eNaira central bank digital currency (CBDC) for financial inclusion in Nigeria

Ozili, Peterson K

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Peterson K. Ozili

Abstract

There is much interest in central bank digital currency (CBDC) among central banks around the world. African countries have also joined the league of nations that are conducting research into CBDC. The launch of the eNaira CBDC in Nigeria has drawn substantial interest from observers around the world including central banks. The eNaira CBDC is envisaged to bring many benefits, and financial inclusion is considered to be one of such benefits. This paper explores the eNaira CBDC and its potential to increase financial inclusion in Nigeria. I show that the eNaira CBDC can increase financial inclusion by (i) offering an easy account opening process for greater financial inclusion (ii) enabling digital access to diverse financial services in the financial system, (iii) offering low-cost financial products and services, (iv) avoiding unexplained bank charges that causes financial exclusion, (v) attracting people who have lost confidence in banks, (vi) introducing interest-bearing eNaira, and (vii) using offline channels to access the eNaira.

Keywords: Nigeria, eNaira, central bank digital currency, CBDC, financial inclusion, eNaira wallet.

JEL classification: G21, G28, E42.

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1. Introduction

This paper explores the eNaira CBDC and how it can increase financial inclusion in Nigeria. A central bank digital currency is defined as fiat digital money (Jia, 2020; Lee, Yan and Wang, 2021; Inozemtsev and Nektov, 2022). It is the digital equivalent of physical money (Cunha, Melo and Sebastião, 2021; Bordo and Levin, 2017; Barontini and Holden, 2019). Some countries have issued a CBDC such as Nigeria and the Bahamas. Other central banks have expressed interest in studying about central bank digital currencies. Central banks are interested in CBDCs for different reasons. Some central banks plan to issue a CBDC for the purpose of broadening financial inclusion and to improve payment efficiency (Zhang and Huang, 2022; Sethaput and Innet, 2021; Calle and Eidan, 2020).

Other central banks plan to issue a CBDC to enhance the conduct of monetary policy, control banking system liquidity, improve payment efficiency, increase government revenue and to provide a legal tender that is relevant to the digital payment ecosystem (Piazzesi and Schneider, 2020; Davoodalhosseini et al, 2020; Ozili, 2022a). Other central banks have launched a CBDC pilot test while a large majority of central banks in developed countries are still studying about CBDCs to determine whether there is a need for a national CBDC and to determine the best use-case of a CBDC (Ozili, 2022a).

There are many benefits of issuing a CBDC. Arguably, the most important benefit of issuing a CBDC in developing countries is to increase financial inclusion since many developing countries have a large unbanked population (Banet and Lebeau, 2022; Ozili, 2022b). Financial inclusion ensures that all individuals and businesses have access to affordable formal financial services which they can use to improve their welfare (Liu and Walheer, 2022; Liu, Xie, Hafeez, and Usman, 2022; Ozili, 2021).

In Nigeria, financial exclusion is an important issue and the central bank of Nigeria believes that the eNaira CBDC can play a significant role in broadening financial inclusion for the benefit of all Nigerians. In this paper, I will show how eNaira can increase financial inclusion in Nigeria. Nigeria launched its own fiat CBDC commonly known as the 'eNaira' on the 25th of September 2021. Nigeria launched the eNaira at a time when there was heated global debate about the risks of private digital currencies and the need for a government controlled digital currency (Brunnermeier and Niepelt, 2019; Ozili, 2022c). Prior to launching the eNaira CBDC, the central bank of Nigeria, in February 2021, barred regulated deposit money banks from aiding or facilitating cryptocurrency transactions because fraudsters used cryptocurrencies to hide illicit financial dealings (Ozili, 2022d). Such practices undermined the integrity of the Nigerian banking system. The implication of the restriction is that cryptocurrency transactions were no longer permitted in the Nigerian banking system. Soon after the restriction was imposed, the central bank launched the eNaira central bank digital currency.

The eNaira CBDC has the same features of the paper Naira and it offers more payment possibilities for Nigerians.[1] The eNaira CBDC is designed to act as an efficient payment tool. It will compete with existing payment channels. The eNaira offers many benefits. It helps to (i) increase financial inclusion, (ii) enhance the efficiency of payments, (iii) encourage broad digitization in the Nigerian society, (iv)

[1] Extensive details about the eNaira CBDC design features and structure can be found in the article: *Ozili (2022d)*

increase cross-border trade, (v) improve monetary policy effectiveness, (vi) improve tax collection, (vii) implement targeted social interventions, and (vii) it helps to facilitate cheaper and faster remittance inflows.

This study contributes to the existing CBDC literature that investigate the potential benefits of a central bank digital currency (Baronchelli, Halaburda and Teytelboym, 2022; Hayashi and Toh, 2022; Ozili, 2020a; Dakila Jr, 2022; Maniff, 2020; Babin, Smith and Shah, 2022). In the literature, financial inclusion is widely acknowledged to be a major reason for adopting a CBDC in developing countries. But it is not a reason for issuing a CBDC in developed countries (Maniff, 2020). This study contributes to the existing CBDC literature by exploring the benefits of the eNaira CBDC for financial inclusion in Nigeria. The discussion in the article also contributes to the existing literature that investigate the relevant use-case of CBDC in developing countries.

The remainder of the paper is organized in the following way. The literature review is shown in section 2. Analysis of trend data is presented in section 3. Section 4 identifies how the eNaira central bank digital currency can increase financial inclusion. Section 5 suggests some important considerations for the future. Section 6 concludes.

2. Literature review

2.1. Theories

Several theories have emerged that explain the reason for using instruments or tools to achieve high levels of financial inclusion. The most notable theories are the *'theories of financial inclusion'* developed by Ozili (2020). For instance, the public good theory of financial inclusion argues that the State should treat 'financial inclusion' as a public good that should benefit everybody. When this happens, the government will use any relevant tool at its disposal to increase the level of financial inclusion as a public good. The government has a compelling reason to use one of its tools, such as a CBDC, to broaden financial inclusion for the benefit of all citizens so that nobody is left out. The government may also have to subsidize the cost of offering financial services through CBDC payments to encourage more people to own a CBDC account for greater financial inclusion.

Another theory is the dissatisfaction theory of financial inclusion. The theory proposes that financial exclusion occurs when people become dissatisfied with the actions of financial institutions to their customers. The customers become frustrated and their frustration lead them to exit the financial system, preferring to return to the informal sector because they have lost confidence in financial institutions and can no longer trust financial institutions. The affected customers would rather trust a central bank than trust financial institutions. A central bank can take advantage of people's dissatisfaction with financial institutions by providing them with an alternative way to access the financial system without dealing directly with financial institutions. One of such alternative ways is through the issuance of a CBDC such as the eNaira. Another theory is the public money theory of financial inclusion which emphasized that public money (e.g. CBDC) should be used to fund financial inclusion programs. Other theoretical perspectives have been explored by Simatele et al (2021), Kling et al (2022) and Ahmad Malik and Yadav (2022).

2.2. Empirical studies

Existing empirical studies focus on the benefits and use-case of CBDC in developing and developed countries. For example, Ozili (2022d) argued in support of the view that central bank digital currency can increase financial inclusion in Nigeria. The author argued that a central bank digital currency will lead to the digitization of value chains in Nigeria, it will improve access to essential digital financial services, it will enlarge the growing digital economy in Nigeria, it will enhance the efficiency of digital payments and it will offer low transaction costs for users of CBDC in Nigeria.

Maniff (2020) argues that central bank digital currency may experience some difficulty in increasing financial inclusion if the design of the central bank digital currency conflict with the other objectives for creating a central bank digital currency. The author also argues that a central bank digital currency that is created for financial inclusion purposes would complement cash (Maniff, 2020). The author further points out that central bank digital currency can increase the level of financial inclusion by modernizing payment systems through new, more efficient technologies that provide additional functionality (Maniff, 2020). A central bank digital currency can also increase financial inclusion by offering a viable solution to the frictions in cross-border (international) payments (Maniff, 2020). A central bank digital currency can also provide a public sector solution that delivers cheaper, more efficient cross-border payments (Maniff, 2020). Murakami, Shchapov and Viswanath-Natraj (2022) argued that central bank digital currencies present some advantages. Some of the advantages include increased financial inclusion of underserved adults and the unbanked population, improving cross-border payments and facilitating fiscal transfers. However, they emphasize that there are still many unresolved issues in the design of a central bank digital currency. The researchers used a two-agent framework to show that central bank digital currencies can increase financial inclusion if households use it as a savings vehicle to smooth consumption. They also revealed that retail central bank digital currencies are more useful and beneficial in economies that have low levels of financial inclusion. Engert and Fung (2017) suggest that even though central bank digital currency might improve financial inclusion, financial inclusion is not a major problem in most advanced economies, and for this reason, financial inclusion is not a compelling motivation for issuing a central bank digital currency in most advanced economies including Canada. They emphasized that financial inclusion is most likely an important concern in some emerging and developing economies. Armas, Ruiz and Vásquez (2022) explore the potential role of CBDC implementation in promoting financial inclusion in Peru. They argued that central bank digital currency can increase financial inclusion by allowing the unbanked population to access digital payment instruments. They argued that this can happen by (i) funds transfers where the banking network is not present, (ii) payments on public transportation, (iii) payment of wages in the informal sector and rural areas, (iv) payments to small merchants' suppliers (v) programs to promote social inclusion among the unbanked population (government to person), (vi) extend accessibility of digital payments to the government. However, they argued that the development of the domestic payment system is limited by low financial inclusion. Barr, Harris, Menand and Xu (2020) argued that central bank digital currency can increase financial inclusion by expanding access to financial services using a central bank digital currency. Allen, Gu and Jagtiani (2022) pointed out that central bank digital currency will increase financial inclusion by reducing transaction fees and the cost of financial services, thereby improving access to capital. Ozili (2022b) argued that central bank digital currency can increase financial inclusion because consumers do not need to own a bank account to hold a CBDC. Ozili (2022a), in a review of literature, maintained that the need to increase the level of financial inclusion is a motivation for issuing a central bank digital currency in emerging and developing countries. The author argues that central bank digital currency can increase financial inclusion by giving people access to payments through central bank digital currency. Morales-Resendiz et al (2021) argued that financial inclusion is a major concern in Latin America and the Caribbean (LAC) countries and the issuance of a central bank digital currency is being considered in these countries to expand access to financial services. Banet and Lebeau (2022) analyzed the impact of introducing a central bank digital currency on financial inclusion. They acknowledged that there has been a growing interest in investigating the potential of a central bank digital currency to support financial inclusion because of the low-cost payments it offers. Gopane (2019) showed that one advantage of a central bank digital currency is that it can be used to broaden financial inclusion, and that central bank digital currency is positively correlated with financial inclusion but is negatively affected by digital inequalities among various segments of the population especially older people. Zuluaga (2021) argued that central banks always cite financial inclusion as a justification for issuing a central bank digital currency because it helps to reduce high fees which make them very appealing to unbanked adults. But the success of CBDC for financial inclusion will depend on whether central banks will rely on private firms to competitively deliver user interfaces such as digital wallets, mobile applications, and customer service. Zuluaga (2021) further maintained that even if central bank digital currency become attractive to many unbanked households, there will be some unbanked adults whose needs CBDCs cannot satisfy. Zuluaga (2021) emphasized that even though technology is helping to increase financial inclusion through CBDC, progress in this area is not automatic and it may take many years to achieve. Maryaningsih, Nazara, Kacaribu and Juhro (2022) showed that a retail CBDC is more prevalent in countries that have low financial inclusion and a large informal economy because it offers easier access to the financial system. Negrea and Scarlat (2022) pointed out that CBDC issuance can help to increase financial inclusion and create a very competitive market for private sector payment solutions. In addition, CBDC can create a digital solution that can help to increase financial inclusion for the 1.7 billion people globally who are not banked or do not have access to essential financial services (Negrea and Scarlat, 2022). CBDC can also be used to serve unbanked adults living in areas where traditional banking or financial infrastructure does not exist (Negrea and Scarlat, 2022). Therefore, CBDC can help to achieve a meaningful level of financial inclusion in such areas.

3. Analysing interest over time in eNaira CBDC and financial inclusion in Nigeria

3.1. Local interest over time in eNaira and financial inclusion

Interest over time data for Nigeria were collected from Google Trends database from September 25 to October 10 of 2022. The interest over time data measures the popularity of the 'eNaira' and 'financial inclusion' on the internet. The numbers represent search interest relative to the highest point on the chart for the given region and time. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough data for this term. Table 1 shows that the highest interest in eNaira on the internet was recorded on the day the eNaira was launched while interest in financial inclusion reached its highest point in May 2022. Table 2 shows that Northern states in Nigeria had greater interest in eNaira than southern states particularly in Gombe State, Adamawa State, Jigawa State and Yobe State.

Table 1. Interest over time data

Week	eNaira: (Nigeria)	financial inclusion: (Nigeria)
31/10/2021	100	0
07/11/2021	76	79
14/11/2021	48	38
21/11/2021	31	0
28/11/2021	24	39
05/12/2021	43	56
12/12/2021	22	0
19/12/2021	33	0
26/12/2021	30	0
02/01/2022	20	65

09/01/2022	10	80
16/01/2022	8	74
23/01/2022	23	68
30/01/2022	18	60
06/02/2022	15	54
13/02/2022	21	22
20/02/2022	11	27
27/02/2022	9	19
06/03/2022	12	51
13/03/2022	13	46
20/03/2022	12	26
27/03/2022	3	48
03/04/2022	9	0
10/04/2022	5	0
17/04/2022	6	53
24/04/2022	0	57
01/05/2022	5	20
08/05/2022	5	100
15/05/2022	14	0
22/05/2022	15	60
29/05/2022	8	42
05/06/2022	6	32
12/06/2022	14	44
19/06/2022	0	75
26/06/2022	5	0
03/07/2022	5	74
10/07/2022	13	61
17/07/2022	9	47
24/07/2022	7	31
31/07/2022	8	22
07/08/2022	16	0
14/08/2022	16	0
21/08/2022	20	64
28/08/2022	14	62
04/09/2022	36	0
11/09/2022	16	20
18/09/2022	22	0
25/09/2022	17	0
02/10/2022	10	24

Figure 1: Local interest over time in eNaira and financial inclusion

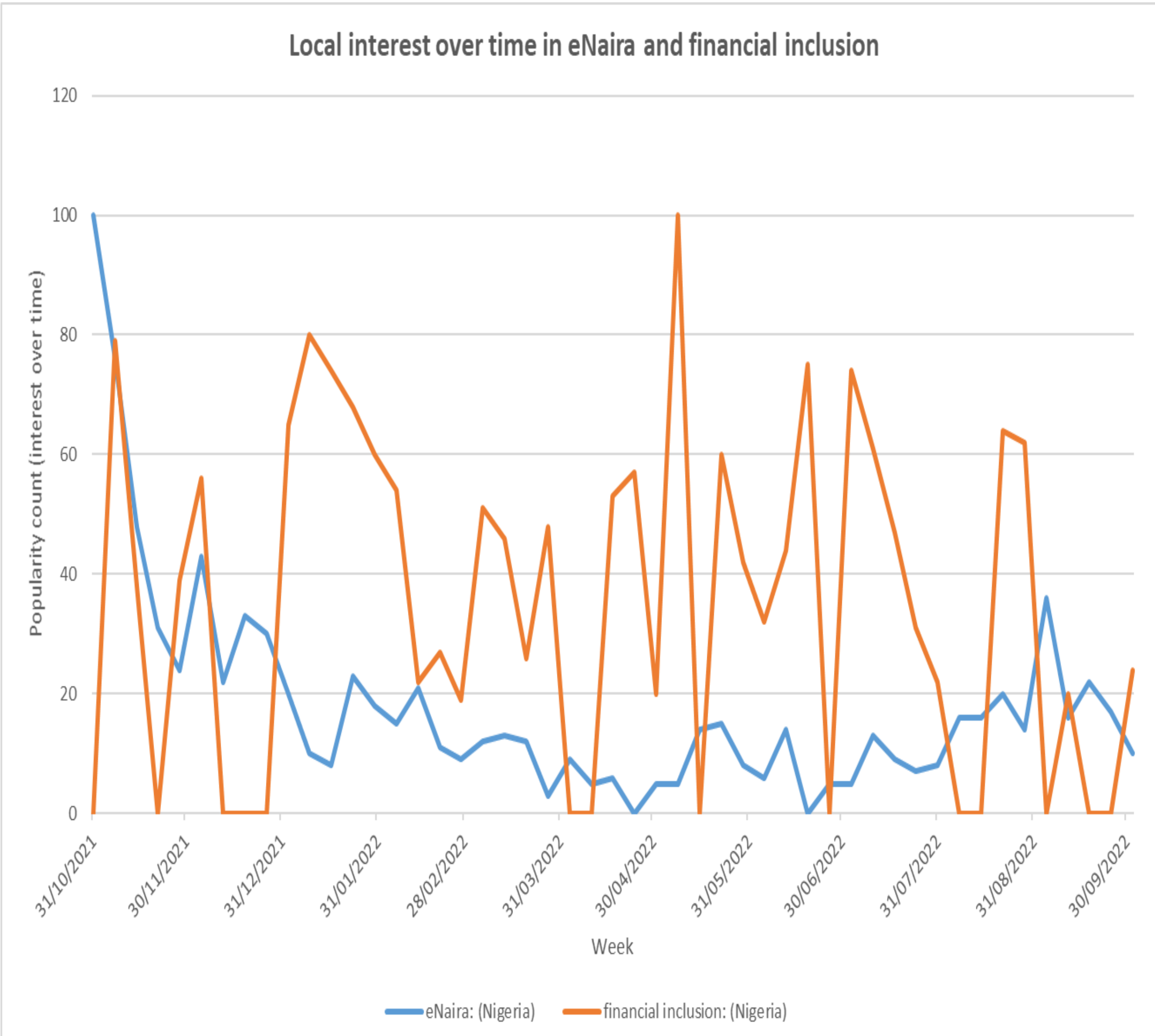
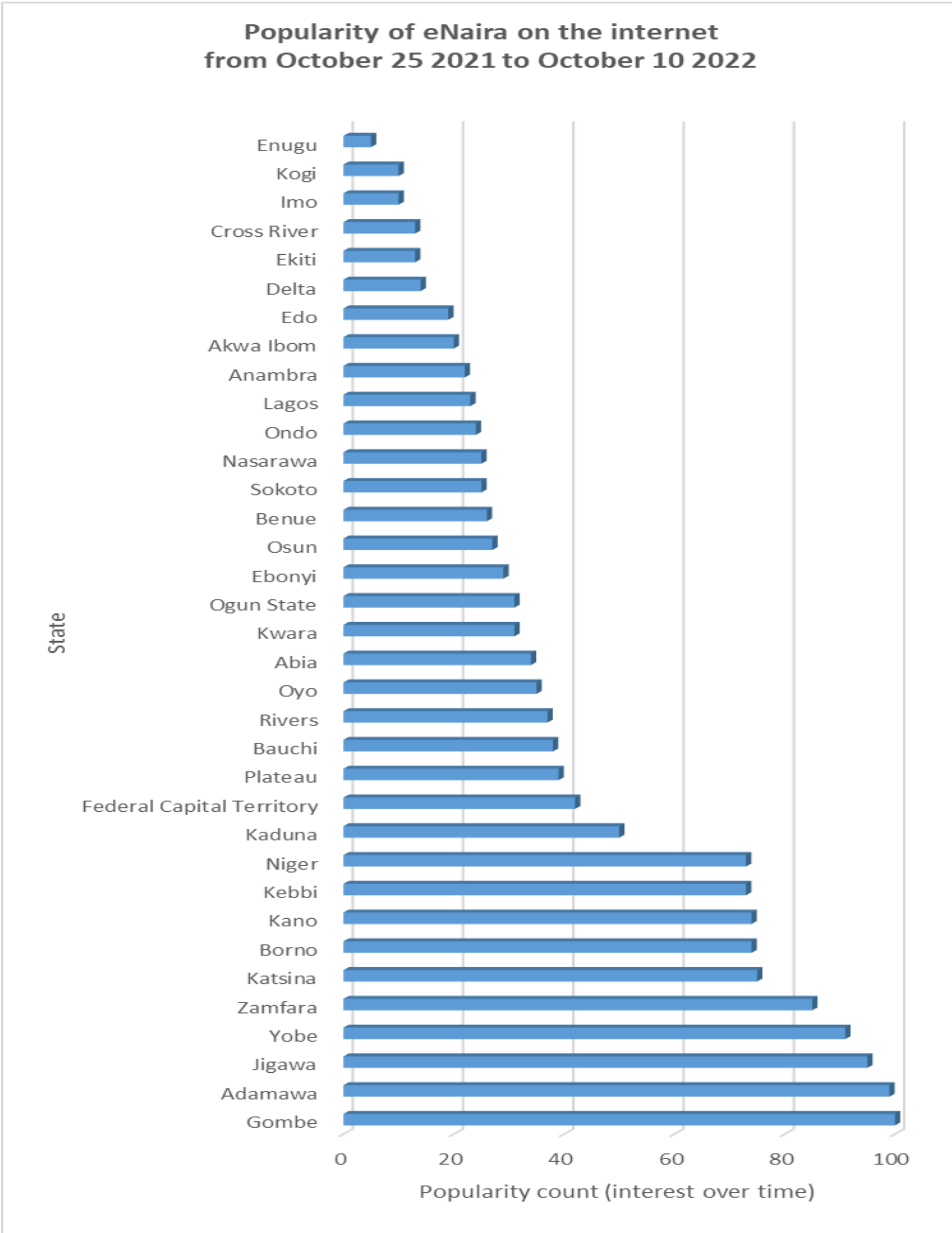


Table 2. Interest over time according to region	
Region	eNaira: (from 10/25/2021 to 10/10/2022)
Gombe	100
Adamawa	99
Jigawa	95
Yobe	91
Zamfara	85
Katsina	75
Borno	74
Kano	74
Kebbi	73
Niger	73
Kaduna	50
Federal Capital Territory	42
Plateau	39
Bauchi	38
Rivers	37
Oyo	35
Abia	34
Kwara	31
Ogun State	31
Ebonyi	29
Osun	27
Benue	26
Sokoto	25
Nasarawa	25
Ondo	24
Lagos	23
Anambra	22
Akwa Ibom	20
Edo	19
Delta	14
Ekiti	13
Cross River	13
Imo	10
Kogi	10
Enugu	5

Figure 2. Popularity of eNaira on the internet



4. eNaira CBDC for financial inclusion

One important benefit of the eNaira CBDC is that it can increase financial inclusion in several ways. Below are examples of how the eNaira can increase financial inclusion in Nigeria.

- **eNaira offers an easy account opening process for greater financial inclusion**

The eNaira central bank digital currency has a simplified account opening process. Individuals do not need to produce any burdensome documentation to open an eNaira account. The easy account opening process will motivate more citizens to open an eNaira account to avoid the burdensome account opening documentation required by the deposit money banks.

- **eNaira enables digital access to diverse financial services in the financial system**

The eNaira central bank digital currency will be accessible to Nigerians through the eNaira speed wallet and USSD code so that they can access the eNaira CBDC both online and offline. With the eNaira, Nigerians will be able to access available digital financial services at the comfort of their homes without the hassle of visiting a bank branch to make or receive payments. They will also be able to make eNaira payments at check-out when making purchases.

- **eNaira offers lower cost of financial products and services**

The eNaira offers a low transaction cost when making payments. This will make the eNaira become a cheaper payment alternative compared to existing payment channels. The eNaira will also help to reduce the cost of remittance and make it cheaper for Nigeria diaspora to send money back home by obtaining eNaira from international money transfer operators (IMTOs) and transferring the remitted funds to the recipients or beneficiaries living in Nigeria by wallet-to-wallet transfers free of charge.

- **No more unexplained bank charges that causes financial exclusion**

One reason why people voluntarily exit the formal financial system is because of unexplained bank charges. The charges affect the poor severely and they react by exiting the formal financial system. The introduction of the eNaira will bring an end to unexplained bank charges. Users of eNaira will pay low transaction cost, and they will understand the purpose of the transaction cost. They will be clearly informed and notified about a change in transaction cost or the introduction of new charges. This will increase central bank transparency, increase trust in the government and make more unbanked adults willing to join the formal financial system by opening an eNaira account.

- **eNaira will be used to attract people who have lost confidence in banks.**

People may lose confidence in commercial banks when they become victims of fraud or victims of unauthorized access to bank account that could lead to loss of their savings. Such experience lead to dissatisfaction and can make people exit the financial system (Ozili, 2020)[2]. The eNaira can accommodate the needs of this category of people. People who have lost confidence in commercial banks will trust the eNaira since the eNaira is a direct liability of the central bank not commercial

[2] This is consistent with the propositions of the 'dissatisfaction theory of financial inclusion' A proposed by Peterson Ozili in his work 'Theories of financial inclusion'.

banks. They can be confident that if they keep their money with the central bank through the eNaira, their savings will be protected and secured, and the central bank will bear liability for any loss of customers' money that is not the customer's fault.

- **Interest-bearing eNaira CBDC can increase financial inclusion**

An interest-bearing eNaira CBDC will increase financial inclusion. The interest earned on eNaira deposits will be attractive to unbanked adults and will give unbanked adults a motivation to join the financial system through the eNaira so that they can take advantage of the interest on the eNaira CBDC deposit. They will bring their savings to the formal financial system through the eNaira. They will also have access to wide range of financial services that can be accessed through the eNaira.

- **eNaira can increase financial inclusion using offline channels**

The eNaira can increase financial inclusion by using a USSD code to onboard the unbanked and underserved users that do not have access to internet connectivity or a smart phone.

5. Important considerations for the future

Some important considerations to increase the potential of the eNaira to increase financial inclusion include the following.

- **eNaira adoption should be gradual**. Enough time should be given to citizens and businesses to adopt the eNaira CBDC. This is important because it will ensure that citizens and businesses use the eNaira because there is a clear benefit of using the eNaira and not because they are compelled to adopt it. People should be allowed to compare the benefits of the eNaira with the benefits of other payment alternative. This will help them to choose the eNaira if it offers superior benefits.

- **Widespread digital literacy among the rural population is essential for greater eNaira adoption and usage.** There is significant digital illiteracy in some communities in Nigeria. Digital illiteracy is highly undesirable in today's society. It is a cause of digital exclusion and social exclusion. Digital illiteracy affects vulnerable people especially those living in rural and remote areas. When people are unable to use digital tools on a daily basis, it prevents them from accessing basic resources that can only be accessed digitally. They won't be able to access financial services remotely because they don't know how to, and they won't be able to teach their family and peers how to use digital tools. Some causes of digital illiteracy in Nigeria are lack of education, improper education, lack of access to internet connectivity and lack of access to mobile phones (Ekoh, George and Ezulike, 2021; Ani, Uchendu and Atseye, 2007). The rural population need basic digital literacy to enable them to fully integrate in the digital society (Tayo, Thompson and Thompson, 2016). They should learn how to download an app, update an app, login into an app, transfer money on the app and check transaction history on the app. They should also learn how to use a USSD code to perform financial transactions.

- **The eNaira should not replace cash completely**. The eNaira CBDC should co-exist with cash because cash remains the dominant form of transaction in Nigeria especially among the financially excluded groups. People need time to adjust to using the eNaira CBDC.

- **eNaira deposits should be interest-bearing to attract unbanked savers**. Unbanked savers will be motivated to bring their savings into the formal financial system through the eNaira because they trust the central bank. The interest earned on eNaira deposits should be lower than the interest on bank deposits to avoid disorderly bank disintermediation.

- **The eNaira CBDC should be non-disruptive**. The phased introduction of eNaira CBDC should not significantly disrupt the financial and banking system.

- **The eNaira may not be well-perceived or welcomed in the informal economy**. The central bank need to find a way to make the eNaira accepted in the informal economy in Nigeria.

6. Conclusion

This paper explored how eNaira CBDC can achieve financial inclusion in Nigeria. The eNaira is being used to broaden financial inclusion as part of the National Financial Inclusion Strategy. It was argued that the eNaira can increase financial inclusion by (i) offering an easy account opening process for greater financial inclusion (ii) enabling digital access to diverse financial services in the financial system, (iii) offering low-cost financial products and services, (iv) avoiding unexplained bank charges that causes financial exclusion, (v) attracting people who have lost confidence in banks, (vi) introducing interest-bearing eNaira, and (vii) using offline channels to access the eNaira.

The implication of the findings is that there is a clear channel through which eNaira can increase financial inclusion. Policy makers should explore other innovative and non-disruptive ways through which the eNaira CBDC can increase financial inclusion for the good of Nigerians.

Although there is a clear pass-through between eNaira usage and financial inclusion, a number of considerations need to be taken into account. Some of which include embarking on a national digital literacy program to increase awareness of the eNaira CBDC. There is also a need to watch out for risks related to cyber-attacks and user protection.

Future studies should examine how the eNaira affects economic growth. Such studies should focus on how the eNaira affects business activities in specific sectors of the Nigerian economy. Future studies can also compare the Nigeria eNaira CBDC with other CBDC in Africa such as Ghana. Such comparison will provide insight in understanding the local modifications in CBDC design.

Reference

Ahmad Malik, F., & Yadav, D. K. (2022). Financial Theories and Their Relevance in Financial Inclusion. In *Financial Inclusion Schemes in India* (pp. 21-35). Springer, Singapore.

Allen, F., Gu, X., & Jagtiani, J. (2022). Fintech, cryptocurrencies, and CBDC: Financial structural transformation in China. *Journal of International Money and Finance*, *124*, 102625.

Ani, O. E., Uchendu, C., & Atseye, E. U. (2007). Bridging the digital divide in Nigeria: a study of internet use in Calabar Metropolis, Nigeria. *Library Management*, 28(6/7), 355-365.

Armas, A., Ruiz, L., & Vásquez, J. L. (2022). Assessing CBDC potential for developing payment systems and promoting financial inclusion in Peru. *BIS Papers chapters*, *123*, 131-151.

Babin, R., Smith, D., & Shah, H. (2022). Central bank digital currency: Advising the financial services industry. *Journal of Information Technology Teaching Cases*.

Banet, J., & Lebeau, L. (2022). Central Bank Digital Currency: Financial Inclusion vs. Disintermediation. *Federal Reserve Bank of Dallas, Working Paper* No. 2218, 1-49.

Baronchelli, A., Halaburda, H., & Teytelboym, A. (2022). Central bank digital currencies risk becoming a digital Leviathan. *Nature Human Behaviour*, 6(7), 907-909.

Barontini, C., & Holden, H. (2019). Proceeding with caution-a survey on central bank digital currency. *Proceeding with Caution-A Survey on Central Bank Digital Currency (January 8, 2019). BIS Paper*, No. 101.

Barr, M. S., Harris, A., Menand, L., & Xu, W. M. (2020). Building the Payment System of the Future: How Central Banks Can Improve Payments to Enhance Financial Inclusion. *U of Michigan Law & Econ Research Paper*, (20-038).

Bordo, M. D., & Levin, A. T. (2017). Central bank digital currency and the future of monetary policy. *National Bureau of Economic Research*. No. 23711.

Brunnermeier, M. K., & Niepelt, D. (2019). On the equivalence of private and public money. *Journal of Monetary Economics*, 106, 27-41.

Calle, G., & Eidan, D. (2020). Central Bank Digital Currency: an innovation in payments. *R3 White Paper*, April.

Cunha, P. R., Melo, P., & Sebastião, H. (2021). From bitcoin to central bank digital currencies: Making sense of the digital money revolution. *Future Internet*, 13(7), 165.

Dakila Jr, F. G. (2022). Deliberations of an emerging market economy central bank on central bank digital currencies. BIS Papers chapters, 123, 153-160.

Davoodalhosseini, M., Rivadeneyra, F., & Zhu, Y. (2020). CBDC and monetary policy (No. 2020-4). *Bank of Canada*.

Ekoh, P. C., George, E. O., & Ezulike, C. D. (2021). Digital and physical social exclusion of older people in rural Nigeria in the time of COVID-19. *Journal of Gerontological Social Work,* 64(6), 629-642.

Engert, W., & Fung, B. S. C. (2017). *Central bank digital currency: Motivations and implications* (No. 2017-16). *Bank of Canada Staff Discussion Paper*, 1-26.

Gopane, T. J. (2019, May). An enquiry into digital inequality implications for central bank digital currency. In *2019 IST-Africa Week Conference (IST-Africa)* (pp. 1-9). IEEE.

Hayashi, F., & Toh, Y. L. (2022). Assessing the Case for Retail CBDCs: Central Banks' Considerations. *Payments System Research Briefing*, (May 26, 2022), 1-7.

Inozemtsev, M. I., & Nektov, A. V. (2022). Digital Platforms for Cross-Border Settlement of CBDC. In *The Platform Economy* (pp. 131-145). Palgrave Macmillan, Singapore.

Jia, P. (2020). Negative interest rates on central bank digital currency.

Kling, G., Pesqué-Cela, V., Tian, L., & Luo, D. (2022). A theory of financial inclusion and income inequality. *The European Journal of Finance*, 28(1), 137-157.

Lee, D. K. C., Yan, L., & Wang, Y. (2021). A global perspective on central bank digital currency. *China Economic Journal*, 14(1), 52-66.

Liu, F., & Walheer, B. (2022). Financial inclusion, financial technology, and economic development: A composite index approach. *Empirical Economics*, 1-31.

Liu, D., Xie, Y., Hafeez, M., & Usman, A. (2022). The trade-off between economic performance and environmental quality: does financial inclusion matter for emerging Asian economies? *Environmental Science and Pollution Research*, 29(20), 29746-29755.

Maniff, J. L. (2020). Motives Matter: Examining Potential Tension in Central Bank Digital Currency Designs. *Federal Reserve Bank of Kansas City: Omaha, NE, USA*.

Maryaningsih, N., Nazara, S., Kacaribu, F. N., & Juhro, S. M. (2022). Central Bank Digital Currency: What Factors Determine Its Adoption?. Buletin Ekonomi Moneter dan Perbankan, 25(1), 1-24.

Morales-Resendiz, R., Ponce, J., Picardo, P., Velasco, A., Chen, B., Sanz, L., Guiborg, G., Segendorff, B., Vasquez, J.L., Arroyo, J. and Aguirre, I. (2021). Implementing a retail CBDC: Lessons learned and key insights. *Latin American Journal of Central Banking*, *2*(1), p.100022.

Murakami, D., Shchapov, I., & Viswanath-Natraj, G. (2022). CBDCs, Financial Inclusion, and Monetary Policy. *Available at SSRN 4102397*.

Negrea, C. I., & Scarlat, E. M. (2022). The Digital Leu Challenges and Possible Areas of Implementation. "*Ovidius" University Annals, Economic Sciences Series,* Volume XXII, Issue 1.

Ozili, P. K. (2020). Theories of financial inclusion. In *Uncertainty and challenges in contemporary economic behaviour*. Emerald Publishing Limited.

Ozili, P. K. (2021). Financial inclusion research around the world: A review. *Forum for social economics*, 50(4), 457-479.

Ozili, P. K. (2022a). Central bank digital currency research around the World: a review of literature. *Journal of Money Laundering Control*.

Ozili, P. K. (2022b). Can central bank digital currency increase financial inclusion? Arguments for and against. In *Big Data Analytics in the Insurance Market* (pp. 241-249). Emerald Publishing Limited.

Ozili, P. K. (2022c). Global Central Bank Digital Currency Research and Developments: Implication for Cryptocurrency. In *Cryptocurrency: Concepts, Technology, and Issues, Forthcoming*, p. 1-16.

Ozili, P. K. (2022d). Central bank digital currency in Nigeria: opportunities and risks. In *The New Digital Era: Digitalisation, Emerging Risks and Opportunities* (Vol. 109, pp. 125-133). Emerald Publishing Limited.

Piazzesi, M., & Schneider, M. (2020). Credit lines, bank deposits or CBDC? competition and efficiency in modern payment systems. *Unpublished, Stanford University.*

Sethaput, V., & Innet, S. (2021, November). Blockchain Application for Central Bank Digital Currencies (CBDC). In *2021 Third International Conference on Blockchain Computing and Applications* (BCCA) (pp. 3-10). IEEE.

Simatele, M.C., Dube, Z., Khumalo, S., Ssonko, G.W., Kawooya, D.R., Bwalya, M., Dlamini, P.G., Kichini, G., Kabange, M.M., Dlova, M. and Mishi, S., 2021. Financial inclusion: Basic theories and empirical evidence from African countries.

Tayo, O., Thompson, R., & Thompson, E. (2016). Impact of the digital divide on computer use and internet access on the poor in Nigeria. *Journal of Education and Learning,* 5(1), 1-6.

Zhang, T., & Huang, Z. (2022). Blockchain and central bank digital currency. *ICT Express*, 8(2), 264-270.

Zuluaga, D. (2021). Which Type of Digital Currency for Financial Inclusion?. *Cato Journal*, 41, 413.