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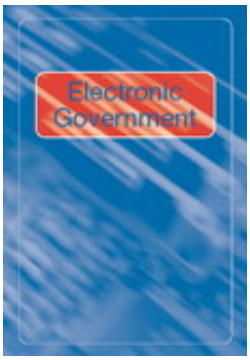

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CBDC as a means of payment and its implications for tax administrations

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Abstract: Cryptocurrencies and central bank digital currencies (CBDCs) are leading a new phase in the increasing money digitalisation trend. However, unlike credit cards and other well-established digital payment services and solutions, digital currencies bring new and complex challenges for the economies, including legal and regulatory implications. Private cryptocurrencies such as Bitcoin have impacted the financial system primarily as a speculative trading instrument. However, with the emergence of central bank digital currencies, digital money has the potential to revolutionise the payment system, since its features can assure the stability needed for a transactional currency. In this context, tax administrations will be affected both on policy and operational aspects. In this article, we focus on the main aspects that can influence the use of cryptocurrencies and CBDCs as a payment method and investigate the consequences and possibilities of this application to the taxation processes.

Keywords: central bank digital currency; CBDC; digital currencies; blockchain; taxation.

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1 Introduction

The process of dematerialisation of money, evidenced by its historical course (Cunha et al., 2021), has gained even more relevance in recent years, leading to a likely future scenario of cashless economy, in which all transactions are conducted with electronic payments, without the use of bills or coins (McKinsey, n.d.). Thus, traditional payment technologies and even new banks and digital services, which have been satisfactory so far, may not be enough for the future (Chuen and Teo, 2021). Despite representing an evolution in relation to physical money, such means are dependent on bank deposits, credit cards or value storage devices. In these solutions, the use of intermediaries increases the costs and complexity of electronic payments, making them inefficient and expensive (Chuen and Teo, 2021).

Thus, to support the growth of electronic commerce, increase the efficiency of payments and take full advantage of digital processes, the ideal would be to use intrinsically digital money (Chuen and Teo, 2021), such as cryptocurrencies. Among them, Bitcoin stands out, which was born associated with the revolutionary idea of being an alternative to official fiat currencies, providing a platform for issuing, managing and

trading non-governmental currencies, deliberately designed to replace bank intermediation (Peneder, 2021). The publication of the article that introduced Bitcoin in 2008 (Nakamoto, 2008) not only was the starting point for the dissemination of cryptocurrencies, but also maximised the recognition of blockchain technology (Demirhan, 2019). Since then, this technology has been consolidating itself mainly in the financial area, thanks to features such as immutability, security, anonymity and transparency.

Bitcoin's initial success triggered other similar innovation projects, so that today there is a large number of cryptocurrencies co-existing with Bitcoin. More recently, Facebook's announcement of its own currency drew the attention of global leaders (Babu and Abraham, 2021). The main concern is the possibility of transferring control of monetary policy from central banks to companies holding cryptocurrencies, which may cause insecurity and instability to the financial market and users.

The union of these forces – both the rise of the diverse and innovative possibilities of payment services, as well as the emergence of new models of cryptocurrencies – has led the monetary authorities of several countries to investigate the idea of introducing a new form of digital money, the central bank digital currencies (CBDCs). CBDCs should be the next milestone in the development of payments and represent the possibility of using official currencies, issued by central banks, but in digital form (Berndsen and Wandhöfer, 2020).

In Tronnier et al. (2020), there is evidence of the existence of studies dedicated to different aspects of CBDCs, such as the possible design choices associated with their implementation, the technological solutions available and, more broadly, economic and monetary implications and legal aspects of its adoption. The present work, however, sought to understand, particularly, how CBDCs could influence the work processes of tax administrations, part of the public administration focused on inspection and tax collection.

In this context, the use of blockchain technology by tax administrations is explored in some studies, which propose new systems for managing and collecting the value added tax (VAT) (Nguyen et al., 2019; Wijaya et al., 2017; Søgaard, 2021). However, such approaches presume the provision of traditional payment services by banks or the use of previously acquired tokens, as an off-chain process that occurs under conventional payment methods.

The association between the payment of transactions with digital currencies and the payment of taxes still needs to be further explored (Søgaard, 2021) and can bring efficiency gains to blockchain-based VAT system models. Therefore, this work aimed to study the relationship between CBDCs and the payment of taxes, considering that their implementation will soon be a reality around the world. To this end, a systematic literature review was carried out to investigate whether, within the vast literature related to CBDCs, there is already any survey on its impacts on the tax collection process, notably in the case of transactional ones, such as VAT, and how tax administrations can prepare for this future integration.

The remainder of this article is structured as follows. Section 2 details the methodology used to carry out the systematic literature review. Section 3 presents an overview of how a Blockchain works and its related fundamental concepts. Section 4 describes CBDCs in more depth and consolidates the main results found with regard to the impact of CBDCs in the fiscal area. Section 5 relates the results obtained to the research questions. Finally, conclusions and future work can be found in Section 6.

2 Methodology

The development of this work follows the guidelines of Kitchenham and Charters (2007), which define a protocol for conducting a systematic review of the literature widely used in the area of computing, to carry out a survey of the state of the art of a topic of search. In this way, it was possible to identify 28 works, which make up the basis of analysis for this article.

The research questions of this review are presented in Table 1.

Table 1 Research questions

	Research question description	*Research question goal*
RQ1	How are tax administrations preparing for a possible impact of CBDCs on their operations?	Understand the state of the art of using CBDCs by tax administrations.
RQ2	Are there any application proposals for a future scenario in which CBDCs are used as a means of paying taxes?	Investigate application proposals that take advantage of the payment of transactions in digital currencies for the payment of taxes.

The search string was derived from the research questions from the following steps:

1 identification of keywords

2 combination of terms to obtain candidate strings

3 running test searches using candidate strings in the following repositories: IEEE Xplore (http://ieeexplore.ieee.org), ACM digital library (http://portal.acm.org), ScienceDirect (http://www.sciencedirect.com), SpringerLink (http://link.springer.com) and Association for Information System (AIS) (https://aisel.aisnet.org/)

4 evaluation of candidate strings from the first results returned.

The strategy for choosing the repositories was to consider those most used in mapping and systematic reviews, as recommended by Kusumo et al. (2011). In addition, the AIS repository was included, due to its relevance in publications in the financial and business areas.

As a result, the following search string was defined:

("blockchain" OR "digital ledger") AND ("central bank digital currencies" OR "CBDC" OR "central bank digital currency") AND ("tax" OR "taxation" OR "Value added tax" OR "VAT")

Inclusion and exclusion criteria determine which articles will be included in the systematic review, and their application should increase the likelihood that the most appropriate studies will be selected. The following inclusion criteria were applied:

1 article deals with one of the research questions

2 the article presents some application, lesson learned or case study related to the research questions

3 primary or secondary studies will be accepted.

Exclusion criteria are listed below:

1 the article is not written in English or Portuguese

2 the work is clearly not related to the research questions.

In addition to inclusion and exclusion criteria, quality assessment is also considered a critical step in the selection of articles that will compose the systematic literature review (Kitchenham and Charters, 2007). The following criteria were applied during the selection process, and only works that adhered to these questions were kept:

1 Are the objectives clearly defined, including the motivations for the study?

2 Is there a clear description of the contextual environment of the research?

3 Are results and conclusions clearly explained?

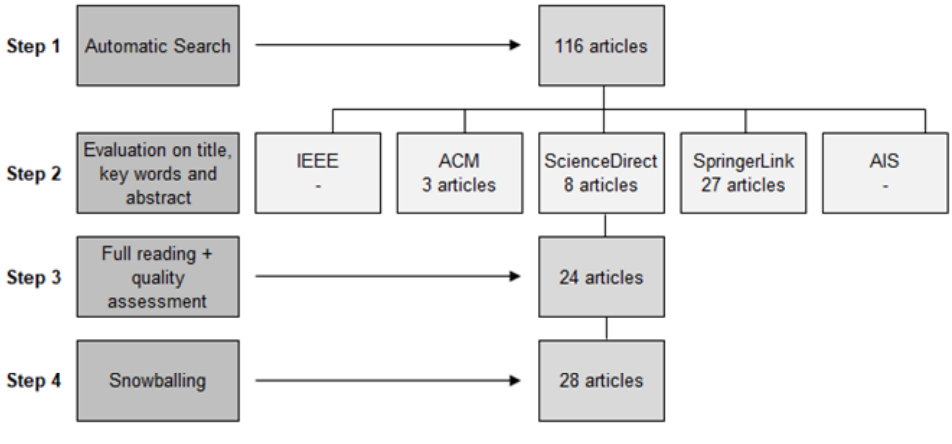
4 Are the results and conclusions obtained related to the research question?

5 Is the study plan adequate to answer the research questions?

The first stage of the search strategy consisted of the automatic search available in the repositories, using the defined search string. With this, a total of 116 articles were found. However, not all articles found are necessarily related to the research questions. Therefore, it was necessary to apply a filtering process, in which each of the completed steps reduces the initial set of works found. In this process, the articles are evaluated based on the title, keywords and abstract, applying the inclusion and exclusion criteria.

The application of inclusion and exclusion criteria proved to be particularly relevant, as many articles resulting from the stage of automatic searches by the search string dealt with topics that are beyond the scope of this study, such as taxation and regulation of cryptocurrencies and their transactions, or studies about CBDCs that approach the subject in a generic way – and not focused on tax administrations. These cited themes are extensively explored in the literature, but are not related to the objective of studying how digital currencies as a means of payment can impact existing processes of tax collection. Therefore, it was important to adopt, during the selection stage, criteria that discarded papers that were clearly not related to the research questions.

Figure 1 Search strategy and results



Approved articles were downloaded and included in *Mendeley* (https://www.mendeley.com/) application. Then, the articles were read in their entirety, and the quality assessment criteria were applied, following the protocol provided in *Parsifal* (https://parsif.al/) application. According to this procedure, each of the quality evaluation criteria questions can be answered in three ways: if the answer is *yes*, ten points are attributed to the work; if the answer is *partially*, only five points are added; if the answer is *no*, no points are added. As a standard selection criterion, only articles that add up to more than 30 points are considered approved. Finally, the last step consisted of the manual inclusion of missing articles, using the snowballing technique, which consists of adding new works to the study from a pre-elaborated list of references or articles cited in the references found.

Thus, in this work, a total of 28 selected articles were reached. Figure 1 summarises the selection process of articles to be analysed.

3 Blockchain

3.1 Overview

Blockchain consists of a network of computers – individually called nodes – responsible for maintaining and storing a shared and decentralised database of records (Formigoni Filho etal., 2017).

As already mentioned, blockchain goes beyond Bitcoin, so data stored on the network can represent a variety of other information, not necessarily money or currency. Communication within the network uses cryptography to provide security in identifying who sends or receives information and to allow only the correct recipient to have access to messages (Frankowski et al., 2017).

Transactions that occur on the network are transmitted to all nodes, which must confirm the content, that is, the validity of the information received, as well as the sequence in which they occurred. Once approved, these transactions are added to structures called blocks, which are confirmed sequentially on the network and form a chain; hence the name blockchain. This architecture eliminates the need for a centralising figure that acts as an intermediary, as it allows the parties to share information and execute transactions directly and securely (Frankowski et al., 2017).

3.2 Main concepts

- *Peer-to-peer*: the basic concept for understanding how blockchain technology works is the concept of P2P or *peer-to-peer* networks. It is an architecture of computer networks in which each of the points or nodes of the network works both as a client and as a server, so that everyone has an equal participation and there is no central administrator, which allows collaborative work between network nodes (Brodersen et al., 2019). It is important to highlight that, in private blockchains, there is a certain level of centralisation, since both access to the network and the role that the nodes play are managed by one or more administrator nodes.
- *Distributed ledger technology (DLT)*: refers to a digital system of record, where transactions and their details are recorded in multiple places at the same time. Unlike

traditional databases, distributed ledgers do not have central data storage or administration functionality (Frankowski et al., 2017). Blockchain is a type of DLT.

- *Consensus mechanism*: transactions are only added to the blockchain if all, or a pre-defined number of network participants, agree on the validity of the information. For this, there is the consensus mechanism, which consists of an authentication process to be followed by the nodes, based on rules that determine which blocks must be accepted and inserted in the chain (Formigoni Filho et al., 2017). The most famous consensus mechanism is *proof of work* (PoW), used by bitcoin.
- *Smart contracts*: from the point of view of applicability, blockchain technology has undergone a great evolution thanks to the possibility of using smart contracts, which are computer programs replicated and executed by all network nodes or by a predetermined set of nodes called validators (Formigoni Filho etr al., 2017). The general objective is to satisfy contractual conditions, minimising exceptions – malicious or accidental, as well as the need for intervention by reliable intermediaries (Szabo, 1996). For this purpose, smart contract clauses are expressed in business logic, directly related to the application domain used, which can then be codified in computer programs and automatically executed through computer systems.

4 CBDC

The trend of cash payments decline, the growth of the prices and of the attention paid to cryptocurrencies and the effort that global corporations are making to enter the digital currency market have raised the question of how central banks should react to the phenomenon of CBDCs, considering its institutional duty to manage and supply the official currency of a country (Tronnier, 2020). According to a recent survey conducted by the Bank for International Settlements (BIS) (Boar and Wehrli, 2021), 86% of central banks are actively engaged in some way in work related to CBDCs. The main objective is to leverage the advantages provided by digital technologies and, at the same time, ensure sovereign control over the issuance of the country's official currency (Cunha et al., 2021).

CBDCs are defined as digital currencies issued by central banks, excluding the reserve and settlement accounts of these banks from this concept (Tronnier, 2020). The BIS defined them as "a digital payment instrument, denominated in the national unit of account, which is a direct responsibility of the Central Bank" (Riksbank et al., 2020).

By definition, CBDCs must be fully regulated by the respective central banks and governments (Pandey and Katsikas, 2021) and each CBDC unit must act as a secure electronic equivalent of traditional paper money.

For central banks, CBDCs offer several potential advantages, including greater market power and greater control over monetary policy (Hampl and Havranek, 2019). There is also the possibility of implementing more effective public policies, thanks to better targeting of groups and individuals (Dapp, 2021). According to the International Monetary Fund (IMF), CBDCs would provide central banks with a "quick and direct means of providing fiscal assistance to vulnerable populations during an emergency, including people without bank accounts" (Digital Money across Borders: Macro-Financial Implications, n.d.).

In addition to the general characteristics mentioned, associated with the perspective of central banks, the analysed studies address aspects of the implementation of CBDCs that directly impact the operation of tax administrations, therefore related to the objective of this work.

Table 2 Classification of articles from the systematic literature review

	Opportunity as a means of digital payment	*Operational efficiency of public administration*	*Collection of taxes*	*Engagement of stakeholders*
Sidorenko and Lykov (2019)	x		x	
Thakor (2020)	x		x	
Howgego (2018)	x			
Søgaard (2021)			x	
Turi (2020)	x	x		x
Priv (Liu and Hou, 2019)	x			
Erdem and Altun (2019)	x		x	
Datta (2021)		x	x	x
Dapp (2021)	x	x	x	
Egelund-Müller et al. (2017)		x		
Lipton and Treccani (2021)	x	x	x	
Ben Dhaou and Rohman (2018)	x			
Dziwok (2021)	x	x		
Berndsen and Wandhöfer (2020)	x	x		
Liu and Hou (2019)	x	x	x	
Pandey and Katsikas (2021)	x	x	x	
Saripalli (2021)	x	x	x	x
Lessambo (2020)	x		x	
Chuen and Teo (2021)	x	x	x	x
Babu and Abraham (2021)	x		x	
Tok (2021)	x	x		
Saiedi et al. (2021)	x		x	
Tronnier (2020)	x	x	x	x
Bel Hadj Youssef and Boudriga (2021)	x			
Opare and Kim (2020)	x	x	x	
Hampl and Havranek (2019)	x		x	
Kaiding and Tobin (2014)	x	x	x	x
Oh and Zhang (2022)	x	x	x	

Thus, the articles analysed in this systematic review of the literature were classified according to four themes – opportunity as a means of digital payment, operational efficiency of public administration, collection of taxes and engagement of stakeholders – as per Table 2. These themes are defined and discussed in Table 2.

4.1 Opportunity as a means of digital payment

The main purpose of CBDCs is to provide a means of electronic payment guaranteed by the state (Turi, 2020). As such, its potential as the next milestone in the history of payment methods, making them faster and less expensive, is recognised in several works. Grey and Dharmapalan (2017) state that such currencies represent the future of innovation in payment systems, in the efficient implementation of monetary policy and in the improvement of its coordination with fiscal policy, as well as in the regulation of illicit activities. Still according to this work, CBDCs can leverage the strengths of the current banking infrastructure and, at the same time, face the existing limitations in this market.

The need for evolution of the traditional banking system in the area of international payments, including the adoption of CBDCs or hybrid models with private cryptocurrencies, is emphasised in Liu and Hou (2019), which highlights that international tourism follows the trend of being increasingly more and more cashless. In Auer and Böhme (2020), it is added that the growth of international electronic commerce is another factor that demands new payment alternatives.

There are also many works that recognise the importance of private cryptocurrencies as a complementary means of payment to those that currently exist. In Turi (2020), it is stated that cryptocurrencies, such as Bitcoin, have the potential to function as peer-to-peer payment systems, in which direct transactions between people or institutions can occur independently of a trusted centralising entity. However, there is still a long way to go before this possibility becomes a reality. First, because such currencies are not yet universally accepted and their unrestricted acceptability is limited to some e-commerce sites (Hazlett and Luther, 2020). Furthermore, Bitcoin price dynamics are characterised by hypervolatility and recurrent bubble formation[1] (Cunha et al., 2021).

In Thakor (2020), it is pointed out that cryptocurrencies will grow in popularity, but they will hardly be able to replace official currencies. According to this work, it is more likely that the evolution of CBDCs will be able to replace physical money, which, however, can happen even without them, given the increased efficiency of the solutions offered by other means of digital payment.

Faced with these possible scenarios, it is important to emphasise that CBDCs and cryptocurrencies are not mutually exclusive, on the contrary: they will certainly coexist, which requires that the necessary policies and safeguards are put in place (Babu and Abraham, 2021).

4.2 Operational efficiency of public administration

In Saripalli (2021), some inefficiencies related to the use of the traditional banking system by governments are analysed. In addition to the high cost and inconsistencies in reconciliation, there is a delay in crediting receivables to the government account. This delay refers to the time elapsed between the taxpayer's account being debited and the

government's account being credited, and is mainly due to the fact that the transaction must flow through several entities.

Most of these issues are a consequence of the presence of intermediaries, which demand the use of historical reconciliation techniques, and of the still limited applicability of just-in-time payments (Saripalli, 2021).

A good approach to solve these inefficiencies would be to build a blockchain layer over the existing infrastructure, instead of building it from scratch (Saripalli, 2021). Accounts could be created for all interested parties in the blockchain network, with the restriction that only the main participants could operate the so-called full-nodes[2]: government treasuries; tax authorities; auditing bodies and central bank.

Citizens, in turn, could access their accounts by connecting to the blockchain network through existing mobile apps or web portals. In the case of tax payment, as the taxpayer would not be part of the network operation, the beneficiary tax authorities could initiate the transaction, based on a request. The taxpayer would then follow the usual payment procedure, which varies depending on the type of tribute, via the Treasury portal or a mobile/web application interface for the blockchain. Subsequently, the tax node could propose the transaction to the blockchain network. After approving the blocks and updating the blockchain, the off-chain databases would also be updated, through specific integrations, in order to guarantee the synchronisation of information.

In this scenario, some examples of transactions permitted for citizens' accounts would be: paying taxes; digital subsidy transactions; withdraw money; transfer money to conventional bank accounts and add balances to the blockchain account linked to your unique ID.

Depending on the technological solution used, CBDCs still have the potential to foster an innovation environment that facilitates the development of new business models that cannot even be predicted today (Babu and Abraham, 2021). In this sense, once central banks are able to collect data on transactions using CBDCs, this data can be made available to tax authorities and the population itself, in the form of innovative services and products (Kaiding and Tobin, 2014).

4.3 Collection of taxes

In the works cited below, the authors mention the potential gain that CBDCs could offer to the current tax collection and collection management system.

In Babu and Abraham (2021), it is pointed out that one of the advantages of CBDCs is to enable better control of the circulation of money by the central bank. According to the work, this control would make it easier for tax authorities to calculate and collect taxes.

Dapp (2021) makes an important counterpoint, highlighting that it is necessary to understand the implications of CBDCs related to privacy, since, depending on the project, it will be possible to track all transactions of all citizens and companies in real-time. Considering one of the possible CBDC implementation scenarios, making anonymous cash payments may become impossible even for fully legal transactions, threatening privacy rights. On the other hand, in such a scenario, governments could use transaction data to customise tax policies (e.g., automatic taxation) and tax benefits (e.g., automatic basic income).

In HM Treasury (2015), it is highlighted that the issuance of a CBDC and its wide acceptance, which would lead to a gradual withdrawal of paper money, would be useful

in deterring tax evasion, money laundering and other illegal transactions. This benefit would be more relevant for developing countries than for developed ones, as the economies of developing countries are largely based on cash, which results in a higher level of tax evasion, laundering of money and other illegal activities.

Based on these and other analysed articles, it appears that, although many possibilities related to the advantages of integrating CBDCs with tax payment processes are highlighted, there is no further discussion on how this can be done.

It would be interesting, for example, to present a proposal for the architecture of this potential integration or a survey of characteristics and requirements that CBDC implementation projects around the world, which are just in the design phase, could consider so that CBDCs can be used for that end.

The only work that outlines a possible architecture, albeit at a very abstract level is Pandey and Katsikas (2021). It indicates the presence of a module called External Systems, which represents the connection and communication of CBDC issuing systems with those of the financial ecosystem. The work points out that several payment applications that provide services to e-commerce companies need to be connected to the CBDC system to enable the use of this payment method. Furthermore, companies wishing to use CBDC for various payments, such as employee salaries, would need to have a connection to the CBDC system. Likewise, if an ordinary user wants to use CBDCs to pay their bills, including government bodies and private organisations, they would also need to have a connection to the CBDC system.

Unlike the trend followed by the aforementioned works, Søgaard (2021) describes a series of desirable design features in a blockchain-based VAT settlement platform and proposes a prototype of such an artefact. One of the main features listed is the *split payment*. This mechanism allows a smart contract to calculate the amount of the tax due and enables its automatic settlement in each transaction – and no longer every month, quarter or year, as in the existing reference model (Søgaard, 2021). Thus, whenever a buyer and a seller agree to carry out a certain transaction, the smart contract divides the payment made by the buyer between the seller and the tax authorities. In this way, the administrative burden arising from the periodic declaration of VAT is eliminated, and, at the same time, a better flow of revenues for the public coffers is guaranteed. Once the invoice is validated by the tax authority, the payment of the amount due to each party is made, according to the results of the execution of the smart contract.

However, the payment layer was not implemented in that work, since, according to the author, the purpose of the prototype was to demonstrate that administrative and bureaucratic burdens can be reduced, consequently eliminating the cost of compliance, instead of demonstrating which payment channel is ideal (Søgaard, 2021).

Although not implemented, two solutions were proposed for the payment layer. In the first, more traditional, payment takes place through connection with banks, making use of standardised integration services. In this model, banks have the role of providing payment services and are categorised as *oracles*[3], which means that they are not participating nodes in the network, but provide services on which nodes can rely (Søgaard, 2021).

The second solution would be the implementation of an on-chain cryptocurrency payment mechanism, through the integration of cryptocurrency platforms. At this point, the author considers that the maturity of CBDC initiatives is still insufficient to develop models that may be suitable for this special group of digital currencies.

4.4 Engagement of stakeholders

In Tronnier (2020), it is considered that the articles published on CBDC mainly address general introductory aspects, or discuss the possible monetary and economic effects that this concept would have on the banking industry and on the economy as a whole. On the other hand, discussions on the possible social and legal impacts, or surveys of stakeholders that could be impacted still constitute a gap in the literature (Tronnier et al., 2020).

Opare and Kim (2020) argue that the collaboration of central banks with all stakeholders is important. Although central banks are already developing dialogues with technology service providers, financial institutions and other central banks, it is equally important that end users, and even the general population, are also involved, for the success and adoption of a CBDC.

However, much of the research in this area is conducted by central banks themselves and naturally focuses on the perspective of these institutions. Scientific articles and published reports direct their discussions to the underlying technical concept and available design options, highlighting the advantages and disadvantages of applying each one in the context of CBDCs (Tronnier et al., 2020).

One of the exceptions to this trend is the study by Leinonen (2019), which focuses on the requirements for a CBDC from an end-user perspective. The work (Auer and Böhme, 2020) takes a similar approach, making a parallel between customer needs and the design choices that must be made in a CDBC project.

The survey carried out by this literature review shows that it is also necessary to broaden the spectrum of research to the point of view of governments, particularly tax administrations, who are directly affected by any changes introduced in the payments sector.

5 Results

This systematic literature review aimed to verify how academia has been addressing the impact of CBDCs on tax administrations. Particularly, we wanted to identify whether the payment of taxes using CBDC is being considered, given that the concept of CBDC is in full debate by several central banks and academics. The results obtained show that this theme still needs further studies, since it is only mentioned, always in a very superficial way and subsidiary to the main discussion. Below, the research questions of this work are resumed and answered.

How are tax administrations preparing for a possible impact of CBDCs on their operations (RQ1)? Tax administrations are not being involved in CBDC projects, which are for the most part led by central banks. Within the scope of these projects, the main interlocution has been with technology companies, in order to obtain technological collaborations on the projects. It is also noted that publications on CBDCs predominantly discuss economic, monetary or implementation aspects. Thus, there is a lack of studies that debate the implications of the use of these currencies in governments, in a broad way. Particularly, the same deficit can be seen with regard to tax administrations, which would be the governmental area most affected by this new form of currency – since this is the area responsible for revenue collection and administration of government finances.

Are there any application proposals for a future scenario in which CBDCs are used as a means of paying taxes (RQ2)? From the works studied, it is noted that there is an idea that the payment of transactions with CBDCs will help tax authorities with regard to tax management. However, despite this finding, there are no proposals to apply the use of CBDCs as a means of paying taxes. As already mentioned in Section 4.3, there are papers that propose VAT management models and suggest the use of cryptocurrencies or CBDCs to pay taxes. However, such works consider that CBDC projects are not mature enough to be incorporated into the proposed models.

6 Conclusions

Payment systems have gone through a number of significant changes over time: from grains to banknotes, coins, cards and checks, all the way to cryptocurrencies. Currently, electronic and mobile payment systems challenge traditional cash payments (Doidge and Bright, 2017). With the decline in cash payments in many parts of the world, economies have shifted towards electronic, online and mobile payment systems.

CBDCs can be seen as a response from central banks to private cryptocurrencies and the need to provide a digital alternative to cash. Thus, this new possibility of representing money has been discussed worldwide both in academia and in central banks, through the publication of articles or tests of pilot projects and proofs of concept (Tronnier, 2020).

For banks and other actors in the financial sector, the widespread use of CBDCs as a means of payment will foster a new generation of financial services offerings, integration possibilities and even new business models.

On the government side, this new form of currency representation will have an impact on the control of taxes, mainly on transactional ones, which are directly affected by the retail trade of goods and services. Therefore, it is important that tax administrations are attentive and prepared not only to deal passively with the new amount of data that will be generated, but, above all, to also be able to offer means for the payment of taxes to be remodelled and adapted to the new possibilities brought about by technology. This is critical to assure a comfortable service for taxpayers and to improve the flow of revenue for carrying out activities under the responsibility of the State.

It was noted that this approach, i.e., the association of CBDCs to the payment of taxes, is quite incipient in the literature. Most of the works identified in this literature review only mention that the use of CBDCs can contribute to the fight against tax evasion, as well as to the automation of the payment of taxes, without going into operational details, nor going deeper into the advantages, risks and challenges of implementation. On the other hand, the present review had the positive aspect of contextualising the scenario of evolution of means of payment, with emphasis on cryptocurrencies and CBDCs. Additionally, the aspects related to taxation that were found, although very restricted, were consolidated and discussed, which will be an important starting point for future works that aim to develop a more in-depth conceptual framework on the impact of CDBCs for the tax area.

Therefore, the adoption of a CBDC as a national digital currency will imply the need to adapt tax administration systems to receive this means of payment or in the development of computational structures and information systems for the use of CBDC in the tax environment. Faced with this reality and given the realisation that proposals for the use of CBDC by tax administrations are still quite superficial in the literature, we

intend, as future work, to develop conceptual proposals that demonstrate how the integration of operational models of taxes with the issuance platforms of CBDCs could address some of the current challenges faced by tax administrations. In this way, the way is also opened for other research projects to be able to focus on the next stages of development, such as proofs of concept and prototypes.

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Notes

1 A speculative financial bubble occurs when there is rapid growth in the market value of an asset or group of securities.

2 Nodes that store the distributed ledger and participate in the consensus mechanism.

3 Oracles allow communication between the blockchain network and the entire external environment that is not part of it.