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Factors affecting the Issuance of Central Bank Cryptocurrency (Token-based CBDC)

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Abstract

This study aims to examine the factors affecting the issuance of Central Bank cryptocurrency (CBDC). This research was conducted using a mixed-methods approach (qualitative-quantitative). The qualitative section employed the grounded theory method through semi-structured in-depth interviews with 15 experts in the fields of payment systems and financial technologies, selected through purposeful and snowball sampling. In the qualitative phase, after three stages of coding, the affecting components were identified, comprising six main categories (axial, causal conditions, intervening conditions, contextual conditions, strategies, and outcomes), along with 37 subcategories and 190 concepts. In the quantitative section, to validate the categories derived from the qualitative phase, a fuzzy Delphi approach was utilized with input from a panel of experts. Additionally, to test hypotheses based on the validation of relationships among the categories, a Partial Least Squares (PLS) approach was employed. The statistical population for the quantitative research consisted of all experts, deputies, and managers at the central bank, from which 110 individuals in the payment systems department were selected as the research sample. The results of the quantitative phase confirmed the validity of the identified components. The findings of this research not only identify multiple factors affecting the issuance of token-based central bank digital currency but also affirm that the issuance of digital currency paves the way for its social acceptance, emphasizing the necessity for precise policymaking. Therefore, it is recommended that managers and policymakers at the central bank utilize the model presented in this study.

Keywords: token-based Central Bank Digital Currency; Mixed Methods; Distributed Ledger Technology; Central Bank Digital Money; CBCC; CBDC

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1-Introduction

The development of Central Bank cryptocurrency (token-based CBDC) as a digital form of debt instrument issued by central banks has garnered attention from countries for various purposes and in different formats. Given the extensive range of capabilities identified for CBDC, diverse objectives, methods, and outcomes have been proposed regarding central bank digital money. Among these, the experiences of countries over the past decade in utilizing decentralized technologies, including distributed ledger technology, have opened new horizons in the realm of central bank digital currency.
In a broad definition, distributed ledger technology essentially represents a decentralized database that is shared among various components based on the concept of decentralization, creating a decentralized environment instead of relying on a centralized entity. The process of updating these databases ensures the uniformity of data across all components. Designing such a structure eliminates users' dependence on a central authority managing the database. This overarching concept has led to the development of various subsequent technologies, with blockchain technology being one of the most well-known.
Blockchain is a method for storing and verifying interactions in a decentralized manner, where participants have complete access to the records of interactions but cannot individually alter them. This technology serves as one of the platforms enabling the development of various digital assets, cryptocurrencies, and central bank digital money, thereby establishing a significant transformation in economic sectors and various business domains (Movahed et al., 2024).
While decentralized solutions are becoming more prevalent globally, semi-decentralized solutions have gained significant attention in recent years as a new generation of blockchain-based products. Among the most notable of these are enterprise blockchain and central bank digital currency (CBDC). The primary objective of semi-decentralized blockchains is to maximize the advantages of blockchain technology while maintaining a degree of controlled centralization. One of the methods for implementing the phenomenon of central bank digital currency, referred to in this study as "digital rial," involves utilizing semi-decentralized blockchain solutions. In this approach, the number of members is limited, and membership is only possible with the approval of the central bank. Furthermore, the issuance of digital rial is exclusively under the control of the central bank, which employs banks and credit institutions as distributors of digital rial among the general public. Each central bank determines its specific objectives for developing digital currency based on its unique requirements, and the Central Bank of the Islamic Republic of Iran is also working on developing digital rial to facilitate the growth of the digital economy. There are additional functions and implicit benefits expected beneath this primary objective, which will be discussed in this paper.
Considering the provided introduction, the world is moving towards a digital era. Despite the advantages and disadvantages of cryptocurrencies, they seem to have transitioned from being an option to a necessity for central banks. Given that central banks, economists, IT scientists, legal researchers, and other specialists have been working on the challenges and opportunities presented by cryptocurrencies, further research on this phenomenon, combining theory and practice, can enhance understanding of their design, allowing for alignment with the transformations occurring in economies worldwide.
Overall, there are significant gaps in the theoretical literature surrounding cryptocurrencies. For instance, important issues regarding this phenomenon and domestic and cross-border payments, understanding the international concepts of cryptocurrency issuance for both issuing and receiving countries and the potential of cryptocurrencies to improve payment systems and integrated (digital) economies exist, where further research can significantly contribute to the effectiveness of these efforts.
This raises the question of what model can be proposed for central bank digital currency upon its issuance, as well as the affecting, contextual, and intervening factors and the consequences of its implementation. Accordingly, this research aims to design a model for the issuance of central bank digital currency by utilizing insights and consultations from experts in the fields of finance and banking.

2-Theoretical Framework

Money, in its initial concept, was an intermediary that humans used to facilitate the exchange of goods and services. In today's world, this function of money still exists; however, we can generally identify three distinct functions of money: as a medium of exchange, a unit of account, and a store of value. Traditional physical currencies fulfill these three functions with the support of the prevailing political system in the country. Accordingly, the governing system guarantees that in exchange for printed money, one can receive other valuable exchange mediums (such as gold and the currencies of other systems). People consider printed money valid for transactions based on the credibility of the political system and the country's gross domestic product (GDP). All currencies whose functions are guaranteed by a centralized political system are referred to as centralized or traditional money. In contrast, there exists another category of money whose volume and transactions are not controlled by a centralized entity, and naturally, its functions are not guaranteed by a centralized system (Nozari et al., 2022).

In this context, with the emergence and expansion of electronic processing tools and the internet, innovations also arose in banking systems. Subsequently, in 2009, the advent of Bitcoin, designed in a decentralized manner, revolutionized this field, leading to the flourishing of decentralized monetary and financial tools created by the private sector using distributed ledger technology and blockchain. In response to this transformation and a series of subsequent events, central banks have begun to focus on the idea and technology of decentralized currencies. Following this introduction, this section will provide an overview of central bank digital currency in the theoretical literature (Agur& Anil, 2022).

Central bank digital currencies are a type of digital money created by central banks. From a technological perspective, central bank digital money can utilize both centralized architecture and distributed technology architectures. This means that transaction verification, unlike centralized infrastructures, is not solely the responsibility of the central bank; rather, a group of members, including the central bank and several commercial banks, participate in transaction verification using blockchain and distributed ledger technology. Therefore, this type of money has the potential to be transferred in a peer-to-peer manner if issued based on tokens on a digital platform.

From a broader perspective, the implementation of central bank digital currencies can occur in one of two formats: account-based (meaning an account with a centralized entity) or token-based. In the account-based method, money owners access their funds solely through a centralized account with a third-party identity (bank). However, in the token-based design, the owner of the token (digital money) can access their digital currency without the need for a central intermediary, with one of its key objectives being the facilitation of value exchange in a peer-to-peer manner.

2-1-Monetary Effects of Central Bank Digital Currency

One form that central bank cryptocurrency (Token-based CBDC) can take is a type of electronic cash that serves solely as a secure and efficient tool for paying for goods, services, and assets, without any interest being paid on it. This type of CBDC, which is essentially considered "small digital money," will not be applicable for settlement between banks or for implementing monetary policies. Therefore, the existence of this type of money is unlikely to impact the mechanisms of money supply. However, what is significant in introducing this type of digital money is determining which assets should serve as backing for the CBDC (Aliahmadi et al., 2013).

It is important to note that designating physical assets as backing for banknotes and coins has prevented their supply from being increased indefinitely. On the other hand, due to the inherent characteristics of banknotes and coins (such as portability issues, low security, etc.), it does not seem that, as long as the economy is in normal conditions, the demand for them will exceed supply, leading to a shortage.

Assuming that the CBDC fully replaces banknotes and coins and establishes a one-to-one relationship between them, the total amount of issued banknotes and coins and electronic cash should not exceed the assets previously held as backing for banknotes and coins. However, the electronic nature of the CBDC means it will not face the exchange issues associated with physical currency. Therefore, if the demand for this type of money exceeds the supply, and if the central bank is unwilling (or unable) to adjust the volume of issued banknotes and digital money due to limitations in providing backing, it will necessarily have to change the composition of banknotes and coins in favor of the CBDC. If the increased demand for CBDC is not met, the value of digital money relative to banknotes and coins will rise. Consequently, the parity between different types of central bank money will be disrupted, weakening monetary stability; as the one-to-one equivalence between digital rials and physical currency will no longer hold, each digital rial may be valued more than its nominal value in paper money (Carstens, 2021; Aliahmadi et al., 2015).

The demand for electronic cash is likely to be a function of other interest rates in the economy, such that changes in the returns of other assets will alter the relative yield of electronic cash and its demand. Changes in demand can create flows between bank deposits or other financial instruments and electronic cash. In this scenario, the demand for electronic cash is likely to move in the opposite direction to policy rates. In other words, when the central bank increases the interest rate paid on reserves as part of a contractionary monetary policy, the interest paid on bank deposits will also rise, thereby reducing the relative yield of electronic cash. This situation decreases the relative attractiveness of holding electronic cash, leading to a substitution with bank deposits. Conversely, an expansionary monetary policy will have the opposite effects. An expansionary monetary policy, by increasing the relative attractiveness of electronic cash, will lead to a conversion of deposits into this type of money. This can reduce banks' resources or, if other financial markets are attractive, lead to a rapid outflow of digital cash balances into those markets. Such flows in electronic cash can be a source of instability in the banking sector or financial markets, affecting banks' balance sheet liquidity and their financing costs, inadvertently acting as a deterrent against desirable policy changes. It should be noted that during the implementation of a contractionary monetary policy by the central bank, the conversion to bank deposits facilitates credit provision for banks, while during the implementation of an expansionary monetary policy, it acts oppositely.

2-2-Financial Effects of Central Bank Digital Currency

A prevailing belief regarding the issuance of central bank cryptocurrency (Token-based CBDC) is its potential dampening effect on banks' deposit and payment activities, which could undermine financial stability and reduce lending to the economy. However, recent research (Panetta, 2022) suggests that this perspective may not be as solid as previously thought.

In general, when considering the risks and potential effects of CBDC issuance on financial stability, it is essential to recognize that, first and foremost, these risks fundamentally depend on the choices made by central banks. Central banks can delegate the distribution of digital money to financial intermediaries while maintaining their role and added value in providing essential services. They can also design CBDC features that create strong incentives for potential demand. For example, they might impose specific and varied fees or set limits on holding different amounts of digital currency. Additionally, central banks can provide ample and favorable financial resources to mitigate pressures arising from potential changes in the composition of bank funding. The interest rate set by the central bank for digital money can also impact the transmission mechanism of CBDC issuance to the financial market (Bindseil et al ., 2021).

Secondly, the issuance of digital money can have positive implications for the financial system. The introduction of CBDC can reduce the demand for cash. Moreover, it can ensure that government money continues to play its role in reinforcing trust in payments. Digital money can improve capital allocation by facilitating payment access and reducing transaction costs. It can also enhance competition in bank financing markets by diminishing banks' market power (Chiu et al., 2019; Andolfatto, 2020). Furthermore, these digital currencies can create innovative opportunities and facilitate competition between banks and new players, such as technology companies. However, the effects of digital currency issuance can become more pronounced when trust in banks is lost. Accordingly, other studies (Maniff & Wong., 2020) have examined whether central bank digital currencies can exacerbate systemic crises. Beyond providing a safe asset, another feature of digital money is that, unlike cash, it offers access to a safe asset that can potentially be held in large volumes without any cost. It also accelerates digital usability and may even lead to its evolution (Kumhof and Noone, 2018). Additionally, some recent research (Keister & Monnet, 2020) indicates that by designing and calibrating safeguards (such as quantity limits and caps), the increased risk to banks from the issuance of digital money can be mitigated. A notable finding is that central bank digital currency can itself serve as a tool to counter such risks. This currency can provide real-time information about deposit flows, allowing the central bank to respond more quickly, which, in turn, can help stabilize depositors' expectations by increasing their confidence (Keister & Monnet, 2020).

In a semi-competitive market where banks have some power to influence the determination of deposit floor rates, the issuance of digital rials within a specified rate range can effectively control banks' willingness to lower deposit rates, acting as a competitor in preventing such rates from falling below a certain threshold. Thus, the allocation of banking resources can occur at an appropriate equilibrium rate, enabling the continuity and improvement of lending facilities. In this scenario, the role of banks as intermediaries is not diminished but rather managed. In a perfectly competitive market, where deposit and lending rates are determined by the interplay of supply and demand for funds, the introduction of digital money as a competitor for deposits, if offered at an appropriate rate by the central bank, would merely act as another asset in the financial market. Commercial banks, with proper management of supply and demand for funds in the market, can continue to maintain their financial intermediation role (Chiu et al, 2022).

2-3-The Goal of the Central Bank of the Islamic Republic of Iran in Developing Digital Rial

As previously explained, central banks pursue various objectives when developing digital currencies, including responding to the payment needs of the digital economy, improving the efficiency of modern payment tools, increasing the accessibility of central bank money, managing the effects of reduced cash usage in society, developing international payment tools with other countries, enhancing the resilience of payment instruments, achieving specific goals in monetary policy, and managing risks associated with the proliferation of private currencies. These objectives ultimately determine many characteristics of central bank digital currencies. In other words, the economic, technical, and business design of central bank digital money is largely dependent on the goals that central banks aim to achieve through the development of digital currency.

The Central Bank of the Islamic Republic of Iran, in its initial step, aims to create a foundation for the development of the digital economy in the country and to address the payment needs related to the digital economy by developing the digital rial. It is also expected that in this phase, benefits such as enhancing the resilience of payment tools, managing the effects of reduced cash usage in society, improving the efficiency of modern payment tools, increasing the accessibility of central bank money, and managing risks arising from the proliferation of private currencies will gradually be realized. Additionally, it is anticipated that other ancillary benefits will also be achieved through the development of the digital rial, which are referenced in this study.

Regarding the role of digital money in the digital economy, it should be noted that with the emergence of the platform economy concept in recent years and the predicted shift towards blockchain-based economies, a world based on tokens is taking shape. In this context, every real entity can have a digital counterpart in the form of a token, and virtual entities can also possess a token-based identity. In such an environment, the use of a payment tool suitable for the created economic space to provide financial services to token-based entities is considered a fundamental necessity, and the complete concept of the digital economy will be realized in such a space. Therefore, the central bank's appropriate forecasting and groundwork for providing suitable money and payment tools to meet the needs of the described digital economy is of great importance; as inadequate responses to this need would promote the use of other types of private tokens as payment tools, jeopardizing the monetary sovereignty of central banks.

Since the technology used to implement the digital rial is closely related to the central bank's goals for developing this product, it is briefly explained why the digital rial is being implemented using distributed ledger technology. One of the central bank's objectives in developing this tool is to activate the programmability capacity of money under the functions of the digital economy. Although this service can be provided concerning various types of digital money, activating this capacity for token-based money issued through distributed ledger technology and blockchain offers a more cost-effective development opportunity, with numerous experiences available regarding the implementation of this capacity on various tokens published on this technology. Additionally, platforms based on distributed ledger technology are highly secure due to the use of consensus mechanisms in the transaction verification process, and because the information is recorded in the form of continuous data blocks in this network, it is possible to trace any changes in the recorded information chain. These features, along with the acceptable speed of this network and the ability to activate extensive processing capacities through managed redundancy in infrastructures, position blockchain as one of the most suitable platforms for issuing central bank digital currency (Hosseini, 2021).

Numerous studies have examined the characteristics of central bank digital currencies. The existing literature focuses on many aspects in common. At the same time, our understanding of how to analyze the impact of digital currencies and how to implement them is evolving. Current questions that the literature focuses on include how to directly provide digital currency to households, the design of technological structures, the management of offline payments, the implications of digital currency regarding privacy issues, and many other matters. The Bank for International Settlements and the

International Monetary Fund have extensively addressed these dimensions. On the other hand, there are not many theoretical approaches to modeling digital currencies or crypto assets in terms of a general equilibrium model from a macroeconomic perspective. However, there are notable exceptions; for example, Davoodalhosseini (2021) presents a model for money that includes a centralized market where money is not needed and a decentralized market where transactions are conducted using money. With such a model, Davoodalhosseini (2021) examines optimal monetary policy when the government issues only cash, digital currency, or both. This study concludes that if the use of digital currency is not excessively costly, it offers significant potential benefits compared to the use of cash for central banks and governments.

Choi and Rocheteau (2021) study price dynamics when money is created using time-consuming extraction technologies, focusing on private crypto assets, showing that money initially used for speculative purposes can also be utilized for trading purposes when it becomes abundant. Chiu and Wong (2015), on the other hand, implement a mechanism design approach to identify the features that different payment systems should have to improve the optimal allocation of limited resources, demonstrating that electronic money can enhance social welfare. A different approach is followed by Fernández-Villaverde et al. (2021) and Schilling et al. (2020), who express concerns about the implications of banking after the issuance of digital currencies and develop models typically used to study banking components. Schilling et al. (2020) address the trilemma of digital currencies, suggesting that the central bank can succeed in at most two of three objectives: (1) efficiency, (2) eliminating frictions, and (3) price stability. Fernández-Villaverde (2021) examines whether an economy with digital currency can be less prone to managing banks than an economy without such a tool. The digital currency unit enables the central bank to perform financial intermediation, which, along with the role of a lender of last resort, stabilizes the system. Furthermore, Fernández-Villaverde et al. (2021) indicate that the issuance of this currency will not improve price stability. All previous methods are highly theoretical. The perspective of Barrdear and Kumhof (2016) studies the impact of introducing digital currency, showing that it can have real output effects through lowering real interest rates in a model with frictions. Kumhof and Noone (2018) explore the concept of issuing digital currency as a substitute for commercial bank deposits, focusing on how digital currency affects the balance sheets of various actors (central banks, commercial banks, non-bank financial institutions, households, and firms). This model is similar to the model of Barrdear and Kumhof (2021). Additionally, the authors aim to study the role that digital currency may play in the loss of trust in the banking system. Faruk and Nawaz(2021) addressed the process of launching a digital currency in China, comparing foreign digital currencies with national digital currencies in terms of stability and reliability, concluding that China has gained an advantage from being a first mover in issuing a central bank digital currency, but the outcome depends on the response of the United States and future developments in the economies of both the United States and China.

Among domestic studies, Ghorbani and Mousavi (2021) state that the cryptocurrency market is rapidly developing and advancing; a trend that, according to economic experts, promises entry into a new world of financial transactions for businesses shortly. Certainly, as the infrastructure becomes more widespread and people around the world gain access to digital currency exchange tools, we will witness a shift towards widespread payments with digital currencies. Their study attempts to address topics related to Bitcoin as the most common digital currency, its advantages and disadvantages, and its position and impact on the financial transactions of today's businesses. Fekri and Pakzadeh (2020) in a library study state that 80% of central banks are somehow active in the field of central bank digital currencies. Additionally, about 40% of central banks have moved beyond theoretical research to practical experiments. Their study concludes that there is still no uniform consensus among central banks regarding the foundations and concepts, but the speed of growth and scientific dissemination and reaching global consensus in this area has significantly increased. Babak et al. (2020) examined the characteristics of various digital wallets according to user needs for better management of cryptocurrencies. In this research, consulting experts in distributed ledger technology and cryptocurrencies in universities, banks, and research institutes led to the conclusion that security, accessibility, online or offline status, support for various cryptocurrencies, wallet price and transaction costs, user interface, and backup of private keys are among the higher priorities for selecting a digital wallet. Ghafari et al. (2020) studied the impact of the expansion of cryptocurrencies (Bitcoin) on the demand for money and seigniorage using dynamic stochastic general equilibrium (DSGE) models and

seasonal time series data from 1989 to 2018. The results indicate that with the increase in demand for cryptocurrencies, the demand for official money decreases, inflation decreases, and consequently, revenue from seigniorage declines. Furthermore, shocks from cryptocurrencies through changes in energy prices will partially compensate for government revenues, although the long-term welfare effects of this policy are significant. Hosseini et al. (2020) examined the impact of the expansion of virtual currencies (Bitcoin) on the demand for official money in Iran using a cash-in-advance (CIA) model with a dynamic stochastic general equilibrium (DSGE) approach. In the designed model, it is assumed that households shape their money demand in both virtual and official money. The holding and demand for virtual money can have significant effects on macroeconomic variables. In this study, the shock from Bitcoin prices and its trading volume is considered an indicator of the demand for virtual currencies. The results indicate that with the increase in demand for virtual currencies, the demand for official money decreases, leading to a decline in revenue from seigniorage.
A review of the studies conducted in the field of digital currencies shows that many foreign studies have entered this area, addressing the benefits, drawbacks, implications, and related issues. Among domestic studies, the focus has primarily been on cryptocurrencies and their affecting factors and consequences. Therefore, the author has not found a study that models the application of central bank digital currency and its various dimensions, which is considered an innovation of this research.

3- Methodology and Research Sample

In this study, a mixed-method approach has been utilized for data analysis. The mixed-method approach combines both qualitative and quantitative research methods. In the qualitative section, content analysis was employed to analyze the information. In this approach, the variables and themes of the conceptual model were identified using a coding method through three stages: open coding, axial coding, and selective coding.
In the open coding stage, the collected data from open-ended questionnaires were examined, and concepts were extracted. Following open coding, in the axial coding stage, the core phenomenon of the research was identified based on the emphasis of the respondents and the theoretical foundations of the study. Subsequently, categories including causal conditions, contextual conditions, intervening conditions, and outcomes were identified, and their interactions were presented in the form of a paradigmatic model. Selective coding, the third stage of the coding approach, is essentially the process of refining the theory and the main stage of theorizing. In other words, based on the results of the previous two coding stages, a theory was developed, systematically relating the core category to other categories, and categories that required further improvement and development were revised.
In the quantitative section of the research, structural equation modeling (Partial Least Squares) was used with PLS software. In this regard, the information and data were collected and analyzed in two stages. First, in the initial step, to develop the literature review and establish a framework for the model, a questionnaire was administered to 20 experts in the field after coordination through personal visits, registered mail, and email. It is noteworthy that theoretical saturation was reached after reviewing the questionnaires and interviews with the 20 individuals, and no new topics were inferred.
Second, the conceptual model of the research, including causal, contextual, and intervening conditions, actions and interactions, the core category, and outcomes, was determined and ultimately validated by 102 informed individuals in the fields of money, cryptocurrencies, and payment systems. The demographic information of the final expert group, including education level, professional background, and age composition, is presented in Table 1.

Table 1 - Characteristics of the Research Expert Group (Percentage)

Workplace		age		Educational Qualification	
University	Banking sector	40>	36-40	Doctorate	Master's Degree
10	90	60	40	70	30

As shown in Table 4, 70% of the respondents to the questionnaire are at the doctoral level, while 30% hold a master's degree. Additionally, 90% of the research experts are involved in the banking sector (holding positions such as general director, deputy, department head, and expert), and 10% are

university faculty teaching in the fields of money and finance. Considering the characteristics of the expert group, efforts have been made to utilize the most suitable group in terms of deep awareness, broad perspective, and sufficient experience to achieve more accurate results. Therefore, it is noteworthy that the subject has been evaluated in a thoroughly scientific and specialized manner.
Furthermore, the characteristics of the respondents to the research questions in the quantitative phase are as follows:

Chart 2 - Position of sample members in the quantitative phase

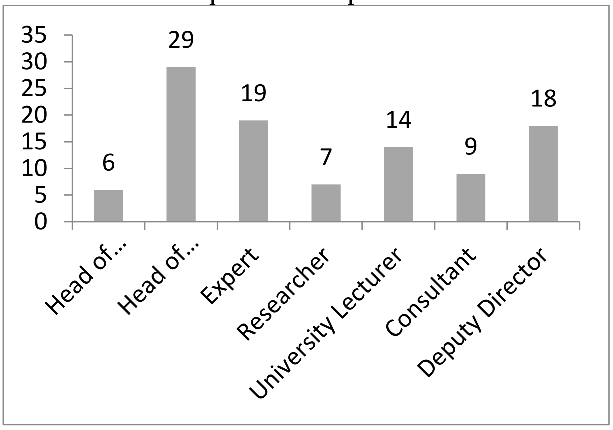
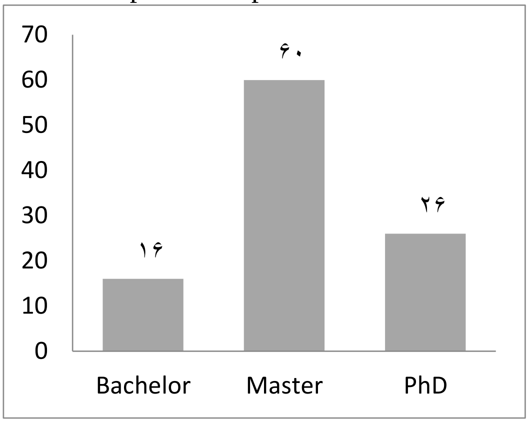


Chart 1 - Education of the quantitative phase sample members



Based on the information from Charts (1) and (2), the research sample in the quantitative phase consists of 16 individuals at the bachelor's level, 60 at the master's level, and 26 at the doctoral level. In this phase, the validity and reliability of the measurement tool (questionnaire) were evaluated based on a review of the relevant literature, which essentially reflects the opinions of specialists and experts. The designed questionnaire was approved by respected professors and several specialists in the field before being presented.
To ensure the validity of the questionnaire, 15 copies were distributed in a preliminary study among randomly selected individuals, and the responses were analyzed and reviewed. To assess the reliability of the questionnaire, the Cronbach's alpha method was employed. If the obtained alpha coefficient is greater than 0.7, the test is considered to have acceptable reliability. The Cronbach's alpha coefficient for the present research questionnaire was found to be 0.89, which is greater than the standard value of 0.7. Therefore, it can be concluded that the questionnaires used in this research have suitable reliability.

4-Findings

In this study, to identify the dimensions and components of the Central Bank's cryptocurrency issuance model using distributed ledger technology, the Strauss and Corbin approach to grounded theory was employed. It is important to note that the data collection and analysis process in this research method was conducted through a back-and-forth, continuous, comparative coding approach. Data collection continued until the researcher reached saturation in the data, and the concepts related to the Central Bank's cryptocurrency issuance model, as proposed by various interviewees, were categorized into repeatable patterns.
In this section, coding, axial coding, and selective coding have been addressed. Initially, by bringing together the corresponding initial codes extracted from 15 conducted interviews, the main concepts were identified, which are essentially a combination of several initial codes. Accordingly, 190 concepts and 37 subcategories were identified.
As the data was opened up and concepts emerged from within it, the researcher sought instances that could help categorize these concepts into categories. According to the Strauss and Corbin (1998) perspective, some concepts can be categorized within a category that has a higher level of abstraction than those concepts. With the help of categories, ongoing phenomena can be described; therefore, in the next step, by bringing together the corresponding concepts, the identified categories were essentially a combination of several concepts. In this research, a total of 190 concepts and 37 subcategories were identified.

Table 2. Subcategories identified in the research

Corresponding Initial Codes	Concepts	Marker
Privacy Preservation	Anonymity of User Information	1
Information Security		2
Fraud and Scam Prevention		3
User Privacy and Information Security		4
Enhanced Usability	Full Convertibility to Other Types of Currency	5
Increased Trade Capability		6
Increased Public Trust		7
Greater Acceptance by Banks and Financial Institutions		8
Reduced Transaction Costs and Time		9
Increased Digital Currency Issuance		10
Economic Growth		11
Security	Regulatory Requirements	12
Crime and Offense Prevention		13
Consumer Protection		14
Technological Advancement		15
Prevention of External Threats		16
Support for Monetary Policies		17
Trust Building		18
Resource Management	Programmability	19
Cost Reduction		20
Inflation Control		21
Increased Transparency		22
Risk Mitigation		23
Trade Facilitation		24
Enhanced Accessibility	Ability to Receive Digital Currency by Presenting Cash	25
Cost Reduction		26
Privacy Preservation		27
Increased Public Trust		28
Balance Creation		29
Faster Transfer and Settlement	Improvement of Speed in Circulation and Transfer of Digital Currency	30
Enhanced User Satisfaction		31
Reduction of Costs and Intermediary Issues		32
Possibility of Fast International Transfers		33
Increased Public Trust		34
Assurance of Security and Reliability	Transaction Verification Authority	35
Preservation of Central Bank Independence		36
Flexibility and Scalability		37
Reduced Transaction Costs and Time		38
Security	Features of Digital Currency	39
Independence from Borders		40
Speed and Efficiency		41
Transparency		42
Scalability and Flexibility		43
Economic Regulation and Control	Interest Rates	44
Capital Attraction		45
Inflation Control		46
Monetary Policy Regulation		47
Financial Risk Regulation		48
Protection of Personal Information	Improvement of Payment Security and Financial Transactions	49
Reduction of Fraud and Imitation		50
Reduction of Security Risks		51
Protection of Intellectual Property Rights		52
Reduction of Transaction Costs	Reduction of Costs in Financial Payments	53
Reduction of Transfer Costs		54

Reduction of Assessment and Settlement Costs		55
Reduction of Maintenance and Liquidity Protection Costs		56
Reduction of Currency Conversion Costs		57
Reduction of Security Costs		58
Acceleration of Settlement Processes	Increased Speed and Efficiency of Financial Transactions	59
Reduction of Payment Transfer Delays		60
Increased Reliability		61
Reduction of Security Risks	Reduction of Financial Risks	62
Reduction of Credit Risk		63
Reduction of Monetary Risk		64
Reduction of Liquidity Risk		65
Blockchain Technology	Role of Digital Currency in the Current Infrastructure of Financial Markets	66
Increased Efficiency and Speed		67
Increased Transparency		68
Cost Reduction		69
Enhanced Access to Financial Markets		70
Combatting Crime and Smuggling	Legal Seizure Capability of Digital Currency	71
Maintaining Financial System Stability		72
Support for Financial and Economic Policies		73
Preservation of Financial Security and Applicants' Rights		74
Reduction of Production and Distribution Costs	Economic Conditions of the Country and Benefits of Using Distributed Ledger Technology	75
Increased Transaction Speed		76
Enhanced Security		77
Increased Transparency		78
Increased Access to Financial Services		79
Security	Level of Technological Growth	80
Speed and Efficiency		81
Transparency		82
Flexibility		83
Direct Communication with Users		84
Preservation of Security and Prevention of Abuse	Establishing Necessary Laws and Regulations	85
Protection of Consumer Rights		86
Market Regulation and Prevention of Unwanted Fluctuations		87
Maintenance of Financial System Stability and Order		88
Technology Development and Creation of Business Opportunities		89
Strengthening Public Trust	Assessment of Public Interest in Utilizing Digital Currency	90
Creation of New Business Opportunities		91
Flexibility in Trade and Fund Transfers		92
Security and Privacy Protection		93
Increased Cryptocurrency Adoption		94
Preservation of Financial Independence and Control	Preservation of the Central Bank's Role	95
Risk Management and Financial Stability		96
Maintenance of Purchasing Power and Inflation Control		97
Preservation of Security and Privacy		98
Combatting Crime and Money Laundering		99
Balance Between Technology and Oversight		100
Combatting Crime and Money Laundering	Combatting Illegal Cryptocurrencies	101
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Open, axial, and selective coding are key stages in the grounded theory method that assist researchers in analyzing and interpreting qualitative data. Open coding is the first stage, where data is divided into smaller sections, and initial concepts and patterns are identified. In this stage, there are no preconceived notions about the data, and the main goal is to discover and identify new topics. Following this, axial coding is performed, where the relationships between the codes identified in the previous stage are examined. This stage involves organizing the codes into related categories and identifying key patterns that lead to a deeper understanding of the data. Finally, selective coding allows the researcher to focus on the key codes and concepts and extract a comprehensive and coherent theory from the data. In this stage, the researcher seeks additional evidence and data to strengthen the theory and reach a conclusion. These three stages help researchers extract meaningful and usable theories from qualitative data. It is worth noting that the above steps are carried out in a back-and-forth process; therefore, the steps of selective coding are not distinct from one another and are conducted through an interactive process alongside open and axial coding. In summary, the data analysis procedure that leads to the creation of a theoretical model includes problem identification and causal conditions, contextual conditions, intervening conditions, policy implementation, strategies and actions, outcomes, and policy evaluation, which describe the main phenomenon, namely the formulation of the Central Bank's cryptocurrency issuance model using distributed ledger technology. After preparing the paradigmatic model to enhance the model's credibility, the paradigmatic model was presented to experts who were familiar with both the Central Bank's cryptocurrency and financial technologies, as well as the grounded theory method. These experts were asked to provide their opinions on the model development process and the final model; most of them approved the model, while some provided corrective feedback, which was applied through a back-and-forth process, and their final opinions were received. Figure (1) illustrates the final research model in the qualitative section.

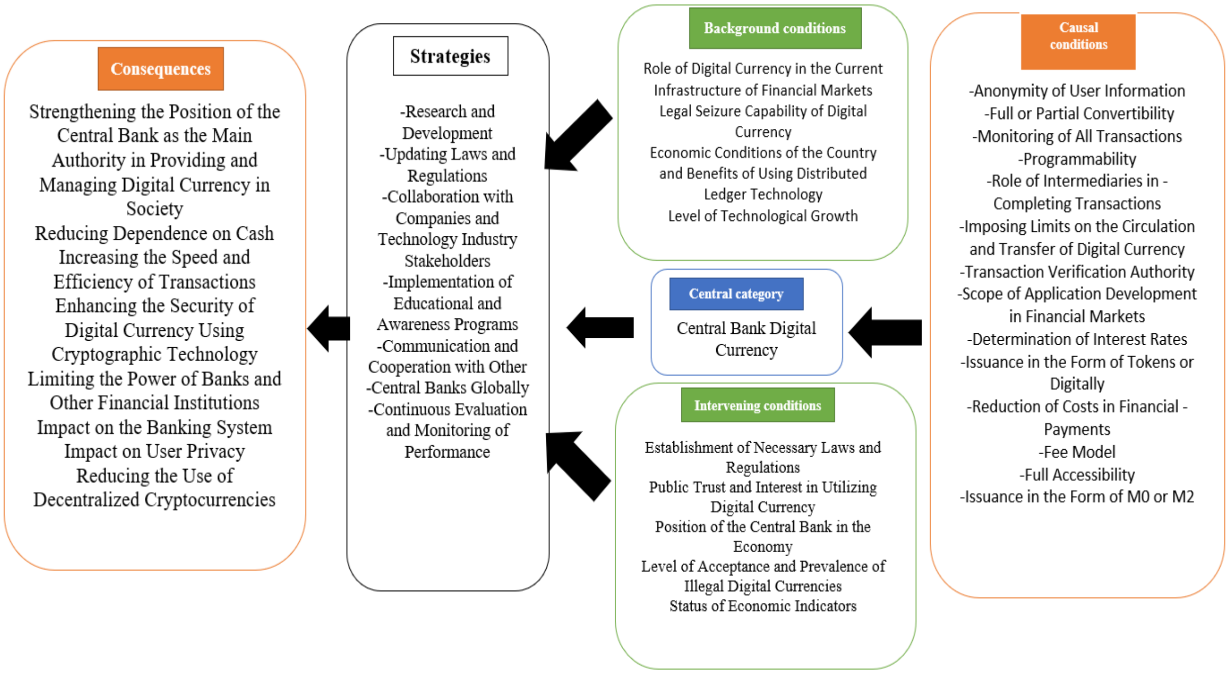

Figure 1. Conceptual research model

To fit the model using PLS, two types of tests are proposed: the measurement model (related to examining the validity and reliability of the measurement tools) and the structural model (testing the research hypotheses and the effects of latent variables on each other). In the first test, the reliability and validity of the model are examined. The reliability of the test relates to the accuracy and stability of the measurement. To assess reliability, two types of tests—internal consistency and composite reliability—are examined:

Assessment of Reliability (Internal Consistency) of Items: The reliability of each item refers to the factor loadings of each observed variable and is used to determine how acceptable the measurement indicators (observed variables) are for measuring the latent variables. The minimum acceptable value is 0.4. The results from examining the factor loading coefficients indicate that several items have factor loadings less than 0.4; therefore, the measurement model was re-evaluated by removing these items, and only those with factor loadings above 0.4 were used in subsequent analyses.

Composite Reliability (Dillon-Goldstein's ρ): The second criterion for reliability must be above 0.6. As shown in Table (3), the composite reliability coefficient for all research variables is at an acceptable level, exceeding 0.6. These steps help the researcher ensure that the measurement tools effectively and accurately measure the intended variables.

Table 3. Results of the composite reliability study of research variables

Composite reliability	Variables title	Composite reliability	Variables title
1.01	E-commerce	0.85	Elimination of Intermediaries from the Supply Chain
0.68	Government Support	0.29	Accessibility
0.72	Information Security and Privacy	0.90	Awareness
0.79	Mandatory Regulations	0.80	Acceptance and Legitimacy
0.67	Perceived Quality	0.82	Reduction of Corruption
0.79	Transparency	0.71	Culture

1.15	National Trust	0.75	Ease of Access

Assessment of Validity of Variables : In the discussion of the validity of the measurement model, there are two important methods: convergent validity and discriminant validity. Convergent validity refers to the extent to which a latent variable is explained by its observable variables. Convergent validity is assessed through the Average Variance Extracted (AVE) criterion. This indicator reflects the amount of variance that a construct obtains from its indicators, and if this criterion exceeds 0.4, the convergent validity of the measurement tool is confirmed.

Table 4. Examining the convergent validity of research variables

Average Variance Extracted (AVE)	Variables title	Average Variance Extracted (AVE)	Variables title
1.01	E-commerce	0.74	Elimination of Intermediaries from the Supply Chain
0.52	Government Support	1.29	Accessibility
0.56	Information Security and Privacy	0.90	Awareness
0.79	Mandatory Regulations	0.80	Acceptance and Legitimacy
0.41	Perceived Quality	0.49	Reduction of Corruption
0.40	Transparency	0.55	Culture
1.15	National Trust	0.60	Ease of Access

Discriminant validity, or divergent validity, complements convergent validity and indicates the distinction of the indicators of a latent variable from other indicators in the same structural model. Discriminant validity is considered acceptable when the square root of the AVE for each construct is greater than the correlation of that construct with other constructs .The results of examining the correlations among the constructs of the research and the square root of the AVE indicate that the values on the diagonal of the matrix (the square roots of the AVE for each construct) are greater than the lower values (the correlation coefficients between each construct and others), demonstrating the acceptable discriminant validity of the constructs.

Additionally, the results obtained from estimating the coefficients and t-statistics for evaluating the structural part of the model are presented in Table (4). If the t-values exceed 1.96, it indicates the validity of the relationship between the constructs and thus confirms the research hypotheses at a 95% confidence level. The quality of the designed model was also tested in this research and is shown in Figure (2). The number next to the indicator for assessing redundancy or excess indicates the quality of the structural model, while the numbers next to the indicator for assessing shared validity or cross-validity indicate the quality of the model. Positive values indicate an appropriate quality of the model.

In the Smart PLS software, the t-value is used to assess the significance of the coefficients, with a threshold of 1.96 for a 5% error rate. To evaluate significance, the t-statistic of the relationships is compared to this assumed value. Specifically, if the t-statistic exceeds 1.96, the indicated relationship is considered significant. Figure (2) illustrates the t-values of significance for the research variables and the path coefficients of the research variables, respectively.

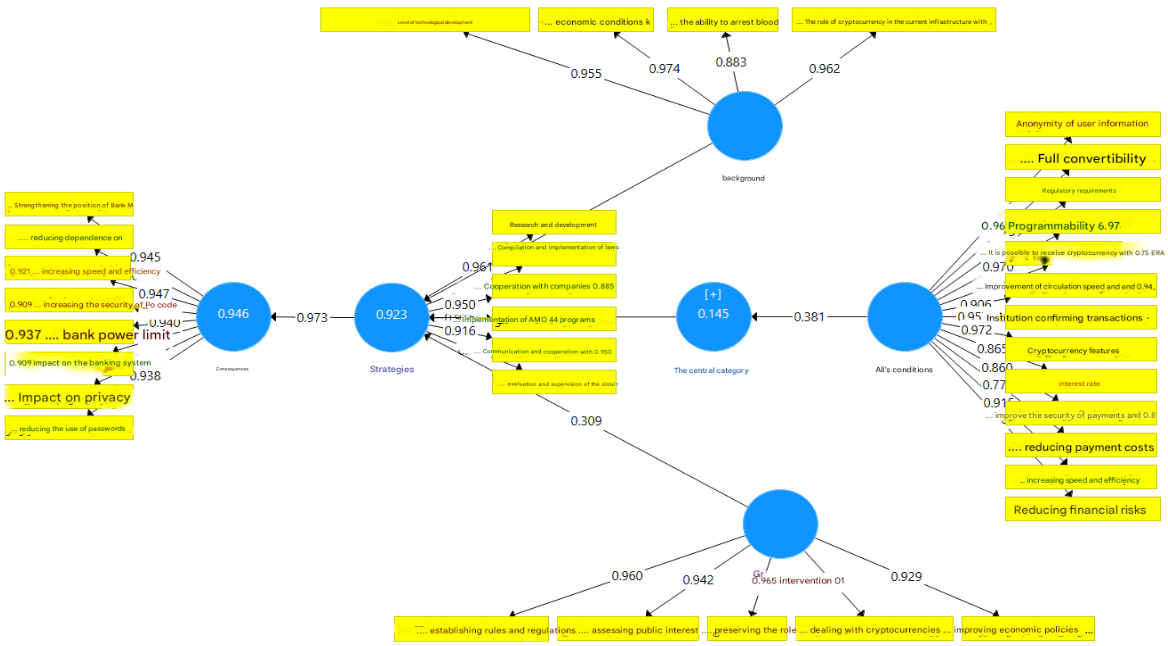

Figure 2. Significance Coefficient of Research Variables

According to Figure (2), all relationships in the model are significant. Based on the software output, the path coefficients and their significance results are presented in Table (5).

Table 5. Impact Coefficients of Variables and Their Significance

Result	t-coefficient	Path coefficient	Route	
			To variable	From variable
Meaningful	2.817	0.381	Central	Causal Conditions
Meaningful	1.998	0.681	Strategies	Contextual Conditions
Meaningful	3.651	0.309	Strategies	Intervening Conditions
Meaningful	2.314	0.124	Strategies	Central
Meaningful	6.248	0.973	Consequences	Strategies

5-Conclusion and Recommendations

The issuance of central bank cryptocurrency (token-based CBDC) utilizing distributed ledger technology is influenced by causal conditions, contextual conditions, intervening conditions, and interactions. This leads to several outcomes, including strengthening the central bank's position as the primary authority in providing and managing digital currency in society, reducing reliance on cash, increasing the speed and efficiency of transactions, enhancing the security of digital currency through cryptographic technology, limiting the power of banks and other financial institutions, impacting the banking system, affecting user privacy, and decreasing the use of decentralized cryptocurrencies. Strengthening the central bank's position as the main authority in providing and managing digital currency can contribute to financial and policy independence, risk reduction, currency stability, facilitation of financial transactions, cost reduction, increased transparency, and improved oversight and control. Given these outcomes, the use of digital currency by the central bank and the reduction of reliance on cash can significantly enhance the speed, efficiency, security, and transparency of financial transactions. The impact on the banking system, as the main authority in providing and managing digital currency by the central bank, includes changes in the role and function of banks, the structure of the banking system, and competition with the central bank. These changes can have both positive and negative effects on the banking system and necessitate appropriate adjustments for banks and the central bank.

The use of digital currency by the central bank may improve the security, control, transparency, and efficiency of the financial system. However, it is important to note that this use may also lead to privacy violations for users and a reduction in illegal and decentralized financial transfers.

Based on the results of this research, research and development, formulation and implementation of regulations, collaboration with companies and industry technology stakeholders, implementation of educational and awareness programs, communication and cooperation with other central banks globally, and continuous evaluation and monitoring of performance have been identified as key strategies.

In justification of this result, it can be said that research and development in the field of digital currency serves as an effective intervening factor in the issuance and establishment of digital currency by the central bank. These activities facilitate technological improvement, ease of establishment, risk assessment, adaptation to technological changes, and increased public trust.

The formulation and implementation of regulations regarding digital currency is an important intervening factor in the issuance of digital currency by the central bank, helping to maintain financial stability, prevent security threats, and enhance public trust.

The implementation of educational and awareness programs regarding digital currency is a significant strategy for the issuance of digital currency by the central bank, increasing public awareness, preventing misuse and fraud related to digital currency, enhancing public trust, developing economic activities, mitigating financial risks, and improving the payment system.

Communication and cooperation with other central banks is also a crucial strategy for the issuance of digital currency by the central bank. In justification of this result, it should be noted that communication and cooperation with other central banks enable the central bank to operate better in international trade and interactions. By establishing connections and collaborations with other central banks, the central bank can leverage its experiences and knowledge, strengthening its financial and economic relations with other countries. This collaboration can facilitate the transfer and exchange of knowledge and experiences in the field of digital currency. By engaging with other central banks, the central bank can benefit from their experiences in the design, implementation, and oversight of digital currencies and avoid mistakes made by others.

Collaboration with other central banks can also enhance financial security. By sharing information and collaborating with other central banks, the central bank can identify and implement best practices and security measures regarding digital currencies, preventing potential damages in this area. Furthermore, communication and cooperation with other central banks can facilitate the direct exchange of digital currencies between countries. By coordinating and collaborating with other central banks, the central bank can align digital currency exchange systems, which can lead to the facilitation and acceleration of direct digital currency exchanges between countries.

Continuous evaluation and monitoring of the performance of digital currencies by the central bank is a highly effective strategy for the issuance and utilization of digital currencies. Through ongoing evaluation and monitoring, the central bank can ensure that these currencies possess the desired security and stability. This can help build public trust in the use of digital currencies and prevent potential damages arising from security deficiencies. By continuously evaluating and monitoring the performance of digital currencies, the central bank can maintain appropriate control over financial policies. This allows the central bank to make adjustments to financial policies based on the economic and financial needs of the country, contributing to the improvement of the national economy.

Moreover, continuous evaluation and monitoring of digital currency performance can help prevent potential financial threats, including money laundering, financing of terrorism, and other illegal activities. Additionally, an accurate evaluation of digital currency performance can reduce the likelihood of economic destabilization and increase the country's debt.

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