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The democratization of digital currency in Nigeria: A sentiment analysis of eNaira app usability

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Globally, Central Bank Digital Currency (CBDC) is receiving a lot of attention in digital currency deliberations since it is at the top of the agenda of almost every central bank today. Although there is a growing body of literature on CBDCs, user perspectives on their usage and adoption in the literature are very sparse. This study set out to analyze factors impacting the actual usage of CBDC through sentiment analysis of eNaira, the first CBDC to be issued in Africa by the Central Bank of Nigeria (CBN). The research relies on the 214 data points extracted from eNaira App users' comments from Google Play and App Store from 2020 to 2021. It framed its analysis based on theories of moral sentiments and appraisal theory of emotion. This research shows that eNaira users faced multiple challenges; however, CBN's responses to these challenges are minimal. The results highlighted the need to include public sentiments in policy formulation; the Nigerian government's ban on cryptocurrency trading negatively impacted the uptake of the eNaira due to mistrust. This research study contributes theoretically to appraisal theory and the theory of moral sentiment by explaining the evolution and public sentiments towards adopting the novel eNaira in Nigeria.

Keywords: digital currency, eNaira, central bank, Nigeria, sentiment analysis, content analysis

Introduction

Central Bank Digital Currency (CBDC) is gaining attention and consideration by central banks worldwide due to its promise of transforming the financial landscape, enhancing financial inclusion, improving efficiency, and providing central banks with new tools for monetary policy implementation in the evolving digital economy (Bystryakov, Nenovsky, and Ponomarenko 2019). The implementation and impact of CBDC will depend on various factors, including regulatory frameworks, technological considerations, and public acceptance (Bitter 2020; Minesso et al. 2022).

There are several reasons for the issuance of CBDC, including financial inclusion, which reflects the notion of democratization where citizens, especially the underbanked and unbanked, are allowed to participate in formal financial services (Lannquist 2023). As noted by Salamopsis and Mention (2018), financial inclusion calls for democratizing financial services, thereby providing a path for persons outside the formal financial services to participate in an equal and unrestricted manner. On the other hand, Omarova (2021) argues that, although there is a lot of debate about how democratizing access to central bank money such as CBDC could transform and democratize the entire financial system, especially enabling financial inclusion, there is no coherent vision of how this democratization process will occur.

The potential of CBDC to strengthen the financial sector of emerging economies, including Nigeria, is numerous. As noted by Jack (2021), the introduction of CBDC can facilitate remittances, which are a major source of income and foreign exchange for Nigeria. CBDC can lower remittance transfer costs, making it easier for the Nigerian diaspora to remit funds to Nigeria by obtaining eNaira from international money transfer operators and transferring them to recipients in Nigeria by wallet-to-wallet transfers free of charge

(Ozili 2022a). Another significant implication of CBDC is that it can improve the conduct of monetary policy, through the provision of more accurate and timely data on money supply and demand, enabling the implementation of more innovative and effective policy tools, such as negative interest rates, or targeted transfers (Soderberg 2023; Xin and Jiang 2023).

However, the CBDC can pose a threat to the profitability and stability of commercial banks, by reducing their deposit base, intermediation role, and fee income, as well as increasing their competition and operational costs (Son, Ryu, and Webb 2023; Tercero-Lucas 2023). While the issuance of a CBDC can have significant implications for financial stability, influence the monetary and credit system, and contribute to more transparent and cheaper payments, it can at the same time reduce the availability of credits (Kochergin and Yangirova 2019) and potentially lead to bank panic (Kim and Kwon 2023). Also, the CBDC can create a risk of bank runs, if the public perceives the CBDC as a safer and more convenient alternative to bank deposits (Meller and Soons 2023).

eNaira was issued on October 25, 2021, by the Central Bank of Nigeria to complement existing payment options available using a variety of channels such as mobile banking apps, point of sale terminals, USSD, quick response codes, and Internet banking (CBN 2021). However, the implementation of CBDC comes with some implementation challenges such as inadequate infrastructure and quality of the population's education level (Ma 2023).

There are a number of studies on Nigeria's CBDC, such as Ozili (2022a), which suggested the eNaira design should be offered at zero transaction cost. Esoimeme (2021) argues that an effective regulatory approach to eNaira can help support Nigeria's CBDC as a tool for financial inclusion. Third, in a paper that reviews the

literature on Central bank digital currency research around the world, Ozili (2022a) identified a research gap, that is lack of country-specific studies on CBDC design. In the literature, there are only a few studies on the eNaira, and none of the research offered a user perspective of users on eNaira design and its usability; therefore, this paper seeks to fill this gap through sentiment analysis of eNaira App usability. This paper is very significant in many ways. First, although CBDC has been implemented in some countries, Nigeria is Africa's largest economy and the first country in Africa to issue CBDC according to Esoimeme (2021). Therefore, this research paper is based on empirical data, expounding on users' perspectives towards CBDCs which are currently not available in the literature.

Also, while extant studies on CBDCs have focused on regulatory and monetary perspectives (Davoodalhosseini 2022; Minesso et al. 2022), implications for commercial banks (Bitter 2020; Mancini-Griffoli et al. 2018), the framework for development and implementation (Ahiabenu 2022), technical development and challenges (Zhang and Huang 2022), and implementation challenges and opportunities (Ahmed et al. 2022; Ozili 2021), studies exploring the user perspectives on CBDC especially in Africa is still lacking. This paper therefore examines public acceptance and use of the eNaira, Africa's first CBDC and one of the few major economies in the world to issue CBDC (Atlantic Council 2022). The objectives of this study are to identify the eNaira user sentiment trends over time, analyze the user sentiments towards eNaira by identifying positive and negative reviews from users' comments and feedback, evaluate the effectiveness of eNaira technical support mechanism, and identify the major challenges associated with eNaira usability.

The rest of this research paper after this introduction is organized as follow: literature review, methodology, presentation of results, and its discussion. This research paper continues by stating its theoretical and practical contributions, a conclusion section, and finally, it indicates the limitations of this research paper and recommendations for future studies.

Literature review

Digitalization is changing the face of finance, this is evident in the increasing adoption and integration of emerging technologies (such as blockchain) and digital solutions into financial services, resulting in the emergence of new and innovative financial solutions (Siano et al. 2020). With the growing adoption of digital payments, which represents the most significant domain of financial technology (fintech) globally (Abdul-Rahim et al. 2022), there has been a rise in the acceptance and use of digital currencies (Keister and Monnet 2022). In the past few years, central banks have contemplated the possibilities of adapting to the new realities of digital disruption in the finance space by issuing an acceptable digital means of exchange. There is a mass and growing adoption of decentralized cryptocurrencies (e.g. bitcoin, dogecoin, Ethereum, etc.), especially among the millennials (Williamson 2022). Although a more general

adoption of digital currencies may be low, the prospects therein are high enough to motivate central banks to consider digitalizing their currencies (Lee, Yan, and Wang 2021; Wu, Yang, and Hu 2022).

To consume CBDC, end users have three options, including using mobile phones based on Unstructured Supplementary Service Data (USSD), that is, mobile phone short code, mobile phone wallets, and mobile banking apps (Ahiabenu 2022). Vuković (2021) suggested that mobile apps remain an essential tool for accessing CBDC, especially since most prospective users of CBDC are mobile phone owners. Nigeria's CBDC eNaira is offered on mobile apps through a download from either the Google Play store or the Apple store (Central Bank of Nigeria 2021). Nigeria is one of the largest three markets for mobile apps in Africa, with one of the fastest-growing numbers of users, as noted by Junowicz and Afullo (2021), reinforcing the notion that Mobile Apps are relatively popular in Nigeria.

CBDC in emerging economies: the case of Nigeria's eNaira

Fiat money is a legal tender because it is issued by the government in the form of coins and paper notes. CBDC, therefore, represents the digital version of a country's fiat currency (Chukwuere 2021). This type of money is issued by the apex bank of the country, and exists only in digital form to facilitate payments, either as an interest-bearing or non-interest-bearing instrument (Bitter 2020 Wu, Yang, and Hu 2022;). As an emerging concept, several authors are attempting to put a definition to this new phenomenon. However, the commonalities in these definitions are; a. it must be in an intangible digital form, b. issued by a recognized authority for money issuance, and c. it must be acceptable within the given geographical borders as a medium of exchange (Ahiabenu 2022).

Banks all over the world are experiencing a massive technological disruption, and the Nigerian banking industry is no exception, these technological disruptions are expressed in the forms of agent banking, online banking, digital currencies, and social banking. (Olaleye et al. 2020). On the 5th of February, 2021, the Central Bank of Nigeria (CBN) announced the imposition of a ban on cryptocurrency transactions in the country with immediate effect (Ozili 2022c). However, by October of the same year, the CBN announced the official launch of the first CBDC in Africa – the eNaira.

According to the official website of the eNaira,

eNaira is a Central Bank of Nigeria-issued digital currency that provides a unique form of money denominated in Naira. eNaira serves as both a medium of exchange and a store of value, offering better payment prospects in retail transactions when compared to cash payments. (eNaira 2022)

The eNaira is designed to have a 1:1 parity with the fiat Naira. Some characteristics of the eNaira include; a regulated transition limit, wallet-based operation, offline enabled, zero interest earnings, and mobile money integration (Ahiabenu 2022).

According to the CBN in the official design paper of the eNaira, Africa's first CBDC is hoped to drive the following eight strategic benefits, which are:

a. improving the availability and usability of Central Bank money, b. supporting a resilient payment system ecosystem, c. encouraging financial inclusion, d. reducing the cost of processing cash, e. enabling direct welfare disbursements to citizens, f. increasing revenue and tax collection, g. facilitating Diaspora remittances, and h. reducing the cost and improving the efficiency of cross-border payments. (CBN 2021)

Whether the eNaira will be successful, sustainable, and can be used for its intended purposes is yet to be established (Chukwuere 2021). Like other CBDCs, the eNaira is expected to drive a more financially inclusive economy among other potential opportunities. Although most central banks are positive and optimistic about their digital currencies, successful implementation and the achievement of the desired adoption are not without challenges (Zhang and Huang 2022). This assertion is also true for eNaira (eNaira 2022).

Sentiment analysis

The process of automatically identifying and classifying opinions expressed in text, such as posts on social networking platforms, news stories, and customer reviews, into positive, negative, or neutral categories is called sentiment analysis (Storey and Park 2022). Sentiment analysis is also known as opinion mining (Liu 2012). The concept of sentiment analysis is a method that aims to understand the influence of emotions and opinions of individuals or groups based on their analysis of text data (Pang and Lee 2008). The concept is based on the idea that emotion, thoughts, behaviour, intent, and opinions expressed in natural language text can be used to infer an overall positive, negative, or neutral sentiment toward a specific topic or entity (Olaleye et al. 2020). The subjectivity nature of sentiment analysis is a key limitation, as the interpretation of the text can vary based on the individual conducting the analysis (Liu 2012). Also, sentiment analysis can be hindered by the use of sarcasm, irony, and other forms of figurative language, which can lead to inaccuracies in the analysis (Wankhade, Rao, and Kulkarni 2022). Despite this, sentiments provide an easy way to access people's feelings about any product or any policy (Khan et al. 2022).

In recent years, sentiment analysis has been applied to the study of emerging technologies and digital transformation. Wankhade, Rao, and Kulkarni (2022), a lexicon-based approach to measure positive, negative, or neutral sentiments reviews on crypto-currencies using Twitter data Rouhani and Abedin (2020) and 'online product purchasing, marketing, and reputation management' (Khan et al. 2022). Another study by Ozturkcan et al. (2019) applied a cross-sectional analysis of tweets with #CBDC hashtags to discuss emerging issues related to CBDC policy. Also, social media texts, including online comments, are particularly useful for sentiment analysis since they contain an expression of a viewpoint and subjective text (Zhang, Wang, and Liu 2018). Therefore, its application in the study of technology adoption in the financial sector, including CBDCs such as the eNaira is

well within context. This is because understanding the sentiment of individuals towards CBDCs is crucial for policymakers and financial institutions in assessing the potential adoption and usage of these digital currencies. The use of sentiment analysis on social media platforms such as Twitter can provide valuable insights into public perceptions and opinions (Olaleye et al. 2020).

Sentiment theory

The different philosophical, psychological, and linguistic approaches that attempt to describe and classify the feelings, attitudes, and opinions expressed by individuals or groups in language or behaviour are called sentiment theories (Storey & Park, 2022). These ideas are utilized in various domains, to comprehend better and analyze feelings, attitudes, and opinions, in addition to the elements that influence them. The following are examples of some of the most influential theories regarding feelings. First, the Affective Event Theory posits that feelings result from experiences or stimuli the individual interprets as having some personal meaning (Weiss and Cropanzano 1996). Second, the Social Comparison Theory proposes that individuals' feelings are affected by how they evaluate themselves about those of other people (Dijkstra, Gibbons, and Buunk 2010). Third, the Social Identity Theory proposes that an individual's feelings are impacted by their participation in a social group and the feelings of those who are a part of that group (Hogg 2016). Fourth, cognitive-appraisal theories emphasize cognitive processes' role in interpreting and assessing experiences and the subsequent formation of emotions (Ellsworth 1991). Also, the linguistic theories of sentiment focus on the language used to communicate feelings, attitudes, and beliefs and how these can be examined and categorized (Taboada 2016). This study integrates and synthesizes the Theory of Moral Sentiments and the Appraisal Theory of Emotion to remain focused.

Adam Smith, an eminent Scottish economist and philosopher, published his work 'The Theory of Moral Sentiments' in 1759 (Smith 1976). This book examines the history of morality, the essence of morality, and how morality directs human behaviour in society. Smith contends that moral sentiments, such as sympathy and empathy, are fundamental to social order and originate from human beings' intrinsic desire to regard other people's views. He believes that this tendency is the source of these feelings.

The theory of moral sentiments explains how individuals form their moral principles, from social interaction and the effect of emotions and intellect. Numerous disciplines, including economics, sociology, psychology, and ethics, have all found applications for this theory. The theory of moral feelings is essential in the modern day because its principles continue to impact contemporary conversations on ethics and the function of morality in a constantly evolving world.

The application of Adam Smith's theories to the moral considerations and consequences of new and emerging technologies refers to integrating the theory of moral feelings in interacting with new technology. An existing study dwells on technology and moral change and focuses on

truth and trust as core human values (Danaher and Sætra 2022). These authors argued that technology impacts the values of truth and trust by influencing the costs or benefits of harnessing them. In recent years, the rapid speed of technological innovation has led to new ethical dilemmas and concerns, such as using artificial intelligence, the protection of privacy, and the role of technology in molding social and moral norms.

The theory of moral sentiments can help guide ethical decision-making in these areas by highlighting the importance of empathy and sympathy in shaping moral behaviour and the role of social norms and interactions in developing moral principles. For instance, in developing eNaira systems, the theory emphasizes the importance of considering the potential influence these systems could have on society and the ethical issues that need to be considered while creating and deploying these systems.

The theory of moral sentiments can also be applied to technology's role in defining social norms and values. This role is an additional application of the theory. As technology continues to play an ever more significant part in our lives, we must consider how technology may reshape our conception of morality and the values we uphold as a society. The theory of moral sentiments provides a framework for understanding the impact of technology on our moral landscape and the need for a continuous examination of our ethical values in the face of technological change. This change is because the theory of moral sentiments posits that our moral landscape is shaped by how we feel about things. In Pizarro's (2000) proposition, the author argued that emotions are partial and tend to play favouritism. It is inferred from this premise that emotions are triggered by the things and people we care about in different circumstances.

On the other hand, the appraisal theory of emotion is a psychological theory that explains how feelings are created in response to events or stimuli. There are variants of appraisal theories in the literature. For example, psychologist John Gottman focused on marriage and family Gottman (1998), while Arnold (1960) and Lazarus (1966) initiated a new theoretical approach called appraisal theory. Moors et al. (2013) reinforced the theory and proposed its future development. In the context of this theory, emotions are not merely the consequence of instinctive reactions to stimuli; instead, they are the outcome of a cognitive evaluation of the stimuli in terms of how relevant and significant they are to the one experiencing the emotion. An appraisal is a name given to this type of evaluation, which entails assessing the stimulus in terms of numerous characteristics, such as its novelty, goal relevance, coping potential, and the presence of opposing emotions. The assessment process causes a shift in physiological arousal and the expression of an emotional reaction suitable for the circumstances.

The appraisal theory of emotion has several potential applications in technology. For instance, the appraisal theory of emotion can help inform the design of technology products since it helps to understand how different technology components elicit varied emotional responses from users (Khan et al. 2021; R. Liu et al. 2019). The designers may develop a more user-centred experience

that generates positive emotions and lowers negative ones by addressing how users will evaluate the technology in terms of goal relevance, novelty, coping capacity, and other characteristics. Based on this information, the functionality of the technology can then be adjusted appropriately. Conclusively, the appraisal theory of emotion offers a valuable framework for understanding and building technology that considers the emotional aspect of human-computer interaction.

Methodology

Textual analysis is a methodology that involves understanding language, symbols, and pictures in texts to gain insight into how people make sense of situations based on their life experiences. *Text mining* is an automatic process that uses natural language processing to extract valuable insights from unstructured text (Agbozo, Watat, and Olaleye 2022). Several studies have employed Google Play and Apple Store reviews for various data analysis techniques (Al-Abbadey et al. 2021; Chen et al. 2021; Frie et al. 2017; Hassan et al. 2018; Schmidt-Kraepelin, Thiebes, and Sunyaev 2019).

This process transforms data into information machines can understand. Text mining automates classifying texts by sentiment, topic, and intent. Text mining is a multifaceted field (Kasemsap 2017) based on various techniques and technologies like knowledge recovery, and it is rooted in databases, machine learning, pattern recognition, and visualization. In this study, text mining is used to illuminate the underlying social context of the eNaira in Nigeria.

Data collection

To respond to the set objectives in this study, the authors holistically examine the reviews of the trending eNaira Speed Wallet in Nigeria from the Google Play and Apple stores. The authors extracted data from Google Play and Apple store with NCapture (Olaleye, Sanusi, and Salo 2017). The files converted to PDF in NVivo were converted into a spreadsheet for further text analysis in Orange Data Mining Software (<https://orangedatamining.com/>). NCapture captures the eNaira speed wallet app reviews and the response of the Central Bank of Nigeria to the reviews. NCapture returned the following information: profile picture, username, ratings (Scale 1–5), date, and reviews.

NVivo is a powerful qualitative data analysis tool that facilitates the in-depth exploration of textual data. It was chosen for its ability to handle large volumes of unstructured text and support the identification of themes, patterns, and sentiments (Mogaji, Ukpabi, and Olaleye 2018). NVivo complements the study by providing a robust qualitative coding and thematic analysis platform (Mogaji, Ukpabi, and Olaleye 2018; Sanusi, Olaleye, and Dada 2020). It aids in identifying recurrent themes in user comments, aligning with the theoretical frameworks of moral sentiments and the appraisal theory of emotion.

Orange is a data visualization and analysis tool with text-mining capabilities. It was selected for its user-friendly interface and visualizations, facilitating the

extraction of meaningful patterns from textual data. Orange complements the study by offering visual representations of sentiment distributions and patterns (Demsar et al. 2013; Patel et al. 2022). Its visualization features enhance the interpretation of sentiment trends, enabling a more accessible presentation of findings.

Voyant is a web-based text analysis tool (<https://voyant-tools.org/>) that provides a range of visualization and analysis options (Miller 2018; Schumann 2022). It was chosen for its ease of use and capacity to generate word clouds, frequency lists, and trend visualizations. Voyant complements the study by offering additional perspectives through its distinctive visualizations. Word clouds, for example, offer a quick overview of frequently mentioned terms in user comments, aiding in identifying key topics and concerns.

While the use of multiple tools enhances the richness of our analysis, it is essential to acknowledge potential limitations and challenges in using them. Using multiple tools may pose a learning curve for researchers. Training and familiarization with each tool were undertaken to mitigate this challenge. Ensuring seamless integration of outputs from different tools requires careful consideration. Steps were taken to harmonize the results to present a unified analysis. Each tool has its specific features and limitations. While we aimed for complementarity, certain functionalities may overlap, leading to potential redundancies.

The choice of NVivo, Orange, and Voyant was guided by their unique strengths and features, which collectively contribute to a comprehensive analysis (Kalantari and Motti 2018; Oberbichler and Pfanzelter 2021). The complementarity of these tools was considered to provide a nuanced understanding of user sentiments. Acknowledging potential limitations and challenges underscores our commitment to transparency and the rigour of our text-mining methodology.

The study realized that NVivo may face challenges in processing slang, ambiguity, and sarcasm, so we adopted a cautious approach in our qualitative coding. The researchers, familiar with potential language nuances, exercised careful judgment in interpreting and coding user sentiments. Regular team discussions were conducted to ensure a shared understanding of the context and potential interpretations of ambiguous or sarcastic comments. To mitigate the impact of potential misinterpretations, particularly in cases of slang or sarcasm, we performed manual reviews of coded segments. This iterative process allowed for a nuanced understanding of user sentiments that automated tools may not accurately capture.

The decision to focus on positive and negative sentiments aligns with the specific research objectives of understanding factors impacting Central Bank Digital Currency (CBDC) usage through user perspectives on the eNaira App. Analyzing positive and negative sentiments enables us to gain insights into user experiences, challenges, and satisfaction levels related to the application (Olaleye et al. 2020). The study is framed within theories of moral sentiments and the appraisal theory of emotion, which often revolve around positive and

negative affective states. Focusing on positive and negative sentiments allows us to operationalize these theoretical frameworks effectively, providing a structured analysis of the emotional dimensions of user comments.

Given the size of the dataset and the complexity of sentiment analysis, focusing on positive and negative sentiments provides a manageable and meaningful scope for analysis. This approach enables a concentrated exploration of user experiences without compromising the depth of the study. The study acknowledges the limitations of NVivo in handling language nuances and expressions such as slang, ambiguity, and sarcasm. Mitigation strategies included a cautious qualitative coding approach, manual reviews, and team discussions. The decision to focus on positive and negative sentiments is justified by its alignment with research objectives, theoretical frameworks, and practical considerations, allowing for a nuanced exploration of user sentiments related to the eNaira App.

The study utilized 214 data points derived from publicly accessible user comments on the eNaira App, sourced from both the Google Play Store and the Apple Store, widely used digital distribution platforms for mobile applications. These user reviews and comments, voluntarily submitted on these platforms, articulate diverse perspectives on various aspects of the eNaira App.

It is crucial to emphasize that the comments analyzed in this study are publicly available and were acquired without resorting to invasive or non-consensual methods. The research adheres to ethical considerations, relying on information willingly shared by users in the public domain. User identities remain confidential, and the analysis centres on aggregated sentiment patterns rather than individual opinions.

The study values the reviewer's insightful comment and recognizes the significance of transparency in their sampling methodology. The comments selected for this study were carefully chosen to ensure representation and minimize bias, capturing the diverse perspectives of both eNaira users and the Central Bank of Nigeria (CBN) as an apex bank.

The selection of comments followed a purposive sampling approach, aiming to encompass a representative cross-section of eNaira users (Campbell et al. 2020). Reviews from different periods, user demographics, and geographical locations were collected, ensuring various experiences and opinions were covered.

All reviews meeting specific criteria were considered for inclusion in the study, fostering inclusivity. This inclusivity included reviews related to challenges encountered during the download and usage of the eNaira App, along with feedback on the CBN's responses to these challenges.

Biases were actively avoided by not selectively focusing on positive or negative comments. The primary objective was to present an unbiased representation of user sentiments, encompassing favourable and critical perspectives.

The data collection spanned from 2020 to 2021, reflecting the dynamic nature of user experiences with the eNaira App. While reviews were publicly available,

ethical considerations were paramount. The study prioritized user privacy, refraining from invasive data collection methods, and maintaining the confidentiality of user identities.

The sampling methodology was meticulously designed to be inclusive, representative, and free from biases. These efforts contribute to the reliability and validity of our findings, offering a comprehensive analysis of the challenges and sentiments expressed by a diverse range of eNaira users. We appreciate the reviewer's insightful comment and acknowledge the importance of specifying the exact time frames for data collection.

For clarity, the data for this study was collected from eNaira App users' comments on the Google Play Store and the App Store between January 1, 2020, and December 31, 2021. This time frame was chosen to cover a period that witnessed the initial launch of the eNaira App and its subsequent developments over two years.

Text mining and sentiment analysis were chosen as the data analysis techniques due to their compatibility with the nature of the data, their ability to uncover insights from unstructured text, their alignment with the research objectives, and their efficiency in handling large-scale textual data. These methods enable a nuanced exploration of user sentiments, contributing to a deeper understanding of the factors influencing the actual usage of CBDC, particularly in the context of the eNaira App.

The dataset for this study consists of textual comments and reviews provided by eNaira App users on the Google Play Store and the Apple Store. Given this textual data's unstructured and qualitative nature, employing text mining techniques allows for the systematic extraction of meaningful patterns, sentiments, and insights from a large volume of user-generated content.

The central objective of our research is to analyze factors impacting the actual usage of Central Bank Digital Currency (CBDC), specifically the eNaira App, by examining user perspectives. Sentiment analysis is a well-established technique that systematically examines user sentiments expressed in textual data. We can gain valuable insights into users' attitudes, emotions, and opinions regarding their experiences with the eNaira App by employing sentiment analysis.

The research is framed within the context of theories of moral sentiments and the appraisal theory of emotion. Text mining and sentiment analysis are well-suited to operationalize these theoretical frameworks by providing a quantitative means of assessing the affective content of user comments. These methods facilitate the identification of positive or negative sentiments, helping us analyze the emotional and moral dimensions of user experiences.

The scale of user-generated comments on platforms like Google Play and the Apple Store can be substantial. Text mining and sentiment analysis offer efficient ways to process and analyze large volumes of textual data, enabling a comprehensive and systematic examination of user sentiments across diverse dimensions.

Efforts were made to obtain a representative sample of user comments by utilizing a purposive sampling method. This approach aimed to include diverse users, encompassing different demographics, geographical locations, and

periods. By adopting a random sampling strategy, we sought to mitigate potential biases that could arise from selectively focusing on specific user groups.

Google Play and the Apple Store are widely used platforms with a diverse user base. These platforms attract users from various backgrounds, demographics, and technological proficiencies. Therefore, the reviews and comments from these platforms inherently reflect a broad spectrum of opinions and experiences related to the eNaira App.

While the study relies on data available on these platforms, we recognize that not all demographic information is accessible. However, by incorporating a purposive sampling approach and considering reviews and comments over a substantial timeframe (from 2020 to 2021), we aimed to capture a range of user demographics and experiences, contributing to the overall representativeness of the dataset.

It is essential to acknowledge that biases may exist in user-generated content, and specific user groups may be overrepresented or underrepresented in online reviews. Despite our efforts to mitigate these biases, the study recognizes the limitations inherent in relying on voluntary user feedback from online platforms.

While the study acknowledges the inherent limitations of online reviews, steps were taken to enhance the representativeness of the dataset. The random sampling method, the utilization of data from diverse periods, and the broad user base of Google Play and the Apple Store collectively contribute to a more inclusive and representative examination of user sentiments related to the eNaira App. The overall workflow in our methodology is represented in Figure 1.

Data pre-processing

Data pre-processing commences with inputting corpus (a collection of documents) and outputs (pre-processed corpus) with Orange Data Mining software. Through the pre-processing text process, the input texts were split into smaller units (tokens), filtered, normalization

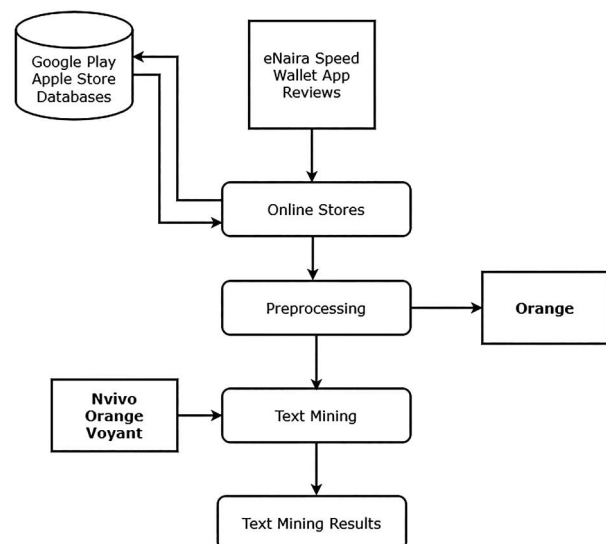


Figure 1: Graphical representation of the study workflow.

(stemming, lemmatization), and created n-grams and tags tokens with Part-of-Speech (POS) labels. The pre-processed text interface of Orange is divided into six sections (Transformation, Tokenisation, Normalization, Filtering, N-grams Range, and POS Tagger). The authors transformed the input data by turning all text lowercase and removing all diacritics or accents. Also, the authors detected HTML tags, parse out text only, and removed all URLs from the text.

In the next step, the texts were broken into smaller components of words, sentences, and bigrams. This process was done by splitting the word and punctuation, whitespace, sentences, and a regular expression (regex) – the authors employed a tokenisation approach for this process. The authors retained English as the language for normalization, applied stemming and lemmatization to words, and used a filter to remove or keep a selection of words. Stopwords were used to remove unnecessary propositions. The study employs the N-grams range to create n-grams from tokens and POS tagger to run the part-of-speech tagging on tokens. All these processes were carried out with Orange workflow that connects the corpus to pre-process text and visualization with a word cloud to see the effect of the changes.

Raw user reviews were preprocessed to remove irrelevant information, correct spelling errors, and standardize the format. This step ensured that the data was in a consistent and analyzable form. NVivo was used for qualitative coding, identifying recurring themes, patterns, and sentiments in the user comments. Coding categories were developed based on the theoretical frameworks of moral sentiments and the emotion appraisal theory. Thematic analysis was employed to categorize user sentiments into positive and negative themes. This process involved iterative coding and refinement to capture the nuances of user experiences (Agbozo, Watat, and Olaleye 2022).

Orange was employed for quantitative analysis, particularly in visualizing sentiment distributions. The tool allowed for the creation of visual representations, such as bar charts and graphs, illustrating the prevalence of positive and negative sentiments over time. Orange's text mining capabilities were leveraged to generate word clouds, providing a visual summary of frequently mentioned terms in user comments. This word cloud aided in identifying key topics and concerns.

Voyant was utilized for additional textual visualization, including word frequency lists and trend visualizations. These visualizations offered complementary insights into the most frequently used words and changes in user sentiments over time.

Manual reviews were conducted on a subset of the data to ensure the accuracy and reliability of the sentiment analysis. This iterative process involved revisiting coded segments, validating sentiment classifications, and refining coding categories.

The methodology of combining qualitative coding with NVivo and quantitative analysis with Orange and Voyant was deemed appropriate for a holistic understanding of eNaira user sentiments.

The qualitative coding in NVivo allowed for a deep exploration of themes and emotions, while the

quantitative analysis provided a broader perspective on sentiment distributions.

Triangulating results from multiple tools enhanced the robustness and reliability of the findings, allowing for a nuanced interpretation of user sentiments.

The data analysis procedure employed qualitative and quantitative techniques, leveraging the strengths of NVivo, Orange, and Voyant (Oberbichler and Pfanzelter 2021). The methodology used aimed to extract meaningful insights from the user comments, ensuring a comprehensive and rigorous analysis aligned with the research objectives.

Data analysis

The period for data collection allows for the observation of the evolution of user sentiments over a crucial phase in the existence of the eNaira App. The analysis is crafted to identify any noteworthy shifts in user sentiment that correlate with changes in the app features or external factors.

This study acknowledges the potential influence of alterations in the app or shifts in user sentiment during the specified period. The eNaira App underwent updates and modifications throughout the data collection, illustrating the Central Bank of Nigeria's commitment to enhancing its functionality. Additionally, external factors such as technological advancements and changes in user expectations could impact sentiments.

The analysis considers temporal variations in user sentiments to address these potential influences. Specifically, it delves into patterns and changes in sentiment across distinct phases of the app's development. This approach enables us to identify correlations between modifications in the app and corresponding shifts in user sentiment, offering a more nuanced understanding of the dynamics involved. This result focus contributes to the strength and pertinence of our findings within the eNaira App's lifecycle framework.

This section explores and analyses the eNaira reviews based on text mining and sentiment analysis. The study employs complementary NVivo, Orange, and Voyant as specialized tools for natural language processing and computational linguistics to make meaning out of the data utilized. Earlier studies have used NVivo (Dhakal 2022), Orange (Zhou et al. 2022), and Voyant (Mahyoob et al. 2022). Further, this study used Google Trends, which can measure keyword popularity rather than keyword search volume. An earlier study emphasized the significance of Google trends in research (Jun, Yoo, and Choi 2018).

In Figure 2, Orange Data Mining Software shows the connections of the corpus to the corpus viewer and connects the corpus for sentiment analysis. The output was viewed with a data table and heat map for data visualization. The output of sentiment analysis in Orange could be four columns, that is, positive, negative, neutral, and compound scores. The sentiment output in four columns depends on the insights of the data utilized and the settings employed in Orange. For example, using row clustering settings will place similar rows closer together and enable clear grouping of the sentiments.

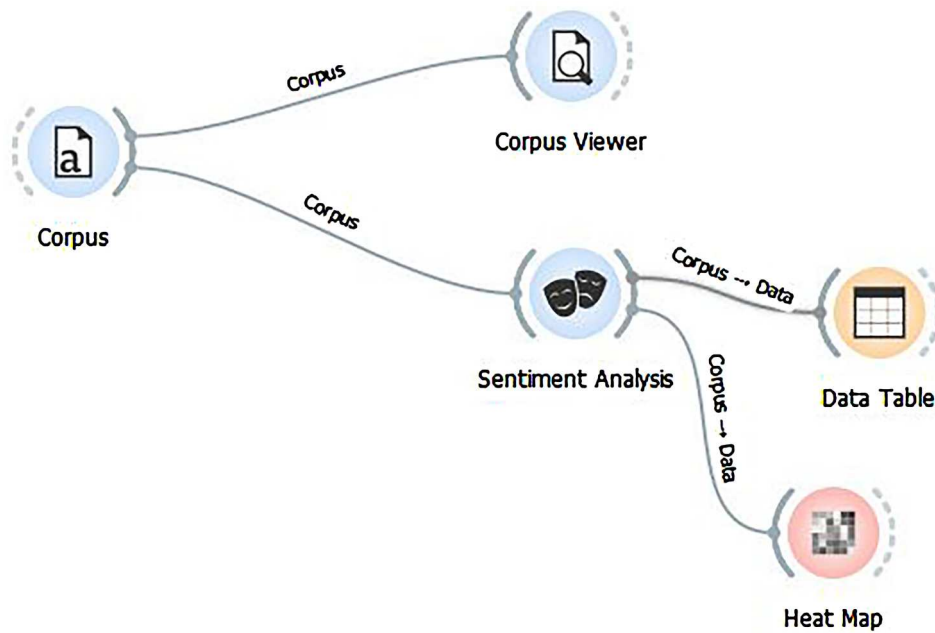


Figure 2: Connections of the corpus to the corpus viewer and connects the corpus for the sentiment analysis.

The process of sentiment analysis in NVivo is different from Orange. Based on the text generated from the eNaira reviews, the study used an auto-code wizard to produce results. This process creates a node matrix, and the content is coded to sentiment nodes. This process is not without limitation because the NVivo analysis tools may not be able to recognize slang, ambiguity, and sarcasm. The initial rigorous data cleaning mitigates this risk, and the study used Orange to complement NVivo to compensate for the shortcomings of the software. NVivo used a scoring system and produced five ranges on a scale of the sentiment of very negative, moderately negative, neutral, moderately positive, and very positive. For ease of results presentations, only the percentage of the positive and negative sentiments was presented. Earlier studies argued that there was no insight into neutral sentiments (Olaleye et al. 2020).

Voyant software, on the other hand, was utilized for text analysis to generate a word cloud of frequent words and graphs of word frequency across the corpus based on some specifics. It is also a statistics tool to compare multiple documents. In this study, there are three primary documents. One from the users of eNaira on Google Play, the other from the users of eNaira on the App Store, and the responses of the Central Bank of Federal Government of Nigeria to the grievances expressed on eNaira reviews. The study uploaded these three documents mentioned into the Voyant online platform for different analyses. One of the strengths of Voyant is the ability to analyse relative frequencies rather than raw word counts. This strength paved the way for adjustment for imbalances in document length. Voyant generates descriptive statistics based on the content of the documents used, interesting trends, and compares the relative frequencies of the three documents. This study utilized Google Trends by entering the eNaira keyword into the search bar with a focus on Nigeria, based

on web search, image search, news search, and YouTube search in Google Trends to pinpoint indicators of interest.

Results

Descriptive statistics

Using Voyant software, the authors generated descriptive statistics for the eNaira corpus based on Google Play, App Store, and CBN users' comments. Voyant reveals 14,256 total words and 1,898 unique word forms. The records of document length for eNaira show that the longest Google Play reviews account for 8,901 while the shortest of Apple Store reviews is 759. Concerning the vocabulary density of the corpus, the highest for eNaira Apple Store reviews is 0.443, and the lowest for Google play for CBN is 0.086. The average word per sentence for Apple Store reviews is 19.5, while Google Play for CBN shows 14.9. The readability index for Google Play CBN accounts for 10.29, and Google Play reviews show 8.73 (Table 1).

4.2. Interest over time

Google Trends results show interest in Nigeria States based on eNaira users' online search, Yobe State in the North Eastern part of Nigeria had the highest web search frequency (100), followed by Sokoto State with 36 frequency, and Niger and Plateau States tallied with 21 frequencies. Apart from Kano, Kaduna, Nasarawa, Lagos, Delta, Rivers, Akwa Ibom, and Federal Capital Territory, Abuja, no other states attempted to conduct eNaira online search. (See Figure 3.)

Sentiment analysis

Using Orange algorithms, eNaira sentiments were classified into negative and positive reviews. Also, Orange used different colours to differentiate the intensity of the sentiments (Figure 3). The Orange Heatmap shows some positive reviews. For example, one of the reviews mentioned

Table 1: eNaira descriptive statistics.

| | | |
|----------------------------|-------------------------------------|--------|
| Document Length | Longest: eNaira Google Play Reviews | 8901 |
| | Shortest: eNaira Apple Store Review | 759 |
| Vocabulary Density | Highest: eNaira Apple Store Review | 0.443 |
| | Lowest: eNaira Google Play CBN | 0.086 |
| Average Words Per Sentence | Highest: eNaira Apple Store Review | 19.5 |
| | Lowest: eNaira Google Play CBN | 14.9 |
| Readability Index | Highest: eNaira Google Play CBN | 10.286 |
| | Lowest: eNaira Google Play Review | 8.726 |

Source: Authors' own constructs based on users' comments (2023).

**Figure 3:** Geographical interests based on Google trends.

that eNaira is 'very excellent, fast and accurate in transactions', while others said that the 'transactions are swift and convenient', 'fantastic app! Very fast and free' and 'secure, fast and reliable'. The first classification focuses on the speed of transactions, convenience, reliability, and security. The second classification of positive sentiments dwells more on the usability of the user interface, the quality of upgrades, and the users' recommendations.

Some eNaira users held negative sentiments: 'I can't sign up I am getting an error saying operation failed ...', 'useless app from clueless developers, can't even log in anymore', and 'unable to receive OTP during registration!!!' The negative sentiments mostly dwell on signup difficulties and error messages about operation failure. The challenge also revolves around One Time Password (OTP), an invalid username, and a problematic transaction pin. Most users shared their grievances of dissatisfaction, frustrations, and regrets and concluded that their usability was a bad experience.

The study compared the positive and negative sentiments for 2021 and 2022. The sentiment results generated in NVivo for App Store reviews are scanty because low number of iPhone users in Nigeria in comparison to Android phones (Figure 4). In 2022 App store recorded more negative than positive sentiments, but the difference is not too significant. The results show an increase in negative sentiments. In 2021 there were 31 outstanding positive reviews, while the negative accounts for 39 reviews. The positive and negative reviews account for a 23% difference. There was a significant difference in 2022. The positive reviews were 86, while the negative reflects 137. Both reviews account for a 47% difference.

Comparative analysis

This study compared Apple Store and Google Play reviews and moderated the two reviews with the CBN response with Voyant and the output was based on relative frequency (Figure 5). This approach helps to know how often the review occurs within the total number of observations. The Voyant reveals six (6) indicators of comparison – app, bank, password, wallet, login, and account. For the app, Apple Store had the highest relative frequency, followed by bank, account, wallet, and password but reviews on login were not available. Similarly, Google Play had the highest relative frequency on apps like Apple Store but unlike Apple Store followed by password, bank, and account tallies then followed by bank and finally login (Figure 6). CBN as a moderator had the highest relative frequency then followed by the app. Wallet and login tallies and followed by password and account. The major concerns of the eNaira users are predominant on the app but the CBN concentrates its reputation management strategy on banks.

Challenges of eNaira

According to the data from this study, an eNaira user faces six major challenges which are; privacy issues, user experience, platform usability, accessibility, difficulties accessing funds, and security concerns.

Platform usability problems

The study results show that the highest number of comments is related to challenges in eNaira App usage. Comments included the inability to sign up as a new user of eNaira, with most users providing feedback on their inability to complete the onboarding process. Some users

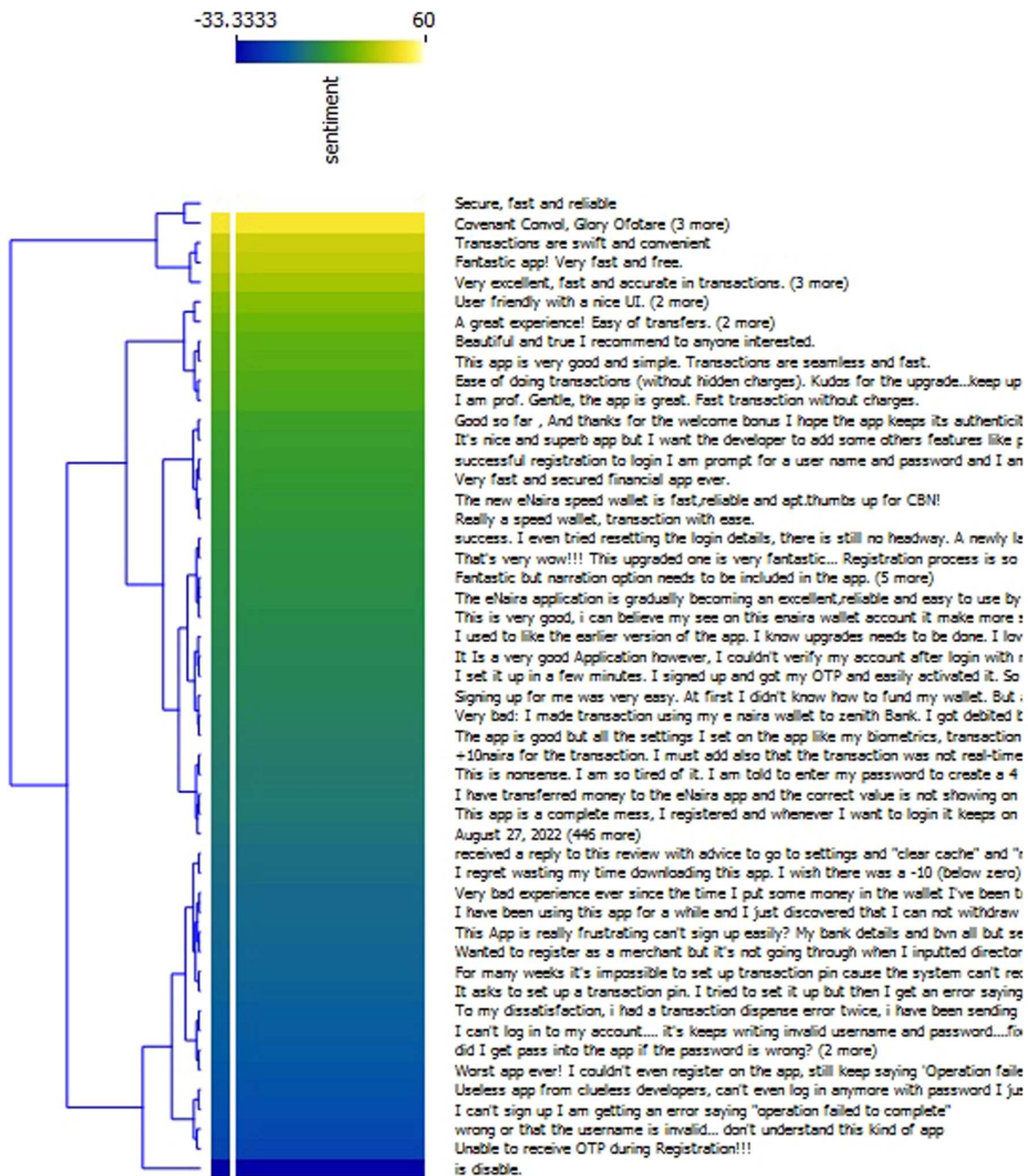


Figure 4. Intensity of the sentiments on eNaira.
Source: Output of data analysis.

were not able to receive the one-time password login (OTP) needed to complete the registration process. These sign-up challenges are mostly related to platform usability glitches:

My experience on this app has been very very poor. I struggled to get registered. Now getting the email link since last night has been terrible. I have refreshed several times but nothing has dropped. I have requested to resend the link twice but it's not working out. (Rev01; October 26, 2021)

eNaira users who were able to go through the huddle of registration still have to confront some challenges, including the inability to log in, password recovery not working, and the system telling users that they have inputted the wrong username and password among other issues.

Difficulties with assessing eNaira funds

The second most common challenge users face, according to the study's data, is linked to their inability to complete financial transactions, access funds on eNaira, load funds to eNaira, inability to connect their eNaira to a bank account, inability to withdraw funds, transfer funds to their bank account and vice versa. Also, there were several comments on incorrect amounts recorded when a transaction was made, the extremely time-consuming process to make withdrawals, and users getting debited when transactions are made on eNaira but the beneficiary account is not credited.

Overall users had a lot of comments related to their inability to access funds on eNaira wallet.

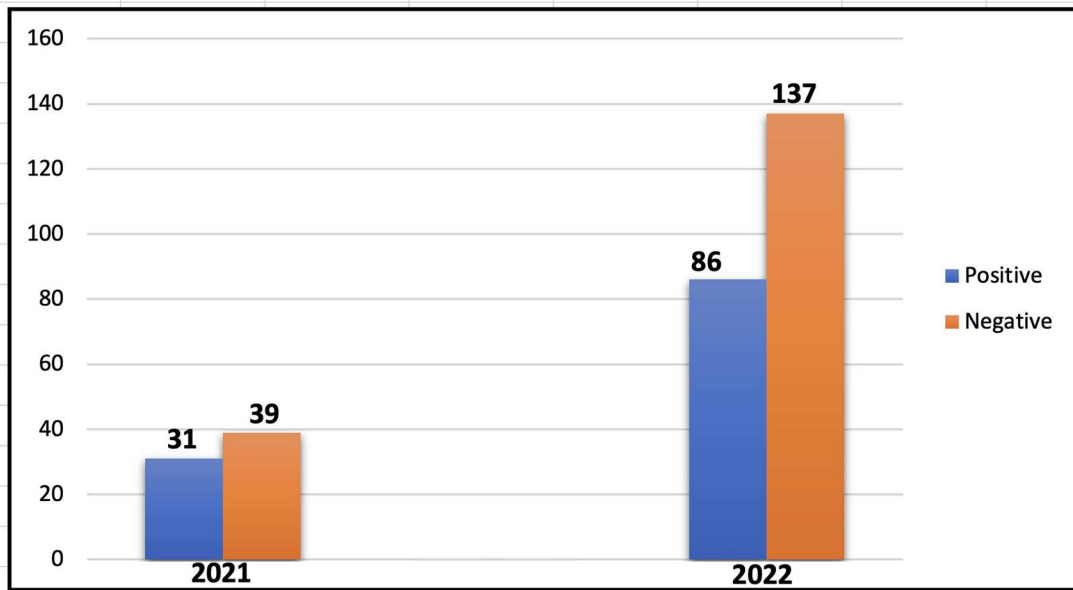


Figure 5: Comparison of eNaira sentiments for 2021 and 2022.
Source: Output of data analysis.

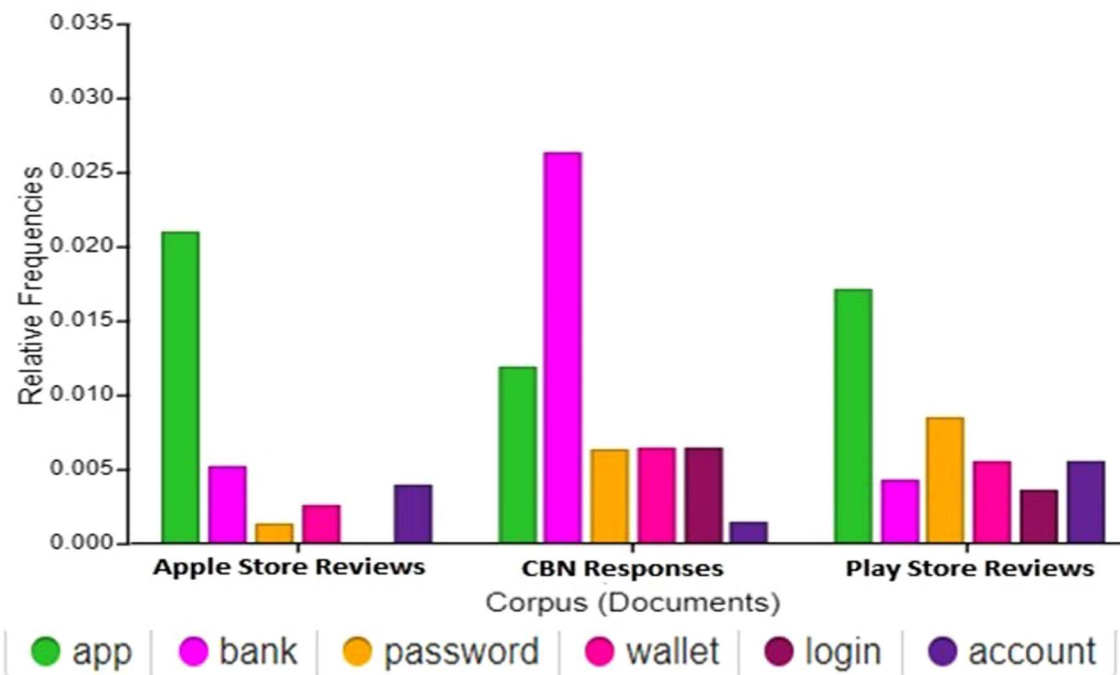


Figure 6: Comparison of issues based on platforms and responses from CBN.
Source: Output of data analysis using Voyant.

One user pointed out that:

Very bad experience ever since the time I put some money in my wallet I've been trying to get it out time and time again but I can't do so, the emails I've been sending are yielding absolutely no results, and despite how many times I call I don't get a response. Please I want to get my money out this is nothing but a scam as far as I'm concerned. (Rev04; October 13, 2022)

Also, some users noted that eNaira was not useful due to the low number of eNaira merchants, including eNaira

POS, to do transactions in comparison to mobile money for example, which have a lot of agents dotted around the country:

I can't find a merchant that accepts eNaira. I can't find a way to transfer the eNaira from my wallet for use. It's just sitting in the wallet without adding value. (Rev07; October 6, 2022)

In buttressing the lack of agents and payment options, one user commented

I downloaded this app, filled in all the details, and linked my bank to it. To be frank I don't know what or how to use

it, haven't met a merchant who receives payment from it. Shops, Supermarkets, streets, and marketplaces never ask of it as a medium for payment. What is it meant for? (Rev08; August 29, 2022)

eNaira users complain about the low daily limit and inability to use eNaira in other payment use cases like school fees, utility bills, etc.:

The app is good and user-friendly, but you have to upgrade it by adding some features like airtime purchases, bill payments, and transfers to any bank account number. (Rev10; June 24, 2022)

Security, privacy, and accessibility concerns

There was only one comments related to the usage of eNaira security, a user noted:

The app looks good, very user friend. The upgrade is very impressive. 2-factor verification should be included for security (Rev11; June 27, 2022). On privacy, a user said: I think this app itself is a scam to just hijack your full personal details to get into privacy. (Rev12; August 29, 2022)

One user commented on accessibility issues linked to network availability:

Lovely app but sometimes we have network problems. (Rev13; October 14, 2022)

Accessing eNaira customer care

Given the high level of comments related to the need for customer care, it is imperative to understand, how CBN, the provider of eNaira was dealing with issues raised by users of eNaira. According to the data from this research, only a few responses came from the customer care unit when users submitted a complaint. When the user asked a follow-up question after getting a response from customer care, customer care did not respond. As one user pointed out:

To my dissatisfaction, I had a transaction dispense error twice, and I have been sending you Email messages without a response, I called your HelpDesk line and my calls ended immediately after I selected 0 to speak with an agent ... I am highly disappointed. (Rev15; October 14, 2022)

Table 2 below presents the challenges of the eNaira and the associated issues encountered bu users.

Users' comments on how to improve eNaira

In addition to complaints, and questions about the eNaira customer care, some users suggested some ideas about how to improve on eNaira app. One user suggested the use of Twitter as a channel for dealing with customer issues:

How I wish we still have our twitter, where we can easily get help in situations like this. I have sent several emails to your helpdesk regarding BVN issues used for too many attempts and have no feedback yet. It's quite frustrating. I just deleted the app as it's of no use if issues can't be resolved in no time. (Rev16; November 8, 2021)

Also, some customers suggested the need to increase education and promotion of the eNaira:

Nice initiative, but so confusing, how do you move money from one's Bank Account to this eNaira Speed Wallet? (Rev17; August 27, 2022)

At first, I didn't know how to fund my wallet. However, after some trials, I was able to fund my wallet from my bank account. More enlightenment is still needed, CBN. Transaction speed has improved. More publicity is required through the electronic and print media. (Rev18; September 6, 2022)

In terms of improving the usefulness of eNaira, customers made the following suggestions:

We are still waiting and eager to see the option of linking more than one bank account in funding our wallets. (Rev19; October 18, 2022)

Very easygoing app i love it. Is there a plan for users of the app to be able to add an eNaira trustlines to be able to have a standard eNaira wallet address, same as other crypto wallets to be able to send eNaira or receive eNaira between different wallets? (Rev20; October 8, 2022)

Lastly, some users suggested separating eNaira individual users from business(corporate) to pay better attention to these two broad categories of users since they have unique requirements.

Based on this, user-proposed or experience-based recommendations for improving eNaira usability are presented in Table 3.

Discussion

The results of this study show that the users of the eNaira App who downloaded the app from the App Store had complaints primarily around issues with the app itself, followed by bank, account, wallet, and password-related issues. This suggests that there may be technical and functional issues with the app that are causing problems for users who downloaded the app from the Apple store. These issues could potentially include bugs, glitches, or other technical problems that are causing the app to malfunction, as well as issues related to the integration of the app with the bank and account functionalities. Similarly, for users who downloaded the app from Google Play, this research also highlights difficulties in downloading the eNaira app tops the concerns of users, followed by the password, wallet, account, bank, and login issues. This means the problems and concerns of the users are consistent across platforms, highlighting a need for immediate action to be taken by the app developers. This can be seen as an indication that the issues are not specific to one platform but rather a general problem with the app functionality.

In terms of the CBN response, the result states that the CBN response focused mainly on bank-related issues, followed by app, login, wallet, password, and a few on-account issues. This suggests that the CBN has identified the bank-related issues as the most critical and is focusing its efforts on addressing these issues first. It could also mean the bank-related issues may have a larger impact on the overall functionality of the app and thus need to be addressed first to ensure proper functioning. However, it is worth noting that the CBN response does not seem to address the issues around the app itself, which is the major concern for users who downloaded the app from the Apple store and Google play. This could imply that the CBN may not fully understand the

Table 2: Challenges, description, and associated issues of eNaira.

| Challenges | Description | Associated Issues |
|---|---|--|
| Platform Usability Problems | Issues related to the usability of the eNaira platform, particularly during the sign-up and onboarding processes. Users reported difficulties in registering, receiving OTP, logging in, password recovery, and system errors regarding user credentials. | <ul style="list-style-type: none"> - Inability to sign up and complete onboarding processes. - Difficulty in receiving OTP for registration. - Challenges in logging in and password recovery. - System indicating incorrect user credentials. |
| Difficulties with Accessing eNaira Funds | Challenges associated with users' inability to complete financial transactions, access funds, load funds, connect eNaira to a bank account, withdraw funds, and make accurate transactions. Users also faced issues with getting debited without the beneficiary account being credited. | <ul style="list-style-type: none"> - Inability to complete financial transactions. - Difficulty in accessing, loading, and withdrawing funds. - Connection issues between eNaira and bank accounts. - Incorrect amounts recorded in transactions. - Time-consuming withdrawal process. - Users getting debited without the corresponding credit to the beneficiary account. - The limited number of eNaira merchants, reducing usability. |
| Security, Privacy, and Accessibility Concerns | Concerns related to the security, privacy, and accessibility aspects of eNaira. Users expressed the need for enhanced security measures such as 2-factor verification. Privacy concerns were raised, suspecting the app of potential data hijacking. Accessibility challenges were noted concerning network availability. | <ul style="list-style-type: none"> - Lack of 2-factor verification for enhanced security. - Suspicions of the app being a potential scam for data hijacking. - Accessibility issues linked to network availability. |
| Accessing eNaira Customer Care | Challenges faced by users in reaching and obtaining satisfactory responses from eNaira customer care. Users reported transaction dispense errors, unresponsiveness to email messages, and difficulties in contacting the help desk for support. | <ul style="list-style-type: none"> - Transaction dispense errors without adequate customer care response. - Unresponsiveness to email messages. - Difficulty in contacting the help desk, resulting in dissatisfaction |

Source: Authors' own constructs based on users' comments (2023).

technical issues that the users are facing and, thus, are unable to provide a comprehensive solution.

Our research findings highlight significant concerns of users of the eNaira App, particularly about technical and functional issues with the app across both App and Play stores. It would be important for the CBN to investigate these issues and work to resolve them as soon as possible to improve the overall experience for users. This could be done through regular communication with the users, gathering feedback and implementing them to improve the

app, ensuring a comprehensive understanding of the issues, and providing a requisite solution.

Negative reviews can significantly impact the eNaira perception, affecting its adoption and sustainability in Nigeria. Reduced trust is one of the potential consequences of negative reviews. Negative reviews can cause people to lose trust in eNaira and discourage them from using it. Negative reviews can also reduce eNaira adoption because people are less likely to use a currency that has received negative feedback. Another negative

Table 3: User-proposed recommendations for improving eNaira usability.

| Recommendations | Explanation |
|--|--|
| Use Twitter for Customer Support | Proposes using Twitter as a dedicated channel for addressing customer issues, aiming to enhance the speed and accessibility of issue resolution. |
| Increase Education and Promotion | Advocates for improved education and promotion efforts to reduce user confusion. Suggestions include clearer information on funding the wallet and increased publicity through electronic and print media. |
| Enhance the Usefulness of eNaira | Focuses on improving overall usefulness, including the option to link multiple bank accounts for funding wallets. Users desire plans for eNaira trust lines, akin to crypto wallets, for standardized addresses and seamless transactions. |
| Separate Individual and Business Users | Recommends categorizing individual and business users separately to better address their unique needs. Implies tailoring eNaira features and support services to suit the distinct preferences of these user categories. |

Source: Authors' own constructs based on users' comments (2023).

review effect is reputation damage. It can also harm eNaira's reputation, making it more difficult to gain support from users. It may also reduce the eNaira's scalability because people are less likely to use it for large transactions or high-value purchases. Negative reviews that focus on security issues may lead to a loss of trust in the safety of the eNaira, which may have a significant impact on its adoption. Oppositely, positive reviews can create a positive feedback loop; as more people adopt and use eNaira, more reviews will come in, and these reviews will encourage even more people to adopt it.

Positive feedback helps establish the eNaira as a viable and trusted digital currency, encouraging more people to use it, promoting economic growth, and increasing financial inclusion in Nigeria. Positive reviews also could increase confidence in the eNaira and encourage investment in the digital currency. On the other hand, mixed reactions to the eNaira make it difficult for people to form a clear opinion on the digital currency, which can halt its adoption and sustainability in Nigeria.

Contribution

Based on insights generated from the results of this study, there are contributions made to advance the literature of sentiment theory and to offer practical solutions to the eNaira managers to promote the development and scalability of this innovative app.

This study's foundation was built on the two predominant theories in the literature of sentiment. First, Smith (2010) proposed the Theory of Moral Sentiments and used 'sympathy' to posit the theory and emphasized the feeling with the passions of others. The negative reviewers of the eNaira believed that the CBN had no experience of what they felt when the government banned Cryptocurrency, and that is why the CBN has no idea of how they are affected by introducing the eNaira. The reviewers felt 'feeling with the passions of others' was missing in the scenario that led to eNaira. Second, the Appraisal Theory of Emotion was defined as processes rather than states. This theory appraises components with the evaluations of the environment and the person-environment interaction. In this context, Nigeria as an environment was evaluated with the person-environment interaction, indicating the Nigerian inhabitants who wish to interact with the eNaira. eNaira app was the appraisal trigger that differentiates emotional episodes through synchronic changes in other components. According to Ellsworth (1994), 'appraisal theories include hypotheses about individual, cultural, and developmental differences' and this salient point differentiates these theories from others. This study contributes theoretically by applying the theories of appraisal theory and the theory of moral sentiment to explain the evolution and sentiment of the novel eNaira in Nigeria. This theory's application is similar to the studies of Jeffery (2011); Khoo, Nourbakhsh, and Na (2012); and Moors et al. (2013).

This study makes a significant scientific contribution by employing advanced textual analysis techniques, including the use of Voyant software for descriptive statistics and Orange algorithms for sentiment analysis. The

application of these tools allows for a detailed analysis of large-scale textual data for an in-depth understanding of both user perspectives and sentiments on eNaira. This scientific approach enhances the rigour of the study and offers a replicable methodology for future studies on the usability analysis of digital currencies and other financial innovations.

Additionally, the study offers a potential contribution to theoretical frameworks related to digital currency adoption and usability by identifying and classifying challenges related to digital currency adoption. This theoretical implication may be extended to the development of models that integrate user feedback and sentiments into the evaluation of digital currencies' success.

From a managerial perspective, this study offers actionable insights for financial application developers, financial institutions, and policymakers, especially those in the CBDC ecosystem. The evaluation of user challenges such as platform usability problems, difficulties accessing funds, and security concerns, provides a roadmap for targeted improvements. Following the output of this study, managers can identify critical and priority areas when deploying innovations such as eNaira. Also, the comparative analysis of user reviews across different platforms and the incorporation of CBN responses highlight the importance of effective communication and reputation management for sensitive financial innovations such as CBDCs.

On the policy front, the study contributes valuable insights that can inform regulatory frameworks and interventions related to digital currencies. The identification of challenges faced by eNaira users, ranging from platform usability issues to concerns about customer care responsiveness, underscores the need for robust regulatory oversight. Policymakers can use these findings to design policies that promote user protection, data privacy, and technological reliability within the digital currency ecosystem. Furthermore, the study's temporal analysis of sentiment trends provides a dynamic perspective on the evolution of user perceptions, enabling policymakers to anticipate and respond to emerging challenges. The suggestions offered by users for improving eNaira such as increased education and promotion efforts can guide policymakers in designing public awareness campaigns and educational initiatives to enhance digital literacy and adoption. Therefore, this study provides a foundation for evidence-based policymaking in digital financial innovation such as CBDCs.

Practical application

It should be noted that negative reviews could be the result of genuine eNaira issues or misinformation. To mitigate the effects of negative and to build trust and confidence in the digital currency, eNaira managers should address issues raised and provide accurate and transparent information about eNaira to the public. Furthermore, it is critical to ensure the safety and security of the eNaira, as well as the prompt and effective resolution of any issues that arise. Regarding the positive reviews, the CBN needs to keep up the excellent work, especially on regular upgrading and updating.

This study suggests that eNaira's financial systems require modification. Existing banking systems and infrastructure will likely need to be modified to accommodate the new digital currency. All eNaira stakeholders should be adequately trained and educated by the CBN on usability and features. Further, the CBN must ensure compliance with any applicable legislation governing the usage of eNaira. With the increasing use of digital currency, eNaira administrators must defend their systems from fraud and cybercrime by ensuring the implementation of security controls. eNaira must ensure lower transaction costs and boost transaction speed, which could benefit entities that rely on these transactions to generate income. Additionally, eNaira could provide new business opportunities and increase competition in the banking industry, alter consumer behaviour, increase the usage of digital payments, and decrease cash transactions.

Conclusion

This research set out to identify the eNaira user sentiment trends over time, analyze these user sentiments, evaluate the effectiveness of the eNaira technical support mechanism, and identify the major challenges associated with eNaira. The result of this research indicates that eNaira users faced multiple challenges in the download and use of the eNaira App; however, CBN responses to these challenges are very minimal. Also, eNaira users reported more negative sentiments than positive ones, and these negative comments have increased over time. The research highlights the need for CBN to be more proactive in responding to eNaira users' challenges since this will ensure sustained adoption of eNaira.

Limitations and future direction of the study

Despite the contribution of this research, it has limitations. While this study provides valuable insights into the usability and sentiments surrounding the entire digital currency within the Nigerian context, it is crucial to acknowledge certain limitations that may impact the broader applicability of its findings. Firstly, the study relies solely on user comments and feedback, potentially introducing a bias towards individuals who have faced difficulties or have strong opinions about the eNaira platform. It may not fully capture users' experiences who have had a seamless interaction with the eNaira system. Also, the study's exclusive focus on Nigeria restricts the generalizability of its conclusions to other continents or nations, necessitating caution in extrapolating results beyond the specific Nigerian context. Additionally, the contextual specificity of findings, particularly those related to the Central Bank of Nigeria (CBN) and the eNaira, raises concerns about the transferability of results to more generalized developing nations. This specificity may limit the study's ability to inform digital currency dynamics in countries with diverse economic, cultural, and regulatory landscapes. The reliance on user comments from Google Play, App Store, and CBN responses introduces potential biases inherent to online reviews, and the absence of in-depth demographic analysis of users limits the nuanced interpretation of the

findings of this study. The study primarily focuses on user-reported issues without an in-depth technical analysis of the eNaira platform, which could limit the understanding of the root causes of the identified challenges. Lastly, the data collection period may not cover the most recent updates or improvements to the eNaira system, as the digital landscape is dynamic, and new features or modifications may have been implemented after the study concluded.

As preliminary research, it can pave the way for empirical studies; future research endeavours could adopt a mixed-methods approach to address the limitations outlined, combining user feedback with technical assessments and expert evaluations. This comprehensive approach would provide a more nuanced understanding of the challenges faced by eNaira users. This approach will give more perspective to the multidimensionality of the eNaira in Nigeria. Additionally, longitudinal studies could be conducted to track the evolution of user experiences over time, allowing researchers to assess the effectiveness of any implemented improvements. Furthermore, exploring the perspectives of eNaira users who have had positive experiences could contribute to a more balanced understanding of the platform's overall functionality. Lastly, an investigation into the technical infrastructure and security measures of the eNaira system would be crucial for a holistic assessment of its capabilities and limitations.

Disclosure statement

No potential conflict of interest was reported by the authors.

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