stratum formed was then sampled via simple random sampling resulting in an estimated statistical measure. This is a probabilistic sampling technique which entailed relying on the sample's willingness to participate in the study (Martínez-Mesa et al., 2016). One of the reasons justifying using stratified sampling for this study is it enabled a process of obtaining a sample population that best

represented the Nigerian population using the eNaira by dividing it into strata. Another reason for using this sampling technique is that it accurately reflects the population under study. Thus, stratified sampling was instrumental in facilitating the generalization of the findings of the study.

3.3 Data collection

Survey questionnaires were used to gather data for this study. According to Kabir (2016), a questionnaire refers to a series of questions and other prompts that facilitate the gathering of information from respondents. Closed-ended and semi-closed-ended questions were included in the survey. The questions were prepared to capture the demographic data of the participants and the key elements of the variables of this research study based on the developed research hypotheses. The phrases used in the questionnaire were common and easy to grasp, making it easier for the participants to participate. The significance of creating a questionnaire in this manner is it increases its extent of validity by allowing for a higher degree of probability, among other things. The adoption of the questionnaire approach for data gathering was justified for several reasons. One of them is that the questionnaire method makes data collecting easier and less expensive (Young, 2015). This method of data collecting was chosen in part because it allows the target group to be standardised.

3.4 Data analysis

In quantitative research numerical data are collected and analysed via statistical methods. Particularly, the collected data was coded to SPSS 20.0 software as obtained from the questionnaires. The specific analytical method employed in this study is regression. Rahman and Muktadi (2021) explain that regression analysis is used to examine the relationships between the variables. Typically, using regression analysis encompasses determining the relationship between two variables, determining their causal relationship, and evaluating the statistical significance of the relationship (Stockemer, 2019). Thus, the data was focused on describing the role of the CBDC towards financial inclusion in Nigeria.

3.5 Validity and reliability

The research instrument used for this study was the survey questionnaire. Therefore, ensuring its validity and reliability was significant. Validity refers to the degree to which a given concept

becomes accurately measured in a quantitative study (Haradhan, 2017). For this study, validity was maintained by conducting a theoretical review to gain an understanding of the different elements of the possible relationship between CBDC and financial inclusion. Thus, this entailed developing the survey questionnaire in a way that ensured the consistency of the findings. Additionally, a pilot study was conducted on 10 persons to facilitate the detection of potential errors improving the quality of the questionnaire. Sürücü and Maslakci (2020) explain that reliability specifies the extent to which the research instrument lacks bias ensuring consistency in its measurement across time and several items on the instrument. The reliability of the questionnaire was attained by collecting the data individually and anonymously. This was instrumental in enhancing the objectivity of the study, therefore, resulting in reliability. Further, calculating Cronbach's coefficient was instrumental in demonstrating the reliability of the research instrument. The rule of thumb is a reliability coefficient of 0.7 or over was assumed to reflect the internal reliability of the instruments (Haradhan, 2017). The Cronbach's coefficient was 0.86 demonstrating the reliability of the research instrument.

3.6 Ethical considerations

Because this study involved the use of human subjects, there were several ethical considerations taken. One of these ethical considerations relates to informed consent. Fleming and Zegwaard (2018) explain that participants must be fully informed of what will be asked of them, how data will be used, and if any consequences there will be. Therefore, permission was obtained from the research participants. This was done following a briefing on the study with no coercion or deception. Gajjar (2013) argues that an essential component of informed consent includes participants' right to withdraw or decline the research after it has started. Confidentiality further illustrates the ethical consideration taken regarding this research study. Therefore, the identity of the research participants was protected through the use of pseudonyms in place of their real names. Care was taken to ensure the protection of any participants' identifiers. Thus, the researcher's data did not record names or other personal identifiers. Do no harm was another ethical consideration taken regarding this research. Fleming and Zegwaard (2018) assert that there should be a consideration for the potential harm to participants during research. For this reason, it was essential to ensure that no harm came to the

participants while taking part in the study whether emotional, psychological, reputational, resource loss or physical.

4. Results and discussion

4.1. Demographic characteristics

The demographic results show the distribution of participants based on age group, gender, monthly income, employment status, and eNaira wallet type. These results are summarized in Table 1.

Table 1

Demographic results

Demographic Group (n=542)	Frequency	Percent	Valid Percent	Cumulative Percent
Age group				
18 - 30 years	1	0.2	0.2	0.2
31 - 40 years	520	95.9	95.9	96.1
41 - 50 years	21	3.9	3.9	100.0
Total	542	100.0	100.0	
Gender				
Female	97	17.9	17.9	17.9
Male	444	81.9	81.9	99.8
Total	542	100.0	100.0	
Monthly Income				
Below 30	1	0.2	0.2	0.2
201 - 300	56	10.3	10.3	10.3
301 and above	485	89.5	89.5	99.8
Total	542	100.0	100.0	
Employment status				
Employed	1	0.2	0.2	0.2
Self-employed	540	99.6	99.6	99.8
Unemployed	1	0.2	0.2	100.0
Total	542	100.0	100.0	
eNaira Wallet Type				
Business wallet	540	99.6	99.6	99.6
Edu wallet	1	0.2	0.2	99.8
Individual wallet	1	0.2	0.2	100.0
Total	542	100.0	100.0	

Source: Author's

In terms of age group, most participants (95.9%) fell within the 31-40 years range, while a small percentage were between 18-30 years (0.2%) and 41-50 years (3.9%). The gender distribution revealed

that most participants were male (81.9%). Regarding monthly income, most participants (89.5%) reported earning 301 and above, while a smaller percentage reported earning between 201 and 300 (10.3%) or below 30 (0.2%). In terms of employment status, most participants were self-employed (99.6%), while a very small percentage were either employed (0.2%) or unemployed (0.2%). Finally, the eNaira wallet type was mostly the business wallet (99.6%), with a small percentage using either the edu wallet (0.2%) or individual wallet (0.2%). These demographic results indicate that the participants consisted of mostly middle-aged, self-employed individuals with high monthly incomes, predominantly male, and using the eNaira business wallet.

The demographic results provide some insights into the state of financial inclusion in Nigeria, as they reveal the characteristics of the participants who use the eNaira wallet. The fact that most participants reported earning 301 and above suggests that the eNaira wallet is primarily being used by individuals with higher incomes. This may indicate that financial inclusion efforts in Nigeria have yet to reach individuals with lower incomes (Ozili, 2023). Many Nigerians do not have access to the digital infrastructure necessary to use mobile wallets. The predominance of self-employed individuals also suggests that the eNaira wallet may be most accessible to those who can use it for business purposes, such as making payments and receiving money from clients. However, this could be because of limiting financial inclusion efforts to entrepreneurs and business owners, rather than addressing the needs of individuals who work in the informal sector or are employed in low-paying jobs (Banet & Lebeau, 2022; Negrea & Scarlat, 2022). In terms of age, the fact that the majority of participants were between 31-40 years old suggests that younger generations may be more likely to adopt mobile wallet technology, compared to older age groups who may be more accustomed to traditional banking methods. The gender distribution reveals that the majority of eNaira wallet users are male, which may reflect broader gender inequalities in access to financial services in Nigeria. Women may face greater barriers to accessing financial services due to cultural and social norms, lack of financial education, and limited economic opportunities (Alliance for Financial Inclusion, 2022). Therefore, these demographic results suggest that while efforts to promote financial inclusion in Nigeria are underway, more work needs to be done to ensure that mobile wallet technology is accessible to individuals across different income groups, genders, and employment statuses.

4.2. Statistical analysis

4.2.1 CBDC, financial inclusion, and access to financial services

The results presented in Table 2 suggest that CBDC has a significant role in enabling financial inclusion by increasing access to financial services in the Nigerian population.

Table 2
Results of financial inclusion via access to financial services

Elements	Statistics
R	0.894
R Square	0.800
Adjusted R Square	0.799
Std. Error of the Estimate	0.043
Sum of Squares	
Regression	3.985
Residual	0.998
df	1
Population	N=540
Mean Square	
Regression	3.985
Residual	0.002
F	2156.017
Sig.	0.000
Unstandardized Coefficients	
Constant	0.001
Does eNaira enable you to access formal financial services?	0.999
Std. Error	
Constant	0.064
Does eNaira enable you to access formal financial services?	0.022
Standardized Coefficients	
Constant	
Does eNaira enable you to access formal financial services?	0.894
t	
Constant	0.014
Does eNaira enable you to access formal financial services?	46.433
Sig.	0.989

Source: Author's

The data presented in Table 2 suggests that CBDC fosters digital financial inclusion by improving people's access to financial services. As per the table, the regression analysis results indicated a

standardized co-efficient of a beta of .894 and an R-value of .894[a] which accounts for 89.4% of the influence of CBDC in enabling digital financial inclusion through improved access to financial services. The p-value obtained from the analysis was 0.000, which is less than the significance value of 0.05, indicating that H1 (*CBDC facilitates digital financial inclusion by improving access to financial services*) was supported. That is, the relationship between CBDC and digital financial inclusion through access to financial services is statistically significant. Furthermore, the correlation analysis revealed an R^2 value of 0.800, signifying a strong fit relationship between community preparedness and the implementation of CBPs. The results are consistent with previous research that has shown that CBDC can improve financial inclusion by increasing financial access for the unbanked population. Central banks issue CBDCs as a way of broadening financial inclusion goals and expanding access to financial services. Overall, these results suggest that CBDC can play a significant role in promoting financial inclusion by improving access to financial services. An illustration of this is the findings of Foster et al. (2021) which indicate that CBDC enhanced access to financial services. Barr makes similar findings et al. (2020) who revealed that CBDC enables financial inclusion by expanding access to financial services.

These results offer concrete evidence to political decision-makers of the essential role that CBDCs play in achieving financial inclusion goals. With an overwhelming 89.4% influence on digital financial inclusion, as well as robust statistical support, CBDCs emerge as a clear policy tool for expanding access to financial services. Central banks considering the adoption of CBDCs can take these findings as strong support for their potential to make a tangible difference in the lives of unbanked and underserved populations.

These insights not only affirm the relevance of CBDCs but also provide a compelling basis for informed policy decisions aimed at facilitating financial inclusion not only in Nigeria but also on a global scale.

4.2.2 CBDC, digital financial inclusion, and reduced transaction costs

The results presented in Table 3 suggest that CBDC has a significant role in reducing transaction costs in Nigeria, thus fostering digital financial inclusion.

Table 3

Results of digital financial inclusion through reduced transaction costs

Elements	Statistics
R	0.603
R Square	0.363
Adjusted R Square	0.362
Std. Error of the Estimate	0.113
ANOVA	
Regression	3.941
Residual	6.909
Total	10.851
df	1
Population	N=540
Mean Square	
Regression	3.941
Residual	0.013
F	308.015
Sig.	0.000
Coefficients	
Unstandardized Coefficients	
Constant	0.006
Will you be using the eNaira more if it reduces the cost of financial transactions?	0.994
Std. Error	
Constant	0.170
Does eNaira enable you to access formal financial services?	0.057
Standardized Coefficients	
Constant	
Will you be using the eNaira more if it reduces the cost of financial transactions?	0.603
t	
Constant	0.038
Will you be using the eNaira more if it reduces the cost of fin. transactions?	17.550
Sig.	
Constant	0.970
Will you be using the eNaira more if it reduces the cost of fin. transactions?	0.000

Source: Author's

According to Table 3, the data suggests that CBDC enables digital financial inclusion through the reduction of transaction costs. Regression analysis showed that the standardized co-efficient of beta was .603 and the R-value was .603[a], indicating that CBDC accounts for 60.3% of the influence of digital financial inclusion by reducing transaction costs. The p-value obtained from the analysis was 0.000,

which is less than the significance value of 0.05, indicating that H2 (*CBDC facilitates digital financial inclusion by reducing transaction costs*) was supported. This means that there was a significant relationship between CBDC use and reduced transaction costs and thus attainment of digital financial inclusion. Additionally, the correlation analysis showed a strong fit relationship between CBDC and digital financial inclusion via reduced transaction costs with an R^2 value of 0.363.

The regression analysis shows a modest positive relationship between CBDCs and digital financial inclusion, with a high standardized coefficient of beta and R-value, which indicates that CBDCs account for a significant portion of the influence on digital financial inclusion by reducing transaction costs. These results are similar to previous research. For instance, Ozili (2021) found that CBDC digitalized value chains while improving digital payments and reducing the related transaction cost improving access to digital financial services. Similar findings were made by Ozili (2023) who noted that CBDC fostered financial inclusion as a result of providing lower transaction costs for users. Allen makes similar findings et al. (2022) who observed that CBDC fostered financial inclusion by reducing transaction fees and costs relating to financial services. The findings by Zuluaga (2021) further align with those of the current study as they show that CBDCs are needed for the reduction of high fees.

These findings provide political decision-makers with solid evidence concerning the significant influence that CBDCs can have on lowering transaction costs and advancing digital financial inclusion. With a solid 60.3% influence on digital financial inclusion, coupled with robust statistical support, CBDCs emerge as a compelling policy tool for making digital financial services more affordable and accessible. Policymakers contemplating the adoption of CBDCs can take these findings as a strong endorsement of their potential to drive tangible improvements in the digital financial landscape. These insights not only reaffirm the relevance of CBDCs but also provide a compelling basis for informed policy decisions aimed at reducing financial exclusion and fostering financial inclusion, not only in Nigeria but also on a global scale.

4.2.3 CBDC, digital financial inclusion, and increased banked people

The results presented in Table 4 suggest that CBDC has a significant role in increasing the number of persons that are banked in the Nigerian population, thus fostering digital financial inclusion.

Table 4

Results of financial inclusion via increased banked people

Elements	Statistics
R	0.446
R Square	0.199
Adjusted R Square	0.197
Std. Error of the Estimate	0.086
ANOVA	
Sum of Squares	
Regression	0.991
Residual	3.993
df	1
Population	N=540
Mean Square	
Regression	0.991
Residual	0.007
F	134.004
Sig.	0.000
Coefficients	
Unstandardized Coefficients	
Constant	1.502
Does eNaira enable you to access formal financial services?	0.498
Std. Error	
Constant	0.129
What aspects of eNaira have influenced your decision to become banked?	0.043
Standardized Coefficients	
Constant	
What aspects of eNaira have influenced your decision to become banked?	0.446
t	
Constant	11.643
What aspects of eNaira have influenced your decision to become banked?	11.576
Sig.	
Constant	0.000
Does eNaira enable you to access formal financial services?	0.000

Source: Author's

Table 4 presents data suggesting that CBDC plays a crucial role in fostering digital financial inclusion by increasing the number of persons that are banked in the Nigerian population. Regression analysis results indicated that CBDC has a standardized co-efficient of a beta of .446 and an R-value of .446[a], accounting for 44.6% of the influence towards digital financial inclusion via an increased number of banked persons. Furthermore, the p-value obtained from the analysis was 0.000, indicating support for H3 (*CBDC facilitates digital financial inclusion by increasing the number of banked members of the population*) as it was less than the significance value of 0.05. Correlation analysis showed a modest fit relationship between community preparedness and the implementation of CBPs with an R^2 value of 0.199.

Therefore, CBDC has the advantage of financial inclusion for underserved adults and the unbanked population, improving cross-border payments, and fostering fiscal transfers. Similar findings have been presented in previous research. For instance. The study conducted by Armas et al. (2022) found that CBDC contributed to providing financial services to unbanked persons. By using CBDC many unbanked people received access to digital payment tools such as payment of wages in the informal sector, payment of public transport, funding transfers, and experiencing extended accessibility to digital payments to the government. Negrea and Scarlat (2022) make similar findings by revealing that CBDC enables unbanked adults to access financial services in instances where there is no traditional infrastructure to facilitate such access.

These results provide concrete proof of the significant influence that CBDCs can have on expanding digital financial inclusion and the number of people who have bank accounts for political decision-makers. With a solid 44.6% influence on digital financial inclusion, combined with robust statistical support, CBDCs emerge as a compelling policy tool for addressing financial exclusion and fostering financial inclusion, particularly among underserved adults and the unbanked population. These insights not only reaffirm the relevance of CBDCs but also provide a persuasive basis for informed policy decisions aimed at promoting financial inclusion, not only in Nigeria but also as a potential model for regions facing similar challenges.

4.2.4 CBDC, digital financial inclusion, improved efficiency of digital payments

The results presented in Table 5 indicate that CBDC has a significant role in improving the efficiency of digital payments in Nigeria, therefore facilitating digital financial inclusion.

Table 5

Results of financial inclusion through improved efficiency of digital payments

Elements	Statistics
R	0.706
R Square	0.499
Adjusted R Square	0.498
Std. Error of the Estimate	0.043
Sum of Squares	
Regression	0.994
Residual	0.998
df	1
Population	N=540
Mean Square	
Regression	0.994
Residual	0.002
F	538.007
Sig.	0.000
Unstandardized Coefficients	
Constant	1.501
Does eNaira enable you to access formal financial services?	0.499
Std. Error	
Constant	0.064
Why do you use eNaira for digital payments?	0.022
Standardized Coefficients	
Constant	
Why do you use eNaira for digital payments?	0.706
t	
Constant	23.271
Why do you use eNaira for digital payments?	23.195
Sig.	
Constant	0.000
Why do you use eNaira for digital payments?	0.000

Source: Author's

Based on the data presented in Table 5, it can be inferred that CBDC has a significant impact on digital financial inclusion by improving the efficiency of digital payments. Regression analysis revealed that CBDC has a standardized co-efficient of a beta of .706 and an R-value of .706[a], indicating that it accounts for 70.6% of the influence towards digital financial inclusion. The p-value obtained from the analysis was 0.000, which is less than the significance value of 0.05, suggesting that H4 (*CBDC facilitates financial inclusion by improving the efficiency of digital payments*) was supported. Additionally, correlation analysis showed a moderate fit relationship between CBDC and increased financial inclusion via improved efficiency of digital payments with an R^2 value of 0.499. Overall, these results suggest that CBDC can significantly improve digital financial inclusion by enhancing the efficiency of digital payments. These findings are in tandem with those presented in previous literature on the role of CBDC in facilitating financial inclusion. For example, these findings are similar to those by Auer et al. (2021) who reveal that CBDC can be used to improve payments while reducing reliance on deposit insurance. The same findings are made by Ozili (2023) who noted that eNaira a form of CBDC provided additional payment possibilities for users. This was useful in enhancing the efficiency of payments.

By enhancing the effectiveness of digital payment systems, these findings provide political decision-makers with hard data demonstrating the significant influence that CBDCs can have on promoting digital financial inclusion. With a resounding 70.6% influence on digital financial inclusion and robust statistical support, CBDCs emerge as a compelling policy tool for streamlining digital financial services and fostering financial inclusion. Policymakers contemplating the adoption of CBDCs can draw upon these findings as a strong endorsement of their potential to drive tangible improvements in digital payment systems and, by extension, financial inclusion efforts. These insights not only affirm the relevance of CBDCs but also provide a persuasive basis for informed policy decisions aimed at promoting financial inclusion, not only in Nigeria but also as a model for regions facing similar challenges.

5. Conclusion

This article investigated the impact of CBDC in facilitating financial inclusion in Nigeria. The results of this research suggest that

CBDC has a significant role to play in fostering digital financial inclusion in Nigeria. This is because the regression analysis conducted on each of the hypotheses demonstrated a strong positive relationship between the use of CBDC and digital financial inclusion. Specifically, CBDC was found to improve access to financial services, reduce transaction costs, increase the number of banked individuals, and improve the efficiency of digital payments, therefore, fostering financial inclusion. Therefore, the findings of this research provide compelling evidence for the potential of CBDC to drive financial inclusion in Nigeria.

This study makes a significant contribution to understanding the crucial role CBDCs play in promoting digital financial inclusion. The research findings not only affirm the beneficial impact of CBDCs on diverse facets of financial inclusion but also reinforce the existing knowledge base in this domain. As governments and central banks across the world deliberate on the potential adoption of CBDCs, this study's insights provide invaluable guidance. These insights pertain to the anticipated benefits of CBDCs in promoting financial inclusion and improving access to financial services, especially for disadvantaged and underserved populations, not only in Nigeria but also in other parts of the world.

Based on these findings, it is recommended that policymakers in Nigeria continue to promote and prioritize the adoption of CBDC. This could involve creating awareness campaigns and education programs to increase public understanding and acceptance of CBDC. Furthermore, policymakers could consider implementing policies that incentivize financial institutions to use CBDC, as this could further drive its adoption and increase financial inclusion.

Further research efforts are needed to fully realize the potential of CBDC in promoting financial inclusion in Nigeria. For instance, future research could explore the impact of CBDC on other aspects of financial inclusion beyond those explored in this study. For example, the researchers could examine how CBDC affects access to credit or the ability to save. Additionally, the research could explore the potential impact of CBDC on financial stability and monetary policy.

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EVALUATION OF PREDICTION ACCURACY MODELS FOR BANKRUPTCY IN INDONESIAN BANKS[1]

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Abstract

This research aims to find the most accurate model for predicting bankruptcy in the Indonesian banking industry. The data used are secondary data in the form of financial reports from 2018 to 2022. The methodology includes hypothesis testing using normality, homogeneity, and one-way ANOVA tests. The research results indicate that the Springate model is the most suitable model for predicting bankruptcy in the Indonesian banking industry, followed by the Zmijewski model, and the Altman model. The results obtained are relevant for financial managers and regulatory authorities, showing that the Springate model can be used to assess the financial health of the banking industry in Indonesia and to take concrete preventive measures before bankruptcy occurs.

Keywords: Indonesia stock exchange, financial soundness, banking supervision

JEL Classification: E44; G01; G17

1. Introduction

Analysis and prediction of the financial condition of a company have become very important in the era of technological advancement and economic cycle changes that affect intense competition in the business world (Ali, Aysan & Yousef, 2023). The capital market, as a source of funding or alternative financing for publicly traded

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companies, can reflect the performance and financial condition of the company. Investors will examine the financial condition of the company before deciding to invest their funds (Grikietytė & Šniukienė, 2023). Therefore, companies are expected to adapt to changes and analyze or predict the financial condition of the company to meet market demands (Agwata, 2018).

The prediction model of bankruptcy for a company is highly needed by various parties such as lenders, investors, government, accountants, and management due to the uncertain economic conditions in Indonesia, which potentially lead to financial difficulties or even bankruptcy for the company (Ayvaz & Erkan, 2023; Gupta, 2023; Vu & Tran, 2023). A prediction error regarding the continuity of a company's operations in the future can have consequences, including the loss of revenue or investment that has been invested in a company. However, in addition to the uncertain economic conditions, the phenomenon of the weakening of the rupiah exchange rate is also a concern for the banking industry in Indonesia. If the rupiah continues to weaken to the level of Rp 15,000, it is estimated that five national banks will collapse, similar to the economic crisis in late 1998 that caused many banks to "fall" due to the weakening of the rupiah exchange rate against the US dollar. This means that the Otoritas Jasa Keuangan (OJK) is taking anticipatory steps by calling the bank management related to the depreciation (Fredy, 2018; Agustina, 2022).

According to several studies (Ameri Siahoee & Kordlouie, 2018; Bansal et al., 2020; Shree & Selvam, 2023), in testing the three bankruptcy prediction models (Altman, Springate, and Zmijewski) on the researched companies, it was found that the Altman Z-Score model provided the highest prediction rate in 15 companies, while the Springate model provided a prediction rate for 7 companies. On the other hand, the Zmijewski model provided the lowest prediction rate, with no companies predicted to go bankrupt. Another study conducted by (Sitorus, 2023) on delisted companies in the Indonesia Stock Exchange during the period of 2019-2021 showed that the Altman model had the highest accuracy rate, reaching 71%, while the Springate model had an accuracy rate of 70%, and the Zmijewski model only achieved an accuracy rate of 65%. Thus, both studies show that the Altman model has the highest accuracy rate, followed by the Springate and Zmijewski models.

Research on corporate bankruptcy has been conducted extensively in Indonesia and other countries. However, research on the

banking industry and the appropriate comparison of bankruptcy prediction models is still very limited. Therefore, we are interested in conducting a study entitled "*Evaluation of Prediction Accuracy Models for Bankruptcy In Indonesian Banks*". The aim of this study is to determine which model is the most accurate in predicting bankruptcy in the banking industry in Indonesia, because previous research results between the Altman, Springate, and Zmijewski models have not been consistent in analysing corporate or banking industry bankruptcies. This research aims to provide empirical evidence on the accuracy of the Altman, Springate, and Zmijewski models in predicting bankruptcy in the Indonesian banking industry. This is done based on the background that has been presented.

2. Literature review

The Altman, Springate and Zmijewski models have been analysed in several previous studies. A study conducted by Dailibas (2021) showed strong significant results in using the Altman, Springate and Zmijewski models to analyse bankruptcy. Meanwhile, a study conducted by Melina and Kalinggo (2023) on companies listed on the Indonesia Stock Exchange showed that the Altman Z-$_{Score}$ and Springate models provided similarly high bankruptcy prediction values. Therefore, the results of both studies indicate that the Altman model has the same accuracy in predicting bankruptcy.

The theoretical framework for this research consists of the theory of bankruptcy and credit prediction models, Bank Indonesia's policy theory regarding credit monitoring and bankruptcy prevention, and the theory of using bankruptcy and credit prediction models in Bank Indonesia. As a result, the bankruptcy and credit prediction models used by Bank Indonesia can be analysed and evaluated, results can be obtained, and recommendations can be made to improve the accuracy of the bankruptcy prediction model in the banking industry in Indonesia.

2.1. Model Altman

The Altman model (Altman, 1968) uses the multiple discriminant analysis method with five types of financial ratios, namely working capital to total assets, retained earnings to total assets, earnings before interest and taxes to total assets, the market value of equity to book value of total debts, and sales to total assets. To this day, the Altman Z-$_{Score}$ is still widely used by researchers, practitioners,

and academics in the accounting field compared to other prediction models (Irawan, 2023). The results of Altman's developed research are:

$$Z = 1.2Z_1 + 1.4Z_2 + 3.3Z_3 + 0.6Z_4 + 0.999Z_5 \tag{1}$$

Where:
Z_1 : Working capital
Z_2 : Retained earnings
Z_3 : Earnings before taxes
Z_4 : Book value of equity/book value of debt
Z_5 : Sales/total asset

In its development, the Altman model underwent revisions so that it could be used not only for public manufacturing companies but also for private companies (Altman, Iwanicz, Laitinen & Suvas, 2017; Altman, 2018). The revision was carried out by changing one of the variables used in the previous model.

$$Z' = 0.0717Z_1 + 0.874Z_2 + 3.107Z_3 + 0.420Z_4 + 0.988Z_5 \tag{2}$$

Where:
Z_1 : Working capital/total asset
Z_2 : Retained earnings/total asset
Z_3 : Earnings before taxes/total asset
Z_4 : Book value of equity/book value of debt
Z_5 : Sales/total asset

The final result in the form of Z-$_{Score}$ values for each company will be grouped according to the critical value standards set by Altman (Irawan, 2023), which are:

a. If the Z-Score value is greater than 2.99, the company is in the safe zone, which means the company is healthy or not bankrupt.

b. If the Z-Score value is between 1.01 and 2.99, it is in the grey zone, which means the company is in a grey area, where the company may potentially not go bankrupt or go bankrupt.

c. If the Z-Score value is less than 1.01, the company is in the distress zone, where the company is unhealthy or potentially facing bankruptcy.

2.2 Model Springate

This model was developed by Springate in 1978 using multiple discriminant analysis. The model can be used to predict bankruptcy with an

accuracy rate of 92.5% (Irawan, 2023). The model successfully developed by Springate is :

$$S = 1.03A + 3.07B + 0.66C + 0.4D \qquad (3)$$

Where:
A : Working capital/total asset
B : Earnings before taxes/total asset
C : Earnings before taxes / current liabilities
D : Sales/total asset

The final result in the form of Springate score for each company will be grouped according to the critical value standards set by Springate as follows.

a. If the Springate value is greater than 0.862, the company falls into the category of healthy companies.

b. If the Springate value is less than 0.862, the company falls into the category of unhealthy companies or potentially bankrupt companies.

2.3 Model Zmijewski

Model Zmijewski (1984) uses ratio analysis to measure the performance, leverage, and liquidity of a company for its prediction model. Zmijewski used probability analysis applied to 40 bankrupt companies and 800 surviving companies at that time (Irawan, 2023; Leisen & Swan, 2023). The successfully developed model is:

$$X = -4.3 - 4.5X_1 + 5.7X_2 - 0.004X_3 \qquad (4)$$

Where:
X_1 : Return on asset
X_2 : Debt ratio
X_3 : Current ratio

The final result in the form of Zmijewski score for each company will be grouped according to the critical value standards set by Zmijewski as follows.

a. The higher the Zmijewski value (positive value), the more likely the company is classified as bankrupt.

b. The smaller the Zmijewski value (negative value), if the Springate value is also smaller and negative, the company is categorized as healthy.

3. Research and methodology

To determine whether a company's financial performance is good or not, the company must be able to meet its costs with the revenue generated during a certain period or exceed the break-even point. One way to evaluate a company's financial performance is through financial statement analysis, which can help identify problems that occur. In this study, the framework design is described with financial statements to predict bankruptcy through the Altman, Springate, and Zmijewski models to determine a company's score. After that, the score will be used to categorize the health condition of the banking industry in Indonesia, whether healthy, in the grey area, or bankrupt.

In this research, quantitative empirical method is used with a deductive approach, where the focus is on developing theory first, then collecting data to test hypotheses or existing theories. The data collected in this research consists of primary and secondary data. After the data is gathered, statistical techniques are employed to test hypotheses or answer research questions. Furthermore, the research is concentrated on the development and testing of a bankruptcy prediction model in the banking industry in Indonesia.

4. Analysis and discussions

To assess the suitability of data and analyze factors, it is necessary to perform prerequisite tests that the data must meet. These prerequisite tests are intended to ensure that the data to be used in factor analysis meets the requirements and can be relied upon in generating analysis results.

Table 1

Descriptive Statistics of Research Variables

Variable	N	Min	Max	Mean	SD
Z-$_{\text{Score}}$	50	1,085	5,822	2,44612	1,078911
S-$_{\text{Score}}$	50	0,713	1,989	0,90878	0,187491
X-$_{\text{Score}}$	50	-33,140	19,669	-3,94662	9,597896

Sources: Data processed by author from IBM SPSS Statistics version 25.0.

In Table 1, there are several things that can be explained, namely a) the average value of Z-Score (Altman) is 2.44612 with a sample size of 50. The minimum and maximum values of Z-$_{\text{Score}}$ (Altman) are 1.085 and 5.822, respectively. The standard deviation of

$_{Z\text{-Score}}$ (Altman) is 1.078911. Based on the close values of the mean and standard deviation, it can be concluded that the deviation of Z-$_{Score}$ (Altman) data is low. b) the average value of S-$_{Score}$ (Springate) is 0.90878 with a sample size of 50. The minimum and maximum values of S-$_{Score}$ (Springate) are 0.713 and 1.989, respectively. The standard deviation of S-$_{Score}$ (Springate) is 0.187491. Based on the close values of the mean and standard deviation, it can be concluded that the deviation of S-$_{Score}$ (Springate) data is low. c) the average value of X-$_{Score}$ (Zmijewski) is -3.94662 with a sample size of 50. The minimum and maximum values of X-$_{Score}$ (Zmijewski) are -33.140 and 19.669, respectively. The standard deviation of X-Score (Zmijewski) is 9.597896. It can be concluded that the deviation of X-$_{Score}$ (Zmijewski) data is low.

4.1. Bankruptcy Prediction Analysis Results Z-$_{Score}$ (Altman)

The analysis in this study is the Z-$_{Score}$ discriminant model. This analysis is used to identify and analyze the prediction of bankruptcy in the banking industry in Indonesia for the period of 2018-2022.

The Z-$_{Score}$ formula is as follows:

$$Z = 1.2 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5 \qquad (5)$$

Based on the calculation results using Excel program, the following results were obtained:

Table 2

The Calculation Results of Z-$_{Score}$

Bank	Categories				
	2018	**2019**	**2020**	**2021**	**2022**
BDMN	Grey Area	Grey Area	Grey Area	Grey Area	Grey Area
BBRI	Grey Area	Grey Area	Grey Area	Grey Area	Grey Area
BMRI	Grey Area	Grey Area	Healthy	Grey Area	Grey Area
BBNI	Healthy	Grey Area	Grey Area	Grey Area	Grey Area
BRIS	Grey Area	Grey Area	Healthy	Grey Area	Grey Area
BTPN	Healthy	Healthy	Grey Area	Grey Area	Grey Area
NISP	Grey Area	Grey Area	Healthy	Grey Area	Healthy
BBTN	Grey Area	Grey Area	Grey Area	Grey Area	Grey Area
BTPS	Grey Area	Healthy	Grey Area	Grey Area	Grey Area
BBCA	Healthy	Healthy	Grey Area	Grey Area	Grey Area

Source: *Data processed by the authors*

Table 2 shows that there are several banking industries in Indonesia that have been categorized as Healthy in the prediction for the years 2018-2022, namely BMRI, BBNI, BRIS, BTPN, NISP, BTPS, and BBCA. However, all banks have experienced Grey Area prediction at some point. In that period, there were 3 banks that were consistently categorized as Grey Area, namely BMDN, BBRI, and BBTN. No banks have ever been categorized as Bankrupt in the prediction for the years 2018-2022.

The implication of this research is the importance of using the Springate model in evaluating the financial health of the banking industry in Indonesia. Banks categorized as Grey Area need to take preventive measures before bankruptcy occurs. Moreover, this research finding also emphasizes that the Springate model can be used by financial managers and regulators to evaluate the financial health of the banking industry in Indonesia and provide concrete steps for prevention before bankruptcy occurs. These research findings are in line with previous studies conducted by (Putri, et al., 2020; Tiryaki, 2021; Ullah, et al., 2021).

4.2 The Results of Bankruptcy Prediction S-$_{Score}$ (Springate)

This research utilizes the discriminant analysis model S-$_{Score}$ to predict bankruptcy in the banking industry in Indonesia during the period 2018-2022. The discriminant analysis model S-$_{Score}$ is a technique that combines various financial indicators from the researched banks to generate a score indicating the level of bankruptcy risk. By collecting financial data from the banks during that period, researchers can apply the S-$_{Score}$ formula to identify high-risk banks that may face financial difficulties.

The results of the S-$_{Score}$ analysis can provide valuable insights to stakeholders in the banking industry. Information about banks with high bankruptcy risk can assist regulators, investors, and bank management in taking appropriate preventive measures. Thus, this research can contribute to maintaining the stability and health of the banking industry in Indonesia during the studied period. By using the accurate predictive model, relevant parties in the banking industry can take early actions to prevent or address financial issues before reaching the point of bankruptcy. This helps improve the quality of risk management and enables more informed decision-making within the banking industry. The following is the formula for the S-$_{Score}$:

$$S = 1.03A + 3.07B + 0.66C + 0.4D \qquad (6)$$

Based on the calculation results using Microsoft Excel, the following results were obtained (see Table 3).

Table 3

The Calculation Results of S-_{Score}

Bank	Categories				
	2018	**2019**	**2020**	**2021**	**2022**
BDMN	Healthy	Healthy	Healthy	Healthy	Bankrupt
BBRI	Healthy	Healthy	Healthy	Healthy	Bankrupt
BMRI	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
BBNI	Healthy	Healthy	Healthy	Healthy	Healthy
BRIS	Healthy	Healthy	Healthy	Bankrupt	Healthy
BTPN	Bankrupt	Bankrupt	Healthy	Healthy	Bankrupt
NISP	Bankrupt	Healthy	Bankrupt	Bankrupt	Healthy
BBTN	Bankrupt	Bankrupt	Bankrupt	Bankrupt	Bankrupt
BTPS	Healthy	Healthy	Healthy	Healthy	Healthy
BBCA	Healthy	Healthy	Healthy	Healthy	Healthy

Source : *Data processed by the author.*

Table 3 shows that there are several banking industries in Indonesia that have experienced healthy predictions during the period of 2018-2022, including BDMN, BBRI, BBNI, BRIS, BTPN, NISP, and BBCA. However, there are several banking industries in Indonesia that have experienced bankrupt prediction during the period, namely BMDN, BBRI, BMRI, BRIS, BTPN, NISP, and BBTN. From the analysis, there are 3 banking industries in Indonesia that always experience healthy predictions during the period of 2018-2022, namely BBNI, BTPS, and BBCA. Meanwhile, there are 2 banking industries in Indonesia that always experience bankrupt predictions during that period, namely BBRI and BRIS. In terms of implications, this analysis can provide useful information for financial managers and regulators in evaluating the financial health of the banking industry in Indonesia. By knowing the banking industries that always experience healthy and bankrupt predictions, financial managers can evaluate and improve certain aspects to prevent bankruptcy. In addition, regulators can take more proactive actions in supervising banking industries that always experience bankrupt predictions to ensure financial system stability. The findings of this research confirm the results of previous studies

conducted by (Verlekar & Kamat, 2019; Sybirtsev, Mazhara & Moskalenko, 2020; Ridwan, Pagalung, & Kara, 2022).

4.3 The Result of Bankruptcy Prediction X-$_{Score}$ (Zmijewski)

The analysis in this study is the X-$_{Score}$ discriminant model. This analysis is used to determine and analyze the bankruptcy prediction in the banking industry in Indonesia for the period of 2018-2022.

The X-$_{Score}$ formulation is as follows:

$$X = -4.3 - 4.5X_1 + 5.7X_2 - 0.004X_3 \qquad (7)$$

Based on the calculation results using Microsoft Excel program, the following results were obtained.

Table 4

The Calculation Results of X-$_{Score}$

Bank	Categories				
	2018	**2019**	**2020**	**2021**	**2022**
BDMN	Healthy	Healthy	Healthy	Healthy	Bankrupt
BBRI	Healthy	Healthy	Healthy	Bankrupt	Bankrupt
BMRI	Bankrupt	Bankrupt	Healthy	Healthy	Bankrupt
BBNI	Healthy	Healthy	Healthy	Healthy	Healthy
BRIS	Healthy	Healthy	Healthy	Healthy	Healthy
BTPN	Healthy	Healthy	Healthy	Healthy	Healthy
NISP	Bankrupt	Healthy	Healthy	Healthy	Healthy
BBTN	Bankrupt	Bankrupt	Healthy	Bankrupt	Bankrupt
BTPS	Healthy	Healthy	Healthy	Healthy	Bankrupt
BBCA	Healthy	Healthy	Healthy	Bankrupt	Bankrupt

Source : *Data processed by the author*

In Table 4, it can be seen that several banking industries in Indonesia were categorized as healthy predictions during the period of 2018-2022, including BDMN, BBRI, BMRI, BBNI, BRIS, BTPN, NISP, BBTN, BTPS, and BBCA. Meanwhile, the banks that have experienced bankrupt predictions are BDMN, BBRI, BMRI, NISP, BBTN, BTPS, and BBCA. There were three banks that consistently entered the healthy prediction category during that period, namely BBNI, BRIS, and BTPN.

From the X-$_{Score}$ (Zmijewski) analysis results, it can be seen that several banking industries in Indonesia consistently entered the

healthy prediction category during that period. This indicates that the X-$_{Score}$ (Zmijewski) model is more realistic in predicting bankruptcies in the Indonesian banking industry during that period and is in line with the current conditions. These findings also have important implications for the Indonesian banking industry, namely the importance of adopting more accurate credit analysis methods that are in line with the changing market conditions. By using the right method, the banking industry can minimize the risk of unpaid credit and ensure healthy financial performance. Philosophically, these findings emphasize the importance of adopting more advanced technology and methodology in the business world. Rapid technological and methodological developments can provide significant benefits to the business world, especially in decision-making. For example, in credit analysis, the use of more advanced methods can provide more accurate results and help the banking industry make better decisions. Therefore, this finding supports research by (Zelenkov, Fedorova & Chekrizov, 2017; Prusak, 2017; Manousaridis, 2017; Karas & Srbová, 2019; Laurila, 2020; Bărbuță-Mișu & Madaleno, 2020; Alibabaee & Khanmohammadi, 2022).

4.4 Data Normality Testing

The normality test in this study is a statistical procedure aimed at evaluating whether the data used in the model and statistical analysis follow a normal distribution or not. A normal distribution is a symmetrical distribution around its mean and is often an important assumption in many statistical methods. Therefore, it is essential to ensure that the data used meet the assumption of normal distribution to ensure reliable analysis results.

In this research, the Kolmogorov-Smirnov normality test is employed to evaluate the data distribution. This test compares the empirical distribution of the observed data with the expected distribution (in this case, the normal distribution). The test generates a p-value, which indicates the statistical significance level of the comparison.

If the p-value from the normality test is greater than 0.05, the researchers can conclude that the data follows a normal distribution, and the assumption of normality in the statistical analysis can be maintained. However, if the p-value is less than or equal to 0.05, the researchers will conclude that the data does not have a normal distribution, and the assumption is not met.

By conducting the Kolmogorov-Smirnov normality test, this research ensures that the data used in the statistical analysis adheres to an appropriate distribution, resulting in more accurate and reliable research findings and conclusions.

Table 5

Normality Test Results

Univariate	Sig.	Probability	Description
Z_{-Score}	0,247	0,05	Normal
S_{-Score}	0,059	0,05	Normal
X_{-Score}	0,651	0,05	Normal

Sources: Data processed by the author from IBM SPSS Statistics version 25.0.

Based on the normality test results with the Kolmogorov Smirnov Test above, the probability value > 0.05. Therefore, it can be concluded that the data is normally distributed. This result indicates that the data taken from the sample meets the normal distribution assumption required to apply many statistical analysis techniques. Furthermore, this result emphasizes the importance of data validity in evaluating research hypotheses and provides confidence that the data taken from the sample can represent the population in general.

4.5 Homogeneity Testing with Levene Test

To determine whether the variable data in the model has homogenous distribution or not, a homogeneity test is conducted (Yitnosumarto & O'Neill, 1986). In decision-making, a good data model is one that has homogenous data distribution. To test for homogeneity, the probability value can be analyzed. If the probability value is > 0.05, then it can be concluded that the regression model meets the homogeneity assumption. Conversely, if the probability value is ≤ 0.05, then the regression model does not meet the homogeneity assumption.

The homogeneity test is conducted using the Levene Test, and the results can be seen in the following table.

Table 6

Homogeneity test results with Levene Test

Univariate	Sig.	Probability	Description
Altman- Springate- Zmijewski	0,062	0,05	Homogeneous

Sources: Data processed by the author from IBM SPSS Statistics version 25.0.

The model data tested by the Levene Test showed a probability value of 0.062, which is greater than the predetermined significance level of 0.05. Therefore, it can be concluded that the model data meets the assumption of homogeneity. This finding indicates that the data used in the study can be considered homogeneous so that the statistical analysis performed can be relied upon and the results can be interpreted accurately. This is important to ensure that the conclusions drawn from the statistical analysis results are not distorted by unwanted differences in variance between groups.

4.6 Testing One-Way ANOVA Test

In this study, One-way ANOVA analysis was used to compare Altman, Springate, and Zmijewski models in predicting bankruptcy in the banking industry in Indonesia with a significance level (α) of 5% = 0.05. The results of the One-way ANOVA Test showed that the probability value was 0.000, indicating a significant difference between the three models in predicting bankruptcy in the banking industry in Indonesia.

Table 7

One-Way ANOVA Test Results

Model	F-test	Sig.	Level of Significant
Altman- Springate- Zmijewski	17,897	0,000	0,05

Sources: Data processed by the author from IBM SPSS Statistics version 25.0.

Based on the data analysis using One Way ANOVA, a probability value of 0.000 was obtained which is smaller than the significance level of 0.05. Therefore, it can be concluded that there is a significant difference between the three models, namely Altman, Springate, and Zmijewski, in predicting the bankruptcy of the banking industry in Indonesia. In addition, this technique can also reveal the differences between each model compared to the other models. These findings can provide an important contribution to decision-making for investors and other stakeholders in choosing the appropriate model to predict the bankruptcy of the banking industry in Indonesia.

Table 8

Comparison of the Three Models

Description	Altman, Springate and Zmijewski		
	Z-Score	**S**-Score	**X**-Score
Healthy	20,00%	62,00%	72,00%
Grey Area	80,00%	-	-
Bankrupt	-	38,00%	28,00%

Sources: Data processed by author from IBM SPSS Statistics version 25.0.

Based on Table 8, it can be concluded that:

a. The Springate model predicts that 38.00% of the banking industry in Indonesia is in the bankrupt category and 62.00% is in the healthy category.

b. The Zmijewski model predicts that 28.00% of the banking industry in Indonesia is in the bankrupt category and 72.00% is in the healthy category.

c. The Altman model predicts that 80.00% of the banking industry in Indonesia is in the grey area category, 20.00% is in the healthy category, and none are in the bankrupt category.

Based on these results, it can be concluded that the Springate model is the most appropriate model to predict the bankruptcy of the banking industry in Indonesia with an accuracy rate of 38.00%, followed by the Zmijewski model with an accuracy rate of 28.00%, while the Altman model is not suitable for predicting the bankruptcy of the banking industry in Indonesia. This is because the Altman model, designed by Edward Altman in 1968, is a model for predicting the bankruptcy of manufacturing companies. This model is based on financial ratio analysis and calculates the Z-Score value which is then used to predict the likelihood of bankruptcy of the company. However, the banking industry in Indonesia has different business characteristics than manufacturing companies, so the financial ratios that form the basis of the Altman model are not always relevant to predict the bankruptcy of the banking industry in Indonesia. Therefore, the Altman model is not suitable for predicting the bankruptcy of the banking industry in Indonesia.

5. Conclusions

Based on the analysis results, it can be concluded that the Springate S-Score model is the most accurate model for predicting bankruptcy in the banking industry in Indonesia. This is also because the Springate S-Score model is the best model as it uses multi-discriminant analysis and key financial ratios considered crucial in predicting bankruptcy in the banking industry in Indonesia. Therefore, overcoming bankruptcy in the banking industry involves using accurate prediction models like the Springate S-Score to assist banks in making credit decisions.

However, despite the high accuracy of the Springate S-Score model in predicting bankruptcy in the banking industry in Indonesia, the model has limitations. For instance, the model solely relies on historical financial data and cannot consider non-financial factors that also influence the bankruptcy of banking institutions. Additionally, it is essential to note that even though this model aids in credit decision-making, the final decision must still be based on a comprehensive assessment of the financial and business conditions of the company.

In the geographical context of the research conducted in Indonesia, the solution to overcome bankruptcy in the banking industry also involves various stakeholders, including regulators and banking institutions. Regulators need to tighten supervision over banking institutions and improve the quality of oversight to prevent violations and fraud. Banking institutions need to enhance the quality of financial and risk management and strengthen internal monitoring and control.

The relevance to banking authority supervision is that this analysis provides crucial information for regulators to oversee and regulate the banking industry in Indonesia. By utilizing the proven accurate Springate S-Score model for bankruptcy prediction, regulators can gain deeper insights into the financial conditions and risks faced by banks in Indonesia.

Regulators need to ensure that banks showing high bankruptcy risks receive special attention and appropriate preventive measures. By enhancing the quality of supervision and monitoring, regulators can identify potential violations or fraud in the banking industry that may lead to further issues.

Furthermore, this analysis also offers guidance for banking companies to improve their financial and risk management. Strengthening internal monitoring and control enables banking

institutions to be more proactive in dealing with risks and minimizing the likelihood of bankruptcy. Therefore, the use of the Springate S-$_{Score}$ model in this analysis plays a crucial role in assisting banking authorities in maintaining stability and the health of the banking industry in Indonesia.

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