CBDC-MXN: Challenges and Perspectives in The Implementation as a Mexican Digital Currency

CBDC-MXN: desafíos y perspectivas en la implementación como divisa digital mexicana

Jessica Nallely Flores Gálvez
Universidad Nacional Autónoma de México (Mexico)
jessicafloresg@comunidad.unam.mx
http://orcid.org/0000-0002-1924-4115
José Miguel Mata Hernández
Universidad Nacional Autónoma de México (Mexico)
josemiguelmata@comunidad.unam.mx
http://orcid.org/0000-0003-0132-6881

ABSTRACT

This research shows a proposal for developing of a Mexican Central Bank Digital Currency by Banco de México. Therefore, a dynamic SWOT matrix is used to present the strengths, weaknesses, opportunities, and threats of the development of the Mexican Central Bank Digital Currency. In addition, an analysis of the stablecoins of the Mexican peso is made to know their landscape and current use, the above making use of Blockchain explorers such as BscScan, Etherscan, Polygonscan, and Tronscan. MMXN, Moneta Digital, is the stablecoin of the Mexican Peso with the most significant number of users and transactions. According to the results obtained, it is shown that the Mexican CBDC is viable, but it must overcome challenges and issues to be implemented and used by the population.

Keywords: Central Bank Digital Currency; Central Banks; Stablecoins; Dynamic SWOT; Blockchain Explorers.

JEL CODE: E42, E58.

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RESUMEN

Esta investigación muestra una propuesta para el desarrollo de una divisa digital del Banco Central de México. Por lo tanto, se utiliza una matriz FODA dinámica con el objetivo de presentar las fortalezas, debilidades, oportunidades y amenazas del desarrollo de la Central Bank Digital Currency de México. Además, se realiza un análisis de las stablecoins del peso mexicano para conocer su panorama y uso actual, haciendo uso de exploradores de Blockchain como BscScan, Etherscan, Polygonscan y Tronscan. MMXN conocida como Moneta Digital es la stablecoin del peso mexicano con el mayor número de usuarios y transacciones. De acuerdo con los resultados obtenidos, se demuestra que la CBDC mexicana es viable, sin embargo, debe superar desafíos y problemas para ser implementada y utilizada por la población.

Palabras clave: Moneda Digital de Banco Central; Bancos Centrales; Monedas Estables; FODA Dinámico; Exploradores Blockchain.

Código Jel**:** E42, E58.

INTRODUCTION

A central bank is a public entity with autonomy in its management and operation (Corder, 2014). This institution implements and enforces monetary, fiscal, and financial policies. It also focuses on issuing a country's currency and the stability of its purchasing power. In addition, a central bank controls the amount of money in circulation, reserves in foreign currency, functioning of payment systems, interest rates, and the performance report to the nation's public, among other activities (Sánchez et al., 2021).

Banco de México, also known by its acronym as Banxico, has as its primary function to guarantee the stability of the purchasing power of the monetary unit and to preserve its value, maintaining low and stable inflation over time and thereby strengthening monetary and fiscal policies related to national development (Banco de México, 2023).

Banco de México has responsibility for accountability and compliance with transparency criteria. It also promotes the management of the development of the financial system. In addition, it contributes to regulating the issuance and circulation of the national currency, intermediation, providing financial services, and facilitating payment systems (Gobierno de México, 1993).

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The activities promoting the sustained economic growth of Mexico's economy flow from implementating a current monetary policy oriented to the pursuit of price stability. Hence a central bank defines the terms in which the money might circulate in an economy and how it will be issued (BBVA Research, 2019).

As a unit of account, the currency is vital as a medium of exchange and payment to acquire goods and services. In addition, Banco de México must maintain a reserve of international assets, which serve as indicators of the degree of compliance with the commitments and obligations agreed in foreign currency, to give confidence and certainty to stakeholders.

Plan Nacional de Desarrollo 2019-2024 pursues the benefit and protection of financial products and services users; in addition, it is oriented to well-being and economic growth. One of its objectives is to increase digital payments among the population, businesses, commerce, and the three levels of government. Therefore, it proposes reducing, but not eliminating, the use of cash, considering increasing and improving the supply of digital payment means (CNBV, 2020).

The rise of cryptocurrencies and stablecoins in the last years has attracted the attention and interest of different regulatory bodies of different economies, central banks, and international

institutions. In response to the need to regulate cryptocurrencies and stablecoins (Allen, Gu, & Jagtiani, 2022), some central banks and financial institutions have proposed strategies to address this situation. To keep up with technological advancements, they have also introduced Central Bank Digital Currencies (CBDCs), as promoted by Catalini et al. (2021).

Making cross-border payments cheaper and more efficient is a goal that policymakers and central banks worldwide have been searching for. Instead, Armelius et al. (2020) affirm that if a CBDC project uses standardized legislative frameworks, it could make international payments more manageable. Furthermore, Xu & Prud'homme (2020) argue that CBDCs can be implemented in international business to make faster operations.

According to Senado de la República (2022), Banco de México announced that it had initiated the development of a Central Bank Digital Currency. The CBDC will be an integral part of the monetary base and will operate with the same attributes as coins and notes; for that reason, it will function as a medium of payment, a unit of account, and a store of value. In addition, it is part of a long-term means of payment strategy. The estimated start date will be 2025 (Senado de la República, 2022).

The objective of this paper is to show the challenges, as well as the current perspectives of a project of a Mexican CBDC, and present proposals that could be implemented. Furthermore, explain the functioning of digital currencies issued by a central bank and their impact on the financial system. Finally, It also shows the current panorama of the Stablecoins of the Mexican peso.

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METHODS

The methodology implemented in the present research makes use of the deductive method. In addition, we implement the SWOT analysis matrix using the dynamic approach of Carnap (2013). We use the proposed method of Armelius et al. (2020) for the implementation of a Mexican Central Bank Digital Currency. These approaches are used to understand the current challenges and perspectives. The study also uses of Blockchain Explorers to analyze the number of transactions and holders of stablecoins pegged to the Mexican Peso.

Humphrey (2005) comments that the SWOT matrix is a strategic tool for analyzing a company, institution, or project. It uses internal characteristics such as strengths and weaknesses, and analyzes external situations, including threats and opportunities. Instead, Carnap (2013) mentions that the dynamic methodology is a strategic analysis tool focused on mistakes, problems, successes, and goals. These methods are used to collect criteria for developing a project on Mexican Central Bank Digital Currency.

Armelius et al. (2020) expose that a Central Bank Digital Currency needs an architecture and a model for their development. For that situation, we implement the models of Armelius et al. (2020) and the Reserve Bank of India (2022) to create proposals for developing the Mexican CBDC. Furthermore, we implement the Blockchain's explorers of BscScan (2023); Etherscan (2023); Polygonscan (2023); Tronscan (2023) to examine the number of transactions and holders of the stablecoins of the Mexican peso.

RESULTS AND DISCUSSION

There is a significant difference in the concepts of cryptocurrencies, virtual assets, tokens, central bank digital currencies, and Stablecoins due to the characteristics of each one being different (López et al., 2022). The definitions of these are presented in Table 1.

Table 1. Concepts of central bank digital currency, cryptocurrency, stablecoin, virtual asset, and token.

Type	Concepts
Cryptocurrency	Cryptocurrencies were created to be a decentralized payment method, using blockchain technologies and cryptography for conducting transactions. The operations carried out with these assets are unalterable, registrable, and public (Hernández, 2022).
Virtual asset	A virtual asset is the representation of value that is recorded electronically and is used among the public to be a payment method with all types of legal acts, from which its transfer is carried out only by electronic forms (Gobierno de Mexico, 2018).
Token	Blockchain tokens are units based on a distributed ledger such as Ethereum, Solana, or Avalanche. These tokens have different functionalities according to the project they participate (López et al., 2022).
Central Bank Digital Currency	A Central Bank Digital Currency is a new form of digital money by a central bank different from a cryptocurrency. This can be distinguished from reserves or settlement balances held by commercial banks by part of central banks. These are denominated in an existing unit of account and serve as a medium of exchange and a store of value (Gemini, 2022).
Stablecoin	The stablecoins are tokens created under a blockchain network with a fixed price and are usually linked to a reserve asset (Catalini et al., 2021). As a result of being linked to a reserve asset, it promises a more fixed price. An example of it is USDT which is pegged to the USD dollar; for this reason, each stablecoin has a reserve of 1 dollar that holds its value.

Source: Own elaboration (Catalini et al., 2021; Gemini, 2022; Hernández, 2022; Gobierno de México, 2018; López et al., 2021).

CBDC models
Rodríguez (2022) mentions that CBDCs have access, distribution, and structure models, which must be implemented for proper functioning. He also comments that for each of these models, there are different architectures and features. However, it can be observable in Figure 1.

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The access model can be Wholesale CBDC, which is focused on being a payment network that serves wholesale customers, so it would be a substitute for the interbank payment system. Instead, CBDC Retail is a model in which digital currencies are available to all users and would be a direct liability to the Central Bank.

Distribution models can be single-tier or two-tier (Reserve Bank of India, 2022). The single-tier model is also known as the direct model; in this one, the central bank operates the payment system and has the issuance and control of digital currencies. On the other hand, the two-tier model is known as the intermediate mode, and it can be indirect or hybrid. In the first one, the intermediaries are introduced into the process, which can provide a more excellent distribution of digital currencies. Instead, the hybrid method combines the direct and indirect models, where the Central Bank is responsible, but intermediaries are involved.

Structure models can be token-based or account-based (Rodríguez, 2022). In a token-based, a digital asset is created in token form, and digital wallets are used. At the same time, the account-based method is necessary for creating an account and using of an interface service.

Blockchain technology is a distributed ledger technology; for this reason, the validation of transactions and the information are based on nodes (Hernández & Cruz, 2022). On the other hand, Permissionless Blockchain allows the public can observe the transactions and operations (Gemini, 2022).

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The main Permissionless Blockchain are Bitcoin, Ethereum, Polkadot, Avalanche, and Cardano, to name a few. Nonetheless, in a permissioned Blockchain, only authorized users can access and view operations. Some central banks with CBDC development projects are developing their research and pilot projects through Permissioned Blockchain with Hyperlerger and IBM technologies. Nevertheless, a CBDC project can be designed through a centrally controlled database.

Furthermore, Armelius et al. (2020) comment that the design process can be centralized, decentralized, and synthetic, each with different trade-offs. Finally, Armelius et al. (2020) mention that Sveriges Riksbank is developing pilot projects of CBDC focused on centralized and decentralized designs. The economic design, such as remuneration and subsidies, is paramount to the development.

Figure 1. The design concept for the CBDC architecture.
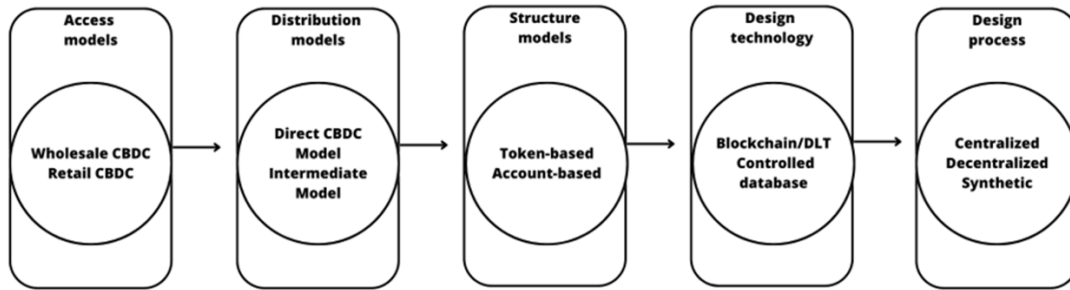
Source: Own elaboration (Armelius et al., 2020; Reserve Bank of India, 2022; Rodríguez, 2022).

Dynamic SWOT of CBDC

The reason for choosing a dynamic SWOT matrix over a traditional SWOT matrix is that the former is a strategic analysis tool that not only focuses on mistakes, problems, successes, and goals but also considers the dynamic nature of the business environment. Table 2 shows the dynamic SWOT according to Carnap (2013).

The table shows the strengths, which are focused on the successes of CBDC projects carried out by the Bank of Jamaica (2023), Sand Dollar (2023.), and eNaira (2023.). We chose the digital currencies projects of the Sand Dollar, Naira, and Jamaican Dollar because the Bank of Jamaica and the Bank of the Bahamas have launched their own CBDC, and the Bank of Nigeria is working on their pilot project named eNaira (CBDC Tracker, 2023). The opportunities are focused on the objectives of a Central Bank's digital currency project. On the other hand, weaknesses are based on errors or activities that may present a type of loss, while threats are related to the problems that may be faced.

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Table 2. Dynamic SWOT of CBDC

Weaknesses	Threats	Strengths	Opportunities
• Fault or null privacy. • Centralization.	• Errors in the smart contracts. • Cybersecurity errors. • High cost of research and development. • Education of CBDC for Banxico officials and the population. • The implementation and management of CBDC's project.	• A central bank backs them. • No fees are charged for transactions. • The emission of CBDC can be controlled.	• Strengthening financial inclusion policy. • Better monitoring of transactions to prevent money laundering. • Transmission of a better and more efficient monetary policy. • It can be used for international payments.

Source: Own elaboration (Carnap, 2013).

CBDC-MXN: Challenges

In the discussion above, we present some relevant challenges of the development of Mexican CBDC and the issues of their implementation:

- The creation of a digital currency that the population uses instead of stablecoins linked to the Mexican peso and cryptocurrencies.
- The CBDC project must coexist with the cash and have accordance with the money in circulation.
- The project could provide more excellent tracking of taxpayers and nontaxpayers with their operations and transactions.
- The role of commercial banks and how this will impact their deposit accounts.
- Government plans on the impact of the project, its projection, and user adoption.
- Promote financial inclusion as compliance and commitment through the CBDC project.
- On technical, logistical, and innovation issues, with a focus on where to store the creation of digital portfolios or special accounts for safekeeping.
- On disseminating knowledge and job creation, examine whether its development will allow the creation of new specializations, certifications, academic programs, and job opportunities.
- The relation of the monetary policy for international trade and how payments and conversion of digital currencies will be made.

Commercial banks in Mexico are concerned about the development and implementation of a CBDC by Banco de México because their account holders' deposits could be affected in the event of a bank run. On the other hand, the role of commercial banks and other financial institutions in Mexico with CBDCs takes on importance because they even charge fees for transfers made in foreign currencies if they are by SWIFT order, adding the exchange rate

difference, also known as the spread, which is reflected by the conversion from one currency to another.

Therefore, implementing the CBDC will cause changes in the management of accounts and could limit the number of international user transactions by financial institutions. Similarly, converting CBDCs into cash or other currencies is another issue that the Banco de Mexico should address. Instead, for where CBDCs will be stored, it is necessary to analyze the model of ownership that would be implemented and if a digital wallet will be created.

Carrying out the project in the face of problems of financial instability and bank disintermediation is a challenge to overcome for Banxico because, in Mexico, a considerable part of the population needs access to financial or banking products.

There are doubts about the future of payment platforms such as CODI and SPEI. However, according to Sánchez et al. (2021), the Mexican population uses the services of CODI and SPEI to do transactions supervised by Banxico due to these being the two principal payment methods in Mexico.

The adoption of CBDCs by the population and Banxico's workers is a subject of discussion that must be raised because promotion and education strategies must be developed. Moreover, as a novel product, this process must be implemented according to a structured action plan. The challenges of Banco de México are shown in Figure 2.

Figure 2. Core challenges of Banco de México on the development of CBDC.
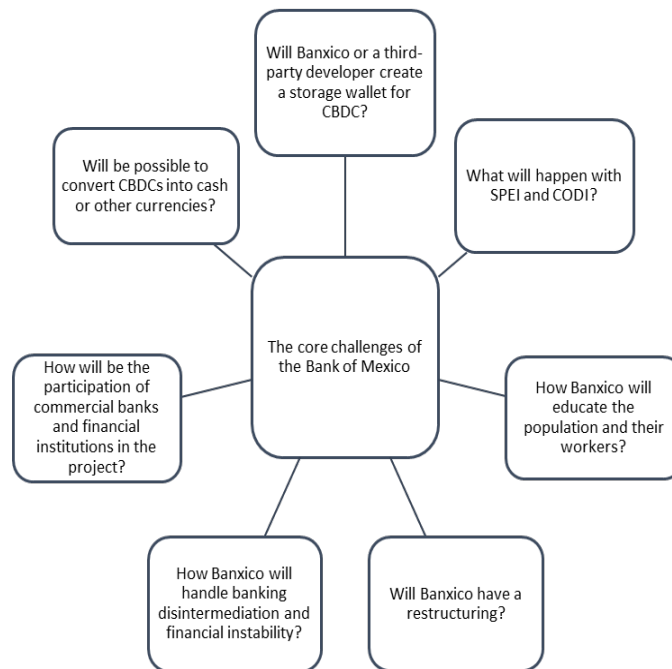
Source: Own elaboration (Rodríguez, 2022; Alfonso et al., 2022).

Proposals of Mexican CBDC

The present proposals are based on the recommendations of Armelius et al. (2020) and the Reserve Bank of India (2022) to show a fully-fledged CBDC that Banco de México can develop. Furthermore, the selection of the proposals has been substantiated by the design and the architecture of digital currencies of the Indian Rupee and E-Krona.

The proposals we did are based on Figure 1. The first is a centralized design using a token-based structure and blockchain technology. The second proposal is a centralized design implementing an account-based structure and blockchain technology. Finally, the third proposal is a decentralized design that employs a token-based structure and blockchain technology.

In Figure 3, we present proposal 1, which is focused on a centralized design process and uses Blockchain Technology or DLT. Furthermore, the access model is Retail, the distribution is indirect, and the structure is token-based. As mentioned above, this proposal could use the intermediation of commercial banks and financial institutions. Also, if the CBDC architecture is retail and token-based, a digital wallet would be necessary to hold the digital currencies.

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This proposal could be costly to implement, but it will receive the support of intermediaries to distribute and realize the Know Your Customer and Anti-Money Laundering process. It is opposite to the comment that the holders of the CBDCs would pay in business, although it is possible to change the CBDC tokens to bank money using the attorney's services.
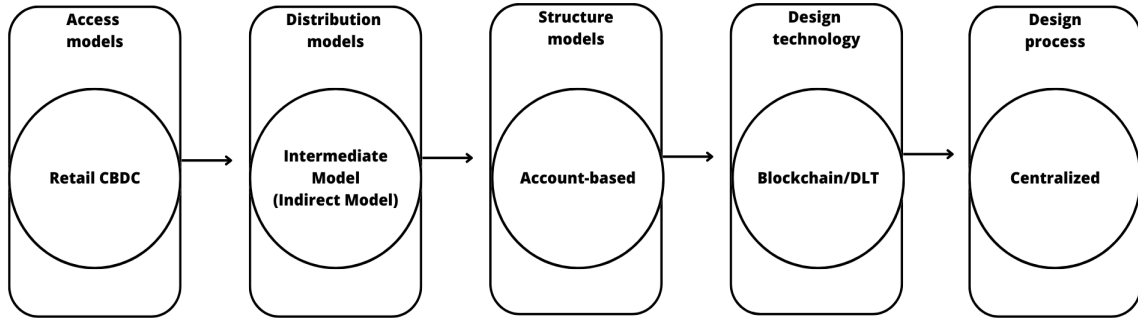
Figure 3. Proposal 1 of Mexican CBDC.
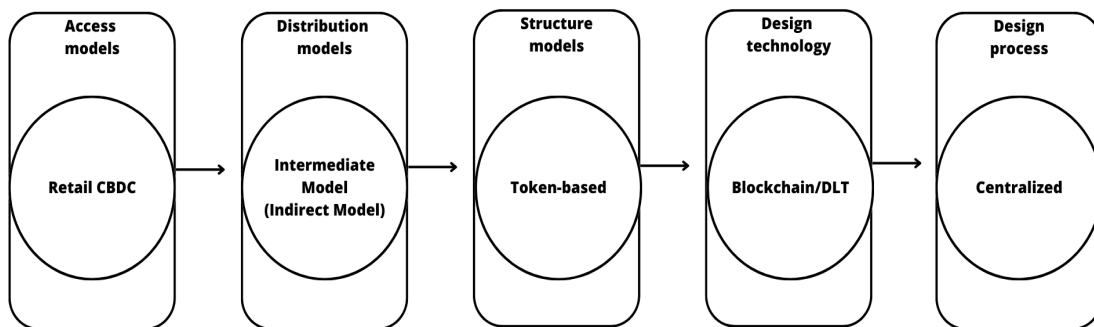
Source: Own elaboration (Armelius et al., 2022; Reserve Bank of India, 2022).

In Figure 4, we present proposal 2, which is focused on a centralized design process and uses Blockchain Technology or DLT. Proposal 2 is like Proposal 1, but it uses an account-based structure. This design could use a similar model that Banxico has with SPEI and the

commercial banks. A difference in the present proposal is that the holder of CBDC can change its units in the account to bank money.

Figure 4. Proposal 2 of Mexican CBDC

Source: Own elaboration (Armelius et al., 2022; Reserve Bank of India, 2022).

In Figure 5, we present proposal 3, which is focused on a decentralized design process and uses Blockchain Technology or DLT. The present proposal has similarities to the one mentioned above, but it uses the power of nodes to validate the transactions. One advantage of it is that each node has a ledger of all transactions that have been implemented, and if one is affected, the other may continue with the process. On the other hand, Armelius et al. (2020) mention that a decentralized proposal could be a big challenge for a Central Bank because it can present problems with controlling and managing CBDCs.

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Figure 5. Proposal 3 of Mexican CBDC.
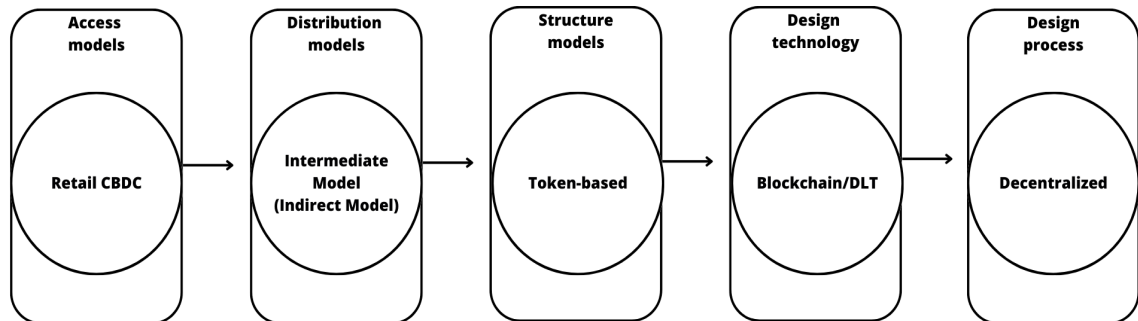
Source: Own elaboration (Armelius et al., 2022; Reserve Bank of India, 2022).).

According to Ensástigue (2023), Banxico is in the first stage of its CBDC; nevertheless, he comments that the process has three stages. In the first stage, Banxico wants to create a platform that can permit the realization of transactions using an ID or cell phone number. In the second stage, the financial institutions will participate in developing a system compatible with SPEI. Finally, in the third stage, Banxico will launch the service to the population.

Nonetheless, it is significant to comment that Banco de México wants to use the SPEI system over a DLT or a Blockchain. However, financial institutions could implement these technologies as part of the intermediation of CBDC. Although, understandably, Banxico could implement our proposal 2, the design technology might be the SPEI system with updates.

Stablecoins of the Mexican peso
Stablecoins are Blockchain tokens that aim to maintain a more fixed price than a cryptocurrency; for this reason, they are pegged to a Fiat asset or a commodity. The Fiat assets are currencies such as the USD dollar, Canadian Dollar or Mexican Peso, and the commodity assets are usually minerals such as gold and silver. The stablecoins projects have liquidity, transparency, regulatory compliance, and customer service. The adoption focuses on these tokens being exchanged at cryptocurrency exchanges, which can be used in digital wallet applications for payments and services (Tether, 2023).

For a user to make a peer-to-peer transfer, the sender must have the recipient's address. One way to obtain it is by scanning the QR code. However, it is essential to note that some of the risks presented using stablecoins are the loss of tokens due to a mistake in the sending address and the theft of keys and accounts.

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The stablecoins of the Mexican peso are a disruptive innovation that has had a boom in 2021 and 2022. Based on the above, cryptocurrency developers such as Tether, Jarvis, Moneta, and PXO have visualized that a Mexican peso stable is an alternative for remittances, payments, and transfers. The stablecoins projects linked to the Mexican peso with greater diffusion are the PXO token, MMXN, jMXN, and MXNT.

For the operation of the stablecoins of the Mexican peso, they must be developed within a Blockchain. Moneta Digital, PXO token, and MXNT are developed on the blockchains of Ethereum, Tron, and BNB Chain. De Azevedo Sousa et al. (2020) explain that making transactions on the Ethereum Blockchain involves paying commissions called gas. As a result, the tokens that are developed on the Ethereum Blockchain must pay commissions for each transaction. It is noteworthy that Ether is the native token of the Ethereum Blockchain. Hence, the increase in Ether's price increments each transaction's cost.

The main features of the stablecoins projects of the Mexican peso, according to Tether (n.d.), PXO Token (2023), Moneta Digital (2023), and Jarvis Network (2023), are shown in Table 3. In this analysis, it is observable that these projects are carried out in several blockchain protocols. They use smart contracts to operate each stablecoin; therefore, the transactions can be viewed through Etherscan, Tronscan, Bscscan, and Polygonscan. It should be noted that

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in the visualized transactions of these stablecoins through scanners, MMXN is the stablecoin that has had more transactions than the others.
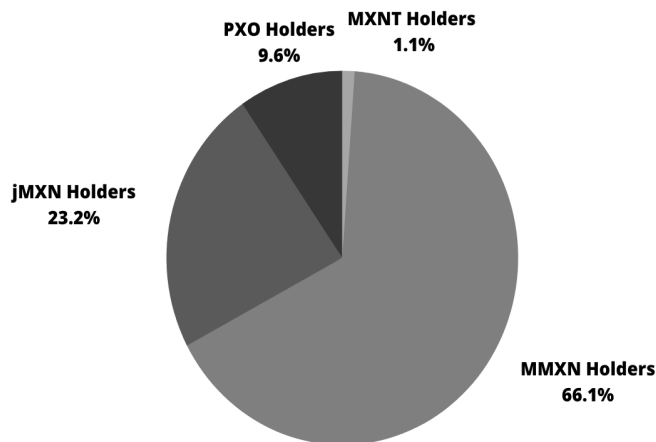
Table 3. Stablecoins' projects of the Mexican peso.

Description	MMXN	MXNŦ	PXO Token	jMXN
Name of the stablecoin	Moneta Digital	Mexican Peso Tether	PXO Token	Jarvis Synthetic Mexican Peso
Blockchain networks	L1: Ethereum and Tron	L1: Ethereum	L1: BNB Chain and Ethereum L2: Polygon Network	L1: Ethereum L2: Polygon Network
Blockchain Explorer	Tronscan	Etherscan	BscScan	Polygonscan

Note. L1 is a Layer 1 Blockchain Network, which is a concept to describe a principal Blockchain; on the other hand, L2 is a Layer 2 Blockchain Network, which is a solution that operates through a principal Blockchain protocol.
Source: Own Elaboration (Tether, 2023; PXO Token, 2023; Moneta Digital, 2023; Jarvis Network, 2023).

The number of holders of each stablecoin of the Mexican peso is presented in Figure 6. It is observable that MMXM has a significant quantity of holders, with 66.1% of the total holders of stablecoins. Since 2021, Trubit, previously named Moneta, has been promoting the benefits of using their stablecoin MMXM for remittances (Moneta Digital, 2023). The present analysis was elaborated with the data of BscScan (2023); Etherscan (2023); Polygonscan (2023); Tronscan (2023.) until November 27 of 2022.

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Figure 6. Stablecoins' holders of the Mexican peso.

Source: Own elaboration (BscScan, 2023; Etherscan, 2023; Polygonscan, 2023; Tronscan, 2023).

It is observable in Figure 7 that the transactions of stablecoins of the Mexican peso are executed mostly with MMXN stablecoin, and jMXN is the second most used. Despite MXNT and PXO Token's efforts, they do not represent competition for Moneta's Stablecoin. The data we use to obtain information about the stablecoins' transactions are from 2021 until November 2022.

Figure 7. Stablecoins' transitions of the Mexican peso.
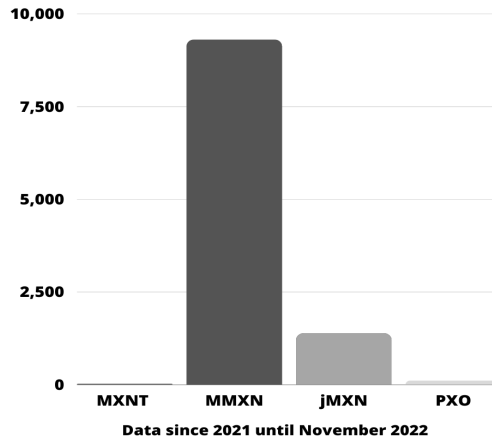
Source: Own elaboration (BscScan, 2023; Etherscan, 2023; Polygonscan, 2023; Tronscan, 2023).

UST stablecoin case

Briola et al. (2022) explain that the failure that occurred with the Terra Labs project is relevant to analyze due to the events that occurred in May 2022, where the price of the Luna token and the algorithmic stablecoin UST lost 99.99% of its value. During the process of high price volatility suffered by Luna token and UST, both tokens were delisted from cryptocurrency exchange platforms to prevent more users from being affected, as they were also waiting for the response of the Terra Labs action plan. However, as Briola et al. (2022) mentioned, it had a significant impact on the cryptocurrency ecosystem, which affected the prices of Bitcoin, Ether, Binance Coin, Tron, and Dot, to name a few.

CONCLUSIONS

Cryptocurrencies were created to be a decentralized payment method focused on Blockchain and cryptography. Nevertheless, due to their price volatility, users use stablecoins for payments and transactions, such as USDT, BUSD, and MMXN. Currently, the Mexican regulatory entities have been implementing limitations on their use.

As a result of this policy, and with the recommendation of the Bank of International Settlements, Banco de México is developing its own Central Bank Digital Currency. The challenges that must be addressed for the Mexican CBDC include promoting financial inclusion, ensuring coexistence with cash, and maintaining consistency with the money in circulation. In addition, Banxico has been working to address adoption, technical, logistical, and innovation issues to develop a digital currency that performs optimally.

Central banks have been exploring ways to enhance and modernize their monetary policy. As part of this effort, many economies collaborate with research teams and institutions to develop projects to implement central bank digital currencies. Besides, the role of commercial banks is paramount; they must collaborate with Banco de México to implement the best strategies for implementing the Mexican CBDC.

The current project of Banco de México, which we discussed in the three proposals, is feasible, but it still faces specific challenges and issues that need to be addressed. Therefore, a fact is mandatory. Its implementation must be subject to thorough study and discussion. In the meantime, stablecoins denominated in Mexican pesos are being used as an alternative payment method, with MMXN having the highest number of transactions and holders.

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