



A Bank of Israel Digital Shekel

Potential Benefits, Draft Model, and Issues to Examine

The Bank of Israel Steering Committee on the Potential Issuance of a Digital Shekel

May 2021



Table of Contents

Executive Summary	3
Introduction.....	7
1. What is a central bank digital currency?.....	10
2. Recent developments regarding central bank digital currencies.....	14
2.1 Introduction	14
2.2 Joint publication by seven leading central banks and the BIS	15
2.3 Main developments around the world	17
3. Potential benefits and motivations for issuing a Bank of Israel digital currency	22
3.1 Introduction	22
3.2 Main motivations.....	23
3.3 Additional possible reasons for issuing a CBDC	29
4. Draft model of a Bank of Israel digital currency, and issues to be examined	32
4.1 Draft model of a digital shekel—a Bank of Israel digital currency	32
a. Structure of the system.....	32
b. Technology and payment interface.....	33
c. Privacy	34
d. Economic characteristics	34
4.2 Main issues being examined by the Steering Committee	35
a. Economic issues.....	35
b. The payment system	35
c. Technological issues	36
5. Conclusion	37
References:.....	38

This document was written by the Bank of Israel Steering Committee on the Potential Issuance of a Digital Shekel, led by Bank of Israel Deputy Governor Andrew Abir. The Committee’s members are Director of the Information Technology Department Lior Georgi; Director of the Payment and Settlement Systems Department Oded Salomi; and the Head of the Monetary Policy Division in the Research Department, Dr. Sigal Ribon. The Committee Coordinator and Project Manager is Yoav Soffer, Advisor to the Deputy Governor.

Executive Summary

In November 2017, the Bank of Israel Governor appointed an interdepartmental team to study digital currencies issued by central banks. In November 2018, the team published a report that provided an in-depth review of the topic, and did not at the time recommend that the Bank of Israel issue a digital currency, but did recommend that it continue to study the issue and monitor global developments. Indeed, in recent years, there have been significant and very rapid changes in the payments market in Israel and abroad, and the COVID-19 crisis accelerated these processes. While no central bank in an advanced economy has yet announced a decision to initiate a project that would lead to the central bank issuing a digital currency, there has recently been an apparent change in global sentiment on the matter. Central banks, including those of the major economies, have significantly increased theoretical research and practical examination of the possibility of issuing a central bank digital currency (CBDC) as a means of payment that would serve the general public alongside the existing means of payment.

In view of these developments, the Bank of Israel has decided to accelerate its learning, research, and preparation leading to the potential issuance of a Bank of Israel digital currency in the future. **It is important to emphasize: Similar to many other central banks, the Bank of Israel has not yet decided whether it intends to issue a digital currency.** The Bank of Israel is preparing **an action plan**, so that if conditions develop in the future that would lead to a Bank of Israel assessment that the benefits of issuing a digital shekel outweigh the costs and potential risks, the Bank of Israel will be prepared to put such a plan into action. For this purpose, and as part of the Bank of Israel's strategic plan, the Bank of Israel Governor established a Steering Committee on the Potential Issuance of a Digital Shekel, led by the Bank of Israel's Deputy Governor. The Steering Committee established a number of working groups from among professionals in various fields within the Bank, through which it is mapping the potential advantages, various issues, and risks involved in a potential issuance of a digital shekel.

Section 1 of this document provides a broad explanation of the meaning of the term "central bank digital currency". It is important to emphasize that while central banks may use distributed ledger technologies (DLT) such as blockchain when designing and establishing CBDC systems, there are essential differences between a CBDC and cryptocurrencies such as bitcoin. First and foremost, while cryptocurrencies do not belong to any specific country and some are characterized by having no central authority to manage them, a CBDC will be issued by the country's central bank, and it is the central bank that would determine its quantity, its manner of use, and the regulation that will apply to it. While many cryptocurrencies feature user anonymity, which has made some of them preferred means for money laundering and other illegal activity, it is clear that a CBDC will be supervised, and will be designed in concert with money laundering and terrorism financing prohibition (AML-CFT) rules. Another important point is that the value of many cryptocurrencies is characterized by very high volatility, which makes them inappropriate for performing one of the basic functions of

money—serving as a means of payment. In view of this, recent years have seen the development of “stablecoins”, which are designed so that their value is indexed to the value of another asset or currency. However, these too are issued by private entities, and the ability to ensure the value of a stablecoin depends on the assets backing it as well as other factors. A digital shekel, if the Bank of Israel issues one, would also have a 1:1 conversion rate with a cash shekel or with a shekel in a bank account, and similar to cash, it would provide the stability and economic certainty that come with money issued by the central bank.

The payment system in Israel is stable and reliable. The public has no doubt in its ability to make payment transactions or that the transactions will be made properly and on time. In discussing a potential project of issuing a CBDC, we must ask ourselves first and foremost—why. What benefits would the Israeli economy derive from the existence of a digital shekel, and what needs would it answer? Is it important that the Israeli public would be able to hold a digital means of payment that would constitute a liability of the central bank, in addition to the central bank’s physical liability held by the public—cash?

The Bank of Israel’s Steering Committee has mapped the advantages that a Bank of Israel digital currency may generate for the Israeli economy if it is issued in the future. The main motivations that may lead to a decision to issue a Bank of Israel digital currency are:

- a. **Creating another efficient, advanced, and secure alternative to the existing and new means of payment in the digital age.** A means of payment that is convenient, available, secure, and inexpensive, provided digitally by the central bank, will ensure that the payment system will continue to increase its efficiency invest in innovation, reduce the costs imposed on households and merchants as a result of making payment transactions, and support the entry of new participants and new value offers to the payment system. In addition, a CBDC that is based on innovative technology and provides a proper response to the public’s payment needs in the coming decades will reduce the risk to financial stability and monetary sovereignty that may come to pass if the public broadly adopts means of payment that are based on private currencies (such as stablecoins, for instance), or digital currencies issued by other central banks.
- b. **Creating an innovative technology that will ensure the adaptation of the payment system to the needs of the future digital economy.** The existing payment systems are based on legacy systems, which makes it difficult to develop advanced functionality in the world of payments. A CBDC may provide infrastructure for “programmable money”—money that is programmed so that payment with it is made only if and where certain conditions exist. The appropriate infrastructure, which will be created by the central bank, will be able to serve as the basis for the development of various applications such as “Delivery Versus Payment” (DVP), smart payments on the “Internet of Things” (IoT), micropayments, and more. These and other applications, which will be developed by the private sector on the infrastructure established by the central bank, will be able to contribute to the development of the digital economy and to overall economic efficiency.

- c. **Ensuring adequate redundancy of the payment system and its proper functioning during emergencies or breakdowns.** The payment system is a critical infrastructure for the economy, and its proper and continuous functioning is a necessary condition for economic activity and prosperity. A CBDC that will be built as a separate infrastructure that is independent—or has limited dependence on—the existing payment systems, will support the redundancy of the payment system and the public’s ability to continue making payments, even if one of the existing payment systems suffers a breakdown.
- d. **Creating an efficient and inexpensive infrastructure for cross-border payments.** Payments transferred from one economy to another, particularly if they involve currency conversions, are inefficient, slow, and expensive. As a small open economy, the Israeli economy can derive considerable benefit from a reduction in the cost of cross-border payments, an increase in their efficiency and immediacy, and a decrease in the uncertainty and risk associated with them. International agencies have presented a roadmap for improving cross-border payment infrastructures, as part of which the ability of CBDCs to streamline and lower these payments will be examined. A Bank of Israel digital currency that will be developed in accordance with the standards to be developed internationally will help streamline and lower the costs of foreign currency and international payments for Israeli residents.
- e. **Maintaining the public’s ability to use digital means of payment while ensuring a certain level of privacy.** In accordance with the characteristics that will be set for it, a CBDC can maintain some of the characteristics of cash in the context of protecting privacy and the right to prevent commercial use of information regarding the payer or the receiver, provided that AML-CFT and required tax reporting rules are fulfilled.
- f. **Support of government policy to reduce the use of cash in the struggle against the “shadow economy”.** In 2018, the Knesset passed the Reducing the Use of Cash Law, in order to reduce the amount of black capital in Israel and to help in the struggle against criminal activity, money laundering, and terrorism financing. In parallel, the Bank of Israel worked to advance, implement, and provide access to means of payment that would serve as alternatives to cash and checks. However, the existing alternatives are mainly based on the existence of a bank account and/or payment card, and some require basic digital literacy, as well as access to the Internet. A digital shekel that would exist alongside the existing means of payment but would be available to all—including those who have no bank account, Internet access, or smartphone—and the cost of which would be low to negligible, would make it easier for the public to reduce its use of cash in line with the government’s policy. In addition, it will make it easier for those wishing to pay through digital means even in small amounts, and will increase the Israeli economy’s transition toward the use of digital means of payment.

It is important to note that some if not all of these benefits may be obtainable through the improvement and upgrading of the existing payment systems, and not necessarily through the issuance of a Bank of Israel digital currency. In addition, the issuance of a CBDC may involve risks. A large part of the Steering Committee’s work is focused on research on these topics and on an examination of the added value that a Bank of Israel digital currency could generate for the Israeli economy over the existing and future payment systems.

In order to examine the various implications of a potential issuance of a Bank of Israel digital shekel, and in order to analyze the business and technological challenges and opportunities, the Steering Committee set out, in general terms only, a draft model for a Bank of Israel digital currency. The draft model forms the basis for a discussion and examination of alternatives by the working teams dealing with the matter at the Bank of Israel. Following the publication of this document, we intend that the draft model will also serve as the basis for a discussion in the professional and academic communities in Israel regarding the necessary characteristics of a digital shekel.

The structure of the draft model assumes a partnership between the public sector (the Bank of Israel) and the private sector (banks, credit card companies, and technology and/or finance companies from Israel and abroad)—a “two-tier” approach. In terms of the technology to be adopted, the model does not at this stage determine whether the system will be based on DLT technologies or on central registry technology, but it does set out that the Bank of Israel will provide the basic infrastructure to enable the private sector to develop innovative applications on it. Full and immediate conversion will be enabled between a digital shekel and existing means of payment, and the system will support conversions to and from foreign currency. Payment will be enabled not only through cellphones, but also through a variety of means, including simple devices, and offline payments will also be enabled, at least in a limited form.

In terms of privacy, the digital shekel will be designed in keeping with anti-money-laundering (AML) rules, and in a way that will not interfere with the government’s efforts to collect taxes. As such, absolute privacy will not be possible. However, various levels of privacy vis-à-vis payment providers and commercial entities will be possible.

In terms of the economic characteristics, according to the draft model, the digital shekel will carry a zero interest rate, but it will remain technologically possible to change this in the future. The infrastructure should allow for the authorities to be able to define restrictions on the volume of holding and use of the digital shekel. The cost of making a payment should be very low or near zero, and its use will also be made possible for those that do not have a bank account in Israel (children, tourists, and so forth).

The objective of this publication is to update the professional community—the payments, finance, and technology sectors, academia, relevant government agencies, and various organizations—regarding progress in the Bank of Israel’s examination of CBDC. In order for the action plan that the Bank of Israel is preparing to be as informed and comprehensive as possible, it will be important for the Bank of Israel to track the thinking that will develop among various entities in the Israeli economy, even if it is decided in the end not to put the plan into action. The Bank of Israel calls on these entities to provide it with written comments on the contents of this document and on the relevant aspects of a possible future issuance of digital currency by the Bank of Israel. Guidelines regarding how to send these comments can be found on the Bank of Israel’s website at: <https://bit.ly/3tAqwBN>

Introduction

One of the main functions of central banks around the world has always been to provide households, businesses, and the economy as a whole with secure, reliable, and easy-to-use means of payment—banknotes and coins that comprise cash. The same is true in Israel. When the Bank of Israel was established in 1954, one of its functions set out in the law was “to administer, regulate and direct the currency system...” (Section 3), that “the Bank may issue and re-issue currency” (Section 27), and that “no person other than the Bank shall issue or distribute currency notes, banknotes, coins, or any other thing... that may serve as an alternative currency” (Section 28). This obligation of the Bank of Israel was revalidated in the new Bank of Israel law (2010), which set out that one of the Bank’s functions is “issuing Currency and regulating and guiding the cash system of the economy” (Section 4(6)), and that “currency issued by the Bank shall be legal tender in Israel” (Section 41b). Over the years, the Bank has invested great efforts in technological improvements in the issuance of banknotes, in ensuring their security, and in an efficient and secure distribution system that enables every citizen to obtain banknotes and coins—money issued by the central bank—and to use them to make payments at any time without concern.

The world is in the midst of a digital revolution that is not excluding the financial system. The time has now come to ask whether in the near or distant future, the Bank of Israel will have to provide the public with another form of fiat currency—digital money, and whether it will be possible to maintain—or even improve—the important qualities of existing money in the digital money. These questions are occupying governments, central banks, financial entities, technology companies, and academics from various fields the world over.

It is important to note that digital money is not a new concept, and that it existed for decades before distributed cryptocurrencies exploded into the public consciousness. The money the public holds in the banking system, and which it pays through bank transfers, payment cards, payment applications, and more, is digital money. Its existence is reflected in the computer systems of the financial institutions that provide it, and it does not exist in the physical dimension. The trust that the public places in the banking system and the close supervision that the Bank of Israel imposes on it enable this arrangement—digital money of the banking system—to exist in a proper and efficient manner. Central bank digital money is also not a new concept. The commercial banks hold accounts at the Bank of Israel, and they charge and credit each other through these accounts on an on-going basis. The innovation discussed in this document is a central bank **retail** digital currency (retail CBDC or general purpose CBDC)—giving the general public access to use the central bank’s digital money in addition to physical cash.

The Bank of Israel has been exploring this topic for some time. In 2017, the Bank established an interdepartmental team to study central bank-issued digital currencies. The team published a comprehensive report in 2018, as part of which it surveyed the theoretical significance of

issuing a digital currency by the central bank, the potential characteristics of such a currency, and its potential effects on the payment system, monetary policy, the banking system, and the financial system in general, as well as households and businesses. The team also examined legal aspects and provided a short summary of the technological alternatives that were relevant at the time. The team did not recommend issuing a Bank of Israel digital currency at the time, and since the publication of that report, it has been monitoring global developments so that the Bank of Israel can gain a deeper understanding of the issue.

In recent years, there have been significant and very rapid changes in the payments market in Israel and abroad, and the COVID-19 crisis has accelerated these processes. The world of payments no longer belongs to just the traditional financial institutions. The fintech industry is booming, in Israel and abroad, and startup companies are developing new ideas regarding how payments will be made in the future. Even global tech giants are showing increasing interest in the field. Almost all of them are offering various payment solutions, and some are even daring to offer digital currencies that will replace, or at the very least compete with, the money that the central banks and the commercial financial system have been providing for many years. Even retail companies, transportation service providers, and other entities are offering their customers digital wallets and various innovations in the area of payments.

Central bank digital currencies became a global topic for discussion around 2015, and according to some even before that. While the theoretical research has grown deeper and practical experiments have been carried out in many countries, a relatively small number of central banks have led the discussion, until recently. The central banks of the major advanced economies—the US, the EU, and Japan—did not explicitly announce their intentions to conduct in-depth studies, much less a decision to issue retail digital currencies. In the past year, there has been an apparent significant change in the trend. While no central bank of an advanced economy¹ has yet announced a decision to initiate a project that would lead to the issuance of a retail digital currency, a number of important central banks have published reports showing tremendous advancement in their work on the matter. In particular, the Bank of International Settlement (BIS) published a joint report with seven leading central banks in October 2020.² These seven banks are actively examining the potential of issuing CBDCs as a means of payment to serve the general public, and the document details the joint principles upon which they have agreed, and their intention to continue cooperation in researching the matter.

In view of the developments in the digital economy and in the world of payments, and in view of the apparent change in trend of the sentiment of major central banks, the Bank of Israel has decided to accelerate its learning, research, and preparations toward the potential future issuance of a Bank of Israel digital currency. **It is important to emphasize: The Bank of**

¹ The central bank of the Bahamas began issuing digital currency for the general public's use, called the Sand Dollar, in October 2020. The central banking community is monitoring this development with great interest, but the country has only 300,000 residents, with characteristics that differ from those of the advanced economies.

² The Federal Reserve, the Bank of England, the ECB, and the central banks of Japan, Switzerland, Canada, and Sweden (BIS, 2020a).

Israel has not decided that it intends to issue a digital currency, and in any case, it has not decided on the terms or timing for such an occurrence. To be clear, the Bank will continue issuing cash in the form of banknotes and coins, as long as there is a demand for such on the part of the public, and as long as the Bank believes that it is necessary in order to support the redundancy and efficiency of the payment system in Israel. The Bank of Israel is preparing an **action plan** so that if future conditions lead to an assessment by the Bank that the benefits of issuing a digital shekel outweigh the potential costs and risks, the Bank of Israel will be ready to put such a plan into action. A Bank of Israel digital currency, if one is issued, will have to win public trust to the same extent that cash has, so the system will have to be designed and built to meet the highest business and technological standards. The preparations for issuing a CBDC are expected to take some time. In contrast, as stated, the world of payments and digitization is developing rapidly. Therefore, the Bank of Israel is already beginning its preparations.

For this purpose, and in accordance with the Bank of Israel's strategic plan, in November 2020 the Bank of Israel Governor established a Steering Committee for the Potential Issuance of a Digital Shekel, led by the Deputy Governor of the Bank of Israel. The Committee was tasked with determining the business and technological characteristics of a digital shekel as preparation for potential issuance in the future, and with examining the benchmark conditions necessary for a decision to issue such a currency. The Steering Committee established a number of working groups from among professionals in different areas within the Bank, through which it will map the potential benefits of issuing a digital shekel, the technological issues, and the potential implications for monetary policy, financial stability, the world of payments and currency, the struggle against the shadow economy, and issues of money laundering, financial inclusion, privacy protection and information security, and more.

In the rest of this document, Section 1 provides a short explanation of the term "central bank digital currency" based on currently existing knowledge. Section 2 reviews the recent global developments in the field of CBDCs. Section 3 maps the potential benefits to the Israeli economy from the issuance of a digital shekel. Section 4 presents a basic draft model of a Bank of Israel digital currency, and maps the various issues that the Steering Committee is examining based on this model. Section 5 concludes.

1

What is a central bank digital currency?

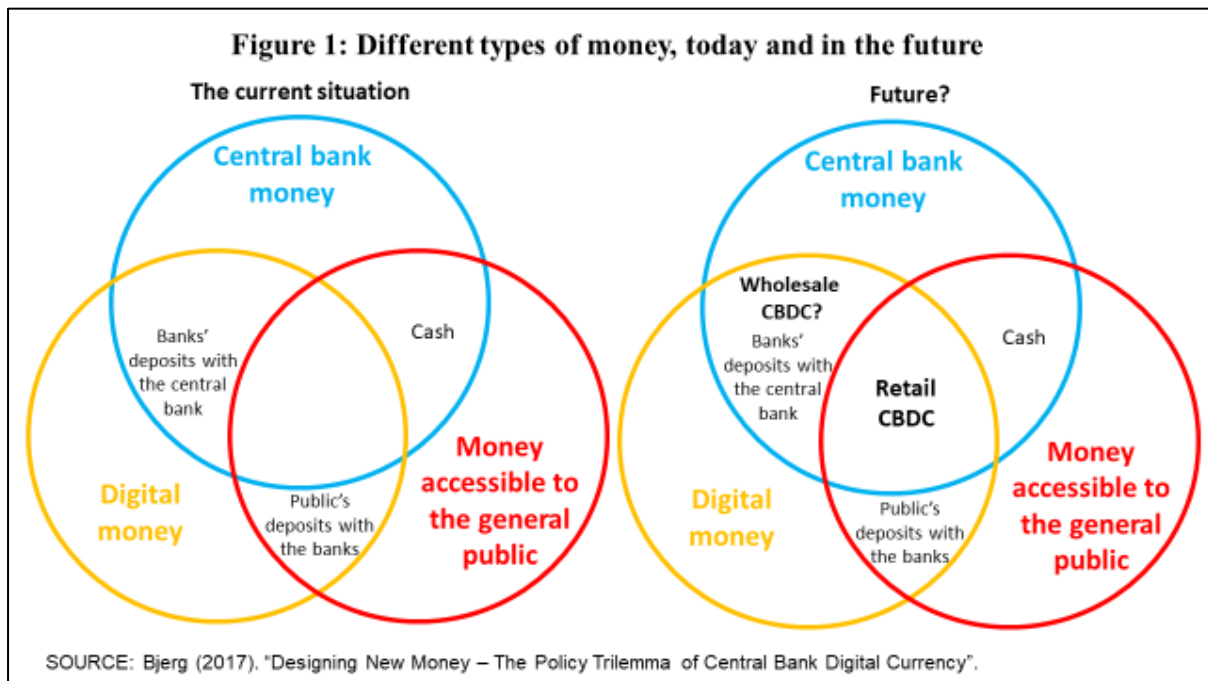
A central bank digital currency (CBDC) is a digital means of payment that constitutes a liability of the central bank liability toward the holder of the currency. There are various CBDC models, differentiated by several dimensions. One common distinction is between a wholesale CBDC and a retail or general purpose CBDC. A wholesale CBDC is basically a product that has existed for decades: commercial banks hold accounts at the central banks and charge and credit each other against the transfers of their customers' money. In recent years, with the development of distributed ledger technologies (DLT), various central banks around the world have begun examining the potential that these technologies may hold for advancing and streamlining the existing settlement systems between the banks and the central bank, as well as among the banks themselves. For instance, a DLT system that enables the banks to transfer money directly from one to the other, in real time and without needing to involve a third party (the central bank) may have advantages over existing RTGS systems (such as the Bank of Israel's ZAHAV system) in which the accounting between banks is not concurrent, and in which the participating banks therefore must hold liquid collateral to ensure their ability to make their customers' transfers. Projects that examined these technologies are called wholesale CBDC.³ At this stage, the Bank of Israel is not examining the possibility of establishing a wholesale CBDC system.

This report deals with a retail CBDC, which is also referred to as a general purpose CBDC: a digital means of payment issued by the central bank, which serves not only the financial institutions, but primarily the general public—households and businesses. As of now, the public uses two main types of money: cash, which is a physical liability of the central bank toward the public, and bank money, which is a liability of the commercial banks toward account holders. The latter is not physical in nature, but exists in the digital realm only. When a member of the public wants to make payment using bank money, he or she makes a transfer in some way from his or her current account to the current account of the party he or she wishes to pay—via a bank transfer, a payment card, a check, or some other way. The liability inherent in bank money is very reliable. The fact that the public has full faith in the liabilities of Israeli banks toward account holders is a result of the stability of the Israeli banking system and the Bank of Israel's close supervision of it. However, as the liability of a financial institution, bank money is not risk-free.

Cash is the liability of the sovereign—through the central bank—and it is the trust the public places in the central bank that makes the cash that the central bank provides risk-free from the public's standpoint. However, as of now, the public has no way of using the central bank's money digitally. In order to pay in cash, there must be a physical meeting between the payer and the receiver. In addition, holding cash is on its own an action that carries some risk: The

³ For more information, please read about projects such as the Bank of Canada's Jasper project: <https://www.bankofcanada.ca/research/digital-currencies-and-fintech/projects/#project-jasper> and the Stella Project by the Bank of Japan and the ECB: https://www.boj.or.jp/en/announcements/release_2020/rel200212a.htm

cash may get lost or be stolen, and cash payment of high amounts is complex and expensive. As such, cash is more secure from a financial standpoint, enables direct payment with no intermediary, and maintains privacy, but it has operational disadvantages compared with digital money, which can be paid remotely, in amounts of any size, and is easy to maintain (although it may be subject to digital fraud). A retail CBDC can enable the public to enjoy the security of money issued by the central bank, together with the convenience and advancement inherent in digital money (Figure 1).



The literature on CBDCs has differentiated between two forms of issuance of the digital currency⁴: “account based” (sometimes referred to as “balance based”), and “token based” (sometimes referred to as “value based”). However, in the up-to-date practical models, this distinction is somewhat blurred. Since the central banks are not considering the issuance of a digital currency that would enable full anonymity, access to the digital currency will require registration and identification even in the token-based approach, so that the digital wallet in which the currency is kept will basically have the characteristics of an account. The central bank of Sweden found that certain technical characteristics of blockchain in a token-based model may give it legal characteristics that are closer to those of an account-based model (Sveriges Riksbank, 2021).

Another distinction deals with how the public obtains access and uses the digital currency. In one model, the digital currency is supplied to the public directly through the central bank. Anyone permitted to make use of the digital currency will hold an account with the central bank (under the account-based approach), or the central bank will provide the electronic wallet in which the individual will hold the digital currency (under the token-based approach). The more common model is that the central bank should not be the party to provide the service

⁴ In this regard, see Bank of Israel (2018), pp. 15–16.

directly.⁵ Central banks do not typically provide service directly to the general public or conduct a “Know Your Customer” (KYC) process that is required in order to ensure that money laundering prohibition rules are adhered to. Furthermore, in order for a digital currency to facilitate technological and financial innovation, the private sector must be involved in the digital currency system. Payment service providers—which could be banks, other financial institutions (for example credit card companies), fintech firms, or big tech firms—would be the ones holding accounts at the central bank, and would in turn open accounts for the general public (account-based approach) or provide the electronic wallets through which the public would use the digital currency (token-based approach). This approach will also help maintain interoperability between the digital currency system and the other payment systems—for instance to enable the public to easily convert bank money into digital money, and so forth.

It is important to emphasize that while the central banks may use DLT such as blockchain in the design and establishment of CBDC systems, there are material differences between CBDCs and cryptocurrencies that have been developed in recent years, the most well-known example of which is bitcoin. First and foremost, while cryptocurrencies are for the most part distributed currencies (they do not belong to any particular country and there is generally no central authority managing them), a central bank digital currency is exactly what its name implies—it is issued by the country’s central bank, and it is the central bank that determines its quantity, how it is to be used, and the regulation that will apply to it. Many cryptocurrencies feature user anonymity, which has made some of them preferred means for money laundering and other illegal activity, sometimes across borders. The issue of how much privacy the CBDCs will afford is complex, and is being discussed in depth among the central banks that are working on the issue. While technologically, we can think of digital currency as a means of anonymous payment, a central bank currency will obviously be supervised and designed in a way that will ensure that it adheres to the money laundering and terrorism financing prohibition rules and will not serve as a tool for tax evasion. However, it may be possible to set a certain holdings benchmark or transaction level below which the currency would be usable while maintaining privacy.

Another major difference between cryptocurrencies and CBDCs is that the value of many cryptocurrencies is generally very volatile.⁶ There have even recently been cases of a single tweet or social media post by some person led to a change of dozens of percent in the value of such currencies. This characteristic makes them inappropriate for fulfilling one of the basic functions of money—to serve as a means of payment. The most elementary function of central banks is to maintain the value of the money they issue. (In the Bank of Israel Law, this is reflected in the first function of the Bank, which is “to maintain price stability”—meaning to make sure that the purchasing power of the money held by the public is maintained in a stable manner.) A digital shekel, if the Bank of Israel issues one, will always be convertible on par with a cash shekel or a shekel in a bank account. Similar to cash, it will provide the economic

⁵ This approach is referred to in the literature as a “two-tier” or “hybrid” model.

⁶ As a result, another type of cryptocurrency has developed in recent years – “stablecoins”. Their value is indexed to regular money. The potential implications of using stablecoins will be discussed later in this document.

stability and certainty provided by money that is issued by the central bank. In recent years, various entities have also developed “stablecoins”, designed so that their value will be indexed to the value of another asset or currency. However, these are also issued by private entities, and the ability to ensure the value of a stablecoin depends on the assets with which it is backed, the corporate governance under which it is managed, and other factors.

There are also similarities between cryptocurrencies and CBDCs beyond the fact that they are both digital. One of the similarities is that they are both usable for immediate payments, without involving third parties that delay the finality of the payment. In the standard payment systems, the payment between Party A and Party B generally passes through at least one third party, and sometimes through a larger number of intermediaries. For instance, a bank transfer is generally settled at an interbank clearinghouse, so the final confirmation of the transaction cannot be made immediately. The same is true regarding transfers through the payment applications that have been developed in recent years in Israel. RTGS systems (such as the Zahav system in Israel) enable real-time settlement, but they are not adapted for the settlement of large quantities of retail transactions of small values. It is generally assumed that payment by CBDC will be immediate and final, in the same way as cash payments. A number of countries have in recent years developed instant payment or faster payment systems that enable the immediate and final settlement of transactions, including P2P (person-to-person) transactions, of small amounts.⁷ However, in general, even in these systems, the settlement between banks is not immediate. The banks receiving the payment take upon themselves a financial exposure between the settlement windows.

What will CBDC “look” like? The use of digital money will naturally be through digital means. For instance, it will be possible to use it to pay from a computer, a cellphone, a smartwatch, or a designated digital accessory. In order for the digital money to actually serve all parts of the population precisely like cash, thereby supporting financial inclusion in the economy, central banks are also examining the technologies that will enable the use of digital money through inexpensive, simple, and accessible means for those who are not digitally oriented, such as a smart card (Bank of Canada, 2020b). Many central banks are emphasizing the need to make sure that it will be possible to use digital money to make payments in offline settings as well. This is important, in order to make sure that it will be possible to make payments in situations where for one reason or another there is no access to the network (areas without cellular reception, electrical outages, and so forth) or for people who do not have access to the Internet. Even though payment cards have for some time had limited functionality in offline payments, this is a complex technological challenge, since without the ability to document the payment in real time, it is difficult to solve the problem of double spending—payment using the same digital currency twice—and it is difficult to make sure that the payer actually has sufficient funds to make the payment. The technological research on this issue is ongoing.⁸

⁷ In Israel, such a system was launched by MASAV in 2020, but its use is still quite small, and it is not a proper alternative to the use of cash.

⁸ See, for instance, VISA (2020), and Veneris, Park, Long, and Poonam (2021).

2

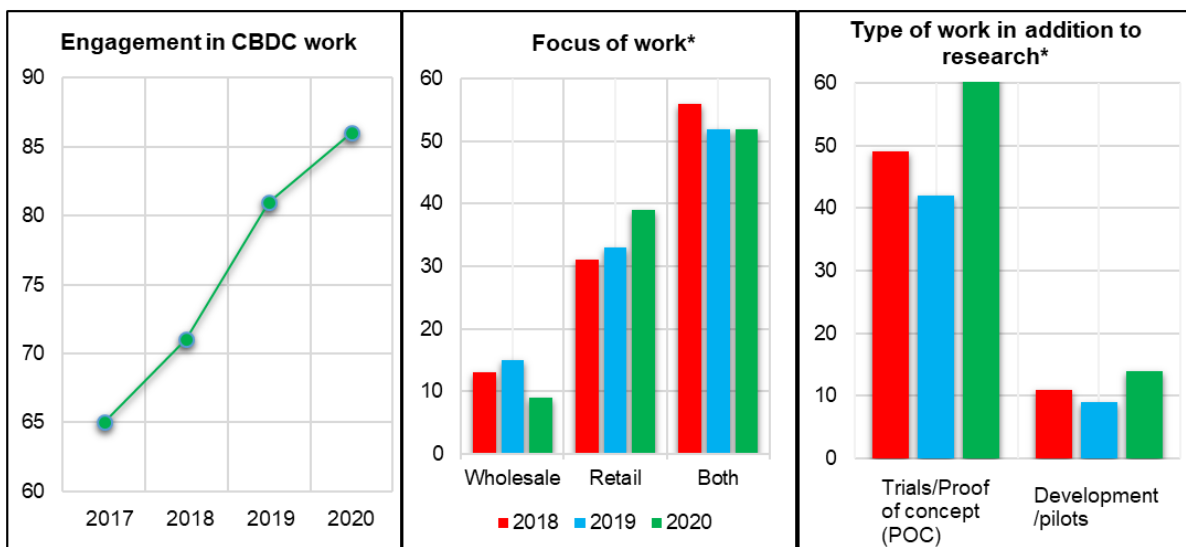
Recent developments regarding central bank digital currencies

2.1 Introduction

In November 2018, the Bank of Israel published a report by the team examining central bank digital currencies. Since then, there have been significant developments in this issue globally. This section presents the main developments in the major central banks' thinking and preparation in the field of central bank digital currencies.

In the past two years, and particularly in 2020 since the outbreak of the COVID-19 crisis, publications by a number of central banks and speeches by their senior officials, as well as practical experimentation projects these banks have undertaken, have reflected significant progress in preparations toward the potential issuance of a digital currency. Even if no central bank of a developed economy has yet announced a decision to issue such a currency in the future, the change in sentiment is being felt, mainly among the large central banks, which until recently were skeptical regarding the potential of issuing digital currency. According to a survey conducted by the BIS among central banks each year since 2017 (BIS, 2021a), in 2020, 86 percent of the central banks worked on CBDCs, compared with about 65 percent in 2017 (Figure 2). Seventy-four percent of the central banks working on the issue are conducting pilots or practical technological experiments. About half of the banks working on the matter are interested in both retail and wholesale CBDC, while out of the other half, the vast majority are interested in only retail CBDC. Despite the fact that no developed economy has yet decided to issue a digital currency, a considerable portion of the banks consider it highly likely that they will issue retail digital currency in a range of up to 6 years (Figure 3).

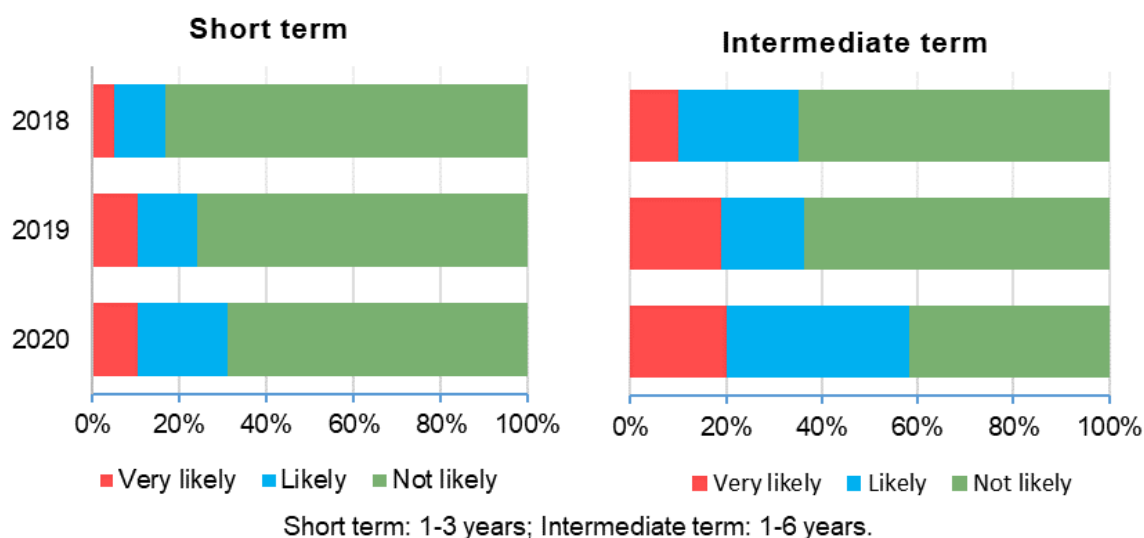
Figure 2: Progress in the central banks' work on CBDC



* Share of respondents conducting work on CBDC.

Reproduced from: "Ready, Steady, Go?: Results of the Third BIS Survey on Central Bank Digital Currency", BIS, 2021.

Figure 3: The likelihood that central banks will issue retail CBDC in the short or intermediate term



Reproduced from: "Ready, Steady, Go?: Results of the Third BIS Survey on Central Bank Digital Currency", BIS, 2021.

In view of the central banks' increasing occupation with the issue, a significant portion of the work of the Innovation Hub established by the BIS is being devoted to finding and examining various technological solutions that may serve the central banks in the establishment of CBDC systems, through global coordination and information sharing between the central banks.⁹

2.2 Joint publication by seven leading central banks and the BIS

In October 2020, a report entitled "CBDC—Foundational Principles and Core Features" was published by the BIS together with seven central banks (BIS, 2020a): the three central banks of the major developed economies (US, European Union, and Japan) and four central banks of additional leading economies (UK, Canada, Sweden, and Switzerland). The very fact that these seven central banks joined the BIS in this publication attests to the seriousness with which they are examining the issue, and the recognition of the need for cooperation and information sharing on the matter. Due to the importance of this report, we list a number of the main points that arise from it.

The report lists three basic principles to guide central banks in their work on the matter:

- "Do no harm" — Digital money distributed by central banks should not interfere with their ability to fulfill their basic functions, particularly maintaining monetary and financial stability.
- Coexistence — Digital money will exist alongside cash (as long as the public wants to continue using it) and commercial means of payment such as current bank accounts.

⁹ For more information, see <https://www.bis.org/about/bisih/topics/cbdc.htm>.

- Innovation and efficiency — If the payment system is not innovative, efficient, and competitive, the public may prefer other means of payment that are less secure or that may pose a risk to stability. Both the public sector (particularly the central bank) and the private sector have roles in the provision of secure, efficient, and accessible payment services.

The report lists fourteen basic characteristics that a CBDC must have:

- The digital currency must be convertible on par with cash and bank money.
- The digital currency must be easy and convenient to use, similar to cash, such that all segments of the population will be able to adopt it.
- The digital currency must be accessible and available – It must be possible to make payments at all places where payment can be made in cash—merchants and payments between private individuals.
- The use of digital currency must come with a low cost or no cost from the end user’s standpoint.
- The system must be highly secure and resilient to cyber-attacks and counterfeiting.
- The payment must be immediate and final settlement.
- The system must be highly resilient and immune to breakdowns, including the ability to make payments during electricity interruptions, damage to infrastructure due to natural disasters, and so forth.
- It must be possible to make payments using digital currency at all times, 24/7/365.
- The system must be able to process a high volume of transactions in short time frames.
- The system must be expandable, such that it will be possible to adapt it to future needs of the economy.
- The system must be sufficiently interactive with the other payment systems so that it will be possible to easily transfer digital money to other means of payment, and vice-versa.
- The system should be flexible and adaptable to changing future conditions and policy.
- The legal infrastructure should be robust, and the central bank’s authority to issue the digital currency should be clear.
- The participants in the system should meet regulatory standards similar to those offering similar services through regular money.

It is reasonable to assume that these principles will form the basis for digital currencies should any be issued by the central banks of leading economies, **and they therefore guide the work of the Bank of Israel’s Steering Committee.**

2.3 Main developments around the world

Some of the main developments at a number of leading central banks in the past year are detailed below¹⁰:

Bahamas

The Bahamas is a small and emerging economy, but in October 2020 it became the first country to issue retail CBDC to the general public (called the “Sand Dollar”). In December 2019, the central bank published a document detailing the country’s program to improve the payment system and increase financial inclusion by issuing a digital currency (Central Bank of the Bahamas, 2019). The complex geographic structure of the country makes it difficult to provide access to financial services for all residents, who are spread over 700 islands that suffer frequent damage to infrastructure due to weather conditions. The system is supported by a WiFi network that is intended only for the needs of the Sand Dollar, and is supposed to be resilient to natural disasters. Citizens can pay through applications or through dedicated cards issued to them by the central bank. As of March 2021, there are about 130,000 Sand Dollars in circulation out of 500 million dollars in cash (IMF, 2021).

United States

The Federal Reserve is conducting an in-depth examination of the implications of digital currencies for the financial system and the payment system. The Fed published a number of policy documents on CBDC, which detail the preconditions for issuing CBDC in the US (Federal Reserve, 2021a), the benefits that may be derived from it (Federal Reserve, 2021b), and more. In the Fed’s view, if it is decided to issue CBDC, it must be a payment system that will serve the public for the next hundred years. Therefore, they intend to do so the right way, not the fast way, or in the words of Fed Chairman Jerome Powell: “It’s more important for the United States to get it right than to be first.” (Bloomberg, 2020).

The Federal Reserve Bank of Boston is cooperating with researchers from MIT in a wide-ranging project, as part of which they are building a kind of prototype for a CBDC that can handle a large throughput—a necessary condition for a digital currency that would be able to serve the American economy. The project’s results are expected to be published in the summer of 2021 (Federal Reserve Bank of Boston, 2020).

United Kingdom

The Bank of England published a discussion paper in 2020 that lays out the opportunities, challenges, and characteristics of issuing a digital currency (Bank of England, 2020). The report notes that if it is decided in the future to issue a digital currency, it would exist alongside

¹⁰ The order of the countries in this section is according to their alphabetical order in Hebrew, and therefore incidental.

cash and bank money. The report outlines a possible model for a digital currency system as the basis for a discussion the Bank would like to have with various interested parties. According to the model, the Bank will provide strong, rapid, and secure technological infrastructure that would include the basic functionality upon which payment interface suppliers will be able to connect and offer digital currency services to the general public, as well as additional services that would not be part of the main system developed by the Bank. For instance, they would be able to offer smart contract services, “programmed money”, and “micropayments”, to meet the future needs of the digital economy. The report does not present a decision regarding a number of potential characteristics of the digital currency system, such as whether it would be based on distributed (DLT) infrastructure or on a standard centralized infrastructure, whether it would be built using an account-based or token-based approach, whether it would bear interest or not, and more. The central bank noted that much further study is necessary in order to reach conclusions on the various issues, and invited the public to answer many questions raised in the report.

In April 2021, the Bank of England and Her Majesty’s Treasury announced the establishment of a joint task force to coordinate the study of the benefits, uses, applications, and risks involved in the potential issuance of a CBDC in the UK.¹¹

European Union

In 2019, the ECB established a task force to examine potential applications for the planning and issuing of CBDC. The taskforce published a report in October 2020 that reviewed the advantages and effects of issuing a digital euro along different potential models (ECB, 2020). The report outlines a number of scenarios that could motivate the ECB to issue a CBDC. These include the need to increase efficiency of payments, response to a decline in the use of cash as a means of payment, response to the issuance of CBDC by other countries, and developments in the broad use of private digital means of payment. The ECB has not yet decided various design issues, but it did note some qualities it views as essential in a digital currency, and discussed the tension and contrasts between some of the required characteristics. The ECB has no intention of using the digital euro as a monetary policy tool, but in the negative interest rate environment, it may be necessary to impose a negative interest rate on the digital euro in order to avoid a transition from deposits with the commercial banks to CBDC and potential harm to the monetary policy pass-through. If such an interest rate is imposed, it is expected to be differential, and would apply only from a certain holding quantity.

Together with the report, the ECB published a public call including about 20 questions, some of which was aimed at the general public, and some of which was aimed at the financial sector and technological firms. The ECB received more than 8,000 responses, and an analysis of those responses, which was published in April 2021, showed that the main issues that are important to the respondents are privacy, security, the ability to make payments throughout the

¹¹ <https://www.bankofengland.co.uk/news/2021/april/bank-of-england-statement-on-central-bank-digital-currency>.

eurozone, low costs, and the ability to make payments offline (ECB, 2021). In the summer of 2021, the ECB is expected to decide whether to initiate a project that will officially examine the potential characteristics and uses of a digital euro.

Japan

The Bank of Japan published a document in October 2020 that details its approach to working on CBDC (Bank of Japan, 2020). It does not intend to issue CBDC in the near future, but based on its commitment to the stability and efficiency of the payment systems, the Bank sees it as important to thoroughly and properly prepare for potential changes in circumstances. The Bank does not expect a decline in the use of cash in Japan, so an issuance of CBDC would in any case be alongside the retention of cash. However, it does expect potential difficulties in providing cash to certain areas in view of urbanization and the decline of the periphery. The Bank has set a target of maintaining the existing payment systems and not competing against them, but rather to match their pace. The Bank announced that if it does issue CBDC, it would be along a two-tier model that involves the private sector, but the Bank is maintaining the option of being more flexible after progress in trials. In April 2021, the Bank began a proof-of-concept (POC) process to serve as a “sandbox” to examine various aspects of CBDC.

China

The People’s Bank of China was one of the first central banks to establish research teams in the area of CBDC, back in 2014. At the end of 2017, they began development of a project called DC/EP (Digital Currency / Electronic Payments). The Bank lists four main motivations for issuing CBDC in China: Ensuring monetary sovereignty and independence in managing monetary policy against the risk from the popularity of cryptocurrencies; ensuring redundancy and resilience in view of the concentration that has developed in the digital payment system in China, which is based on two huge companies, while creating backing for technical or financial failure scenarios in those companies; increasing the efficiency of the payment system; and strengthening financial inclusion, mainly among distant populations and those that are excluded from the existing financial services.¹²

The central bank launched a pilot of Retail CBDC in various Chinese provinces in 2020 (BIS 2020c). According to various reports, as part of the pilot, digital currency was distributed via lottery to tens of thousands of residents in a number of cities. In 2021, the pilot was expanded, so that thus far, a total of a few million dollars' worth in digital currency has been distributed. The digital currency is built along a two-tier model, where the central bank is the only entity permitted to issue and absorb digital currency, while the currency is made accessible to the public through financial intermediaries. The central bank enables the use of a number of “grades” of wallets, in accordance with the KYC’s strength, such that the better the user’s identification is, the lower the restrictions on transactions through the wallet are. The system

¹² For more information, see the BIS interview with Changchun Mu, Director of the Digital Currency Institute, People’s Bank of China on March 25, 2021. <https://youtu.be/Dywea8d9YW4>, beginning at the 12:37 mark.

is not based on blockchain, since according to the central bank, DLT technology is not yet mature enough to handle the transfer of about 300,000 transactions per second, as necessary in a large economy such as that of China (BIS, 2020c). The pilot is expected to be expanded significantly prior to the winter Olympics in Beijing in February 2022, when it is supposed to enable the use of digital currency for visitors from abroad as well.

The digital wallets are hosted on cellular devices, and users do not have to have a bank account in order to register for them. The wallets enable offline payments based on NFC technology on smart devices (Central Banking, 2020). In addition, the People's Bank of China together with the BIS and various other countries began working this year on immediate cross-border payments using CBDC (BIS, 2021b). The People's Bank of China notes that if it reaches understandings with other countries, it does not rule out the possibility that nonresidents would be able to hold the digital currency (BIS, 2020c).

South Korea

The Bank of Korea has not announced an intention to issue CBDC in the foreseeable future, but it does intend to be prepared for a situation in which CBDC will be issued by other countries, which may lead to a similar necessity in South Korea. The Bank's first study on the issue was published in 2019 (Bank of Korea, 2019), and examined how issuing an interest-bearing CBDC on the account-based model would impact the commercial banks and financial stability. The Bank launched a pilot in March 2020 with the aim of studying the technological uses and the legal planning required in order to issue CBDC. The Bank of Korea's main motivations are technological innovation in the payment system and preparedness for regional developments. In December 2020, the Bank published another study that examined whether the introduction of interest-bearing CBDC could improve aggregate welfare and deincestivize tax evasion (Bank of Korea, 2020).

Canada

The Bank of Canada does not plan to issue digital currency in the foreseeable future. However, it is developing the ability to launch such a currency if the need arises, and is devoting significant resource to the matter. The Bank has published dozens of articles and policy papers on the matter in recent years, and in February 2020 it presented its concept to the public in a contingency plan document as part of the Bank's broad strategy to fulfill its mandate—to respond to potential developments relating to the future of the payment system and money (Bank of Canada, 2020a). In November 2018, the Bank of Canada, the Bank of England, and the Monetary Authority of Singapore published a report that examined alternative models for cross-border transactions (BoC, BoE, MAS, 2018). In February 2021, reports commissioned by the Bank of Canada from three Canadian universities were published, recommending three independent potential designs for a Canadian digital currency (Bank of Canada, 2021). At the beginning of December 2020, the Bank of Canada's Deputy Governor for Financial Technology, Timothy Lane, announced that the COVID-19 crisis may accelerate Canada's need for CBDC.

Sweden

In Sweden, the use of cash has been declining significantly, and as a result, the country's central bank was among the first to study the issue of CBDC (referred to as the e-krona). In 2017, the Riksbank began conducting a comprehensive series of studies, and published a number of reports during the process. The reports include comprehensive discussions of potential design paths, and analyses of the potential effects of issuing CBDC. The Bank's main motivation is a commitment to provide a central bank-issued digital means of payment to the general public in view of the decline in the use of cash, but it is examining additional benefits such as improvements to the payment system, cross-border payments, and more. In 2019, the Sveriges Riksbank proposed the establishment of a government committee of experts that would examine the legal basis and the need for issuing CBDC. The Bank emphasized the need for the user interface to be easy to use, so that the digital currency would enable financial inclusion of the entire population. However, decisions have not yet been made regarding the characteristics and design of the potential digital currency. The bank has completed the first stage of a pilot based on the Corda blockchain technology (Sveriges Riksbank, 2021). In the second stage, various uses will be examined, including the possibility of offline payments.

3

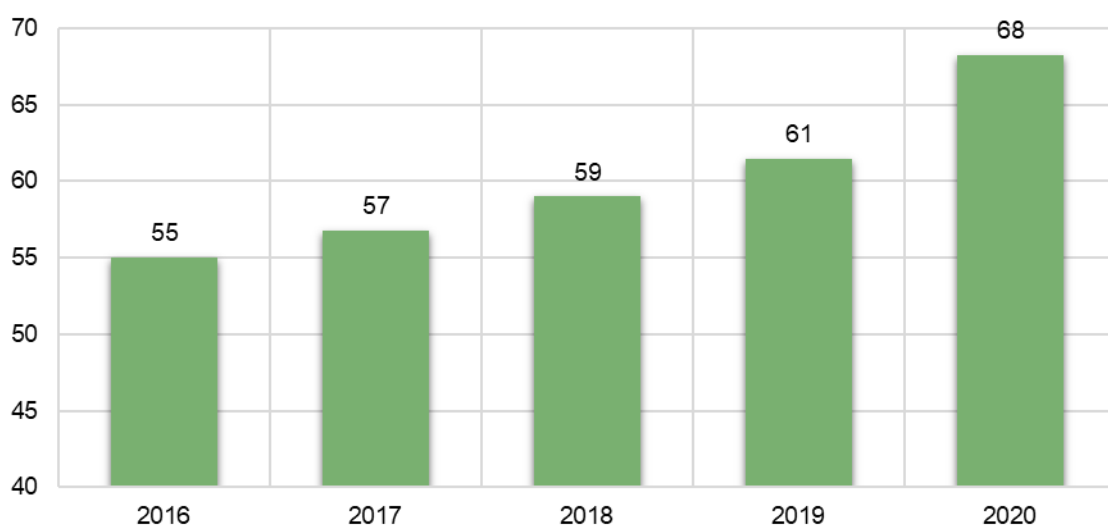
Potential benefits and motivations for issuing a Bank of Israel digital currency

3.1 Introduction

The State of Israel enjoys a stable and developed financial system, and the public generally trusts the system and receives a high level of services from it. The banking system, which is closely supervised by the Bank of Israel, is stable and strong, and the Bank of Israel ensures the stability and efficiency of the payment and settlement systems, such that the public does not doubt the ability to make payments or that they will be made in a proper and timely manner. The penetration rate of electronic payments in the Israeli economy is increasing, as reflected for instance in the ratio between payment card use and total private consumption (Figure 4). Mobile payment applications entered into broad use a few years ago, and it recently became possible to make payment card transactions via cellphone at a merchant's terminal, with the implementation of a significant milestone in the deployment of the EMV standard.

However, there are technological aspects of the payment system in Israel that are not among the most advanced in the world. The financial system as a whole is adapting itself to technological developments, and the payments sector is expected to make the same adaptation in parallel with the implementation of various reforms announced in recent years and with global tech giants' entry into the payment industry in Israel. In view of this, when discussing a potential issuance of CBDC, we must first and foremost ask ourselves why. How would the Israeli economy benefit from the existence of a digital shekel, and what needs would it fill? Is it important that the Israeli public would be able to hold a digital means of payment that would constitute a central bank liability, in addition to the physical central bank liability that the public currently holds—cash—and to the digital means of payment provided by the financial system?

Figure 4: Annual Ratio of Credit Card Expenditures to Private Consumption (percent)*



In 2020, there was a significant increase in credit card purchases due to the COVID-19 crisis. It is difficult at this stage to assess whether this was a one-off increase or whether this was a structural change that will be at least partly permanent.

SOURCE: Based on Central Bureau of Statistics and Shva.

Various publications by central banks and articles in the economic literature suggest a wide variety of benefits that the economy and society could derive from the existence of CBDC.¹³ The Bank of Israel’s Steering Committee recently remapped the main benefits that a Bank of Israel digital currency could generate for the Israeli economy if one is issued in the future, in view of developments in the economy and in the payment systems in Israel and abroad, and particularly in view of the technological developments and potential for further developments in the payments field. The committee identified a number of main motivations that may be relevant in the foreseeable future, as well as secondary motivations that are less relevant for the Israeli economy at this time.

It is important to note that it may be possible to attain some, if not all, of these benefits through the improvement and upgrading of the existing payment systems without necessarily issuing a Bank of Israel digital currency. Moreover, issuing a digital currency, particularly if it is not meticulously designed, may also involve significant risks. The main risk is that of bank disintermediation. The public’s deposits with commercial banks are a source of liquidity for the provision of credit by the banks, and if the public chooses to convert a significant portion of its deposits at the banks to digital shekels, the banks’ ability to fulfill their basic function—intermediation between savers and borrowers—may suffer, thereby causing significant harm to the economy, or they will be forced to make credit more expensive due to the decline in the supply of sources. In particular, in an extreme scenario of concern over the stability of a particular bank, the ability to “flee” with relative ease to the digital shekel may accelerate the crisis. A digital shekel may also have an impact on the monetary pass-through. If the system is not meticulously designed, it may also generate cyber risks, risks to privacy, and risks to the central bank’s reputation: A technical failure of the system may harm the public’s trust in the central bank.

A significant part of the Steering Committee’s work is focused on studying the risks and benefits, as well as examining the added value that a Bank of Israel digital currency could generate for the Israeli economy compared with existing and future payment systems.

3.2 Main motivations

The main motivations for issuing a CBDC, and the main potential benefits for the Israeli economy, as mapped by the Bank of Israel’s Steering Committee, are as follows:

- a. Creating an efficient, advanced, and secure alternative to the existing and new means of payment in the digital era.** Cash is partly an alternative to means of payment that are based on bank money. A cash payment transaction is simple (assuming that the payer and receiver are in the same location), and the direct cost for making the payment is zero. This alternative essentially creates competitive pressure toward other

¹³ See for instance Bank of Israel (2018), p. 29; Bank of England (2020), p. 13; ECB (2020), p. 10; and Bordo and Levin (2017).

means of payment, and provides an incentive for the system to provide inexpensive and efficient payments. A convenient, available, secure, and inexpensive means of payment that would be provided digitally by the central bank would ensure that the payment system continues to increase its efficiency and invest in innovation, reduce the costs imposed on households and merchants due to making payment transactions, and support the entry of new participants and new value offers to the payment system.

Means of payment based on bank money have in recent years been exposed to competition from a new source. Some cryptocurrencies aim to be an alternative means of payment and replace both bank money and the money supplied by the central banks. It is reasonable to assume that some of them will have difficulty providing a proper alternative to the familiar means of payment. The high volatility of cryptocurrencies damages their ability to serve as an efficient means of payment, as do the relatively long time it takes to make a transaction and the total capacity of the system (Mechkaroska, Dimitrova, and Popovska-Mitrovikj, 2018), the lack of any proper corporate governance, and the lack of a clear address for handling consumer issues. (For instance, according to assessments, the owners of millions of bitcoin units cannot realize their “money” because they lost the password to the wallet in which it is stored. A customer of a supervised bank will never lose access to his or her money if he or she forgets the password to the account.) However, in recent years, a number of “stablecoins” have been developed, which are designed so that their value will be indexed to the value of another asset or currency, or to some basket of currencies, so that those holding them will maintain their purchasing power relative to the asset to which the currency is indexed. Some of these currencies are being developed by global tech giants and are expected to operate under appropriate regulation.

A broad adoption by the public of means of payment based on private currencies, mainly if they are not denominated in domestic currency and are not under supervision, may pose a risk to financial stability, monetary sovereignty (“digital dollarization”), and the effectiveness of monetary policy.¹⁴ However, the chance of a wide scale public adoption of such currencies is smaller if the financial system and the central bank properly fulfill their roles—providing the public with a convenient, inexpensive, advanced, innovative, and efficient means of payment. A CBDC that is based on innovative technology and provides a proper response to the public’s payment needs in the coming decades will reduce the risk to financial stability and to monetary sovereignty that may be realized if the public broadly adopts private means of payment, particularly those that are not under supervision. A similar risk may be realized if the central banks of other economies, particularly major economies such as the eurozone or the US, issue digital currencies that are innovative, convenient, and inexpensive to the point that the public prefers using those currencies over means of payment denominated in domestic currency.

¹⁴ See for instance BIS (2020b) and Bank of England (2019).

b. Creating a payment infrastructure that will support the adoption of innovation and adapting the payment system to the needs of the digital economy. The existing payment systems are based on legacy IT systems, which make it difficult to develop advanced functionalities in payments. The development of distributed ledger technologies (DLT) has brought with it new ideas for the development of advanced payment applications based on the use of smart contracts. A CBDC may provide infrastructure for “programmable money”—money that is programmed so that payment is made only if and when certain conditions are met. The appropriate infrastructure, when developed by the central bank, whether through DLT or some other technology, can provide a basis on which various applications are developed.

A digital currency could support “delivery versus payment” uses that would simplify many payment processes in the economy and would provide security and certainty to both parties in a transaction. This could be the case, for instance, in a situation in which the payer in a transaction does not want to make the payment before the exchange is provided, while the party receiving the payment does not want to take the risk of providing the exchange before the payment is made. A smart contract that conditions the provision of the exchange on the payment, and vice-versa, for instance, by using tokenization technology, would cancel the risk to which each party is exposed in the transaction, thereby supporting overall economic efficiency.

Digital money could also support the development of smart payments in the “Internet of Things” (IoT) (for instance, a car that automatically pays for fueling or for travel on a toll-road, or goods that are moved from a wholesaler to a retailer while payment for supply is activated based on the geographic location of the goods). Another field is micropayments. As of now, many services are consumed on the basis of a periodic subscription, partly due to the high cost of making single payments of small amounts. Micropayments would make it possible, for instance, to collect payment at the level of a few agorot (one hundredth of an Israeli shekel) against the consumption of certain Internet content (music, articles, and so forth) as an alternative to a monthly subscription that requires the customer to pay in advance for the consumption of a lot of content that he may not be interested in.

These are obviously just examples, and the industry can develop many smart money applications. Here, it is important to distribute functions properly between the central bank and the private sector. In order to ensure that the CBDC supports constant innovation in the world of payments, the private sector will need to develop the various end-user applications according to market demand and in keeping with technological developments. The central bank’s function is to establish the central infrastructure upon which payment service providers will be able to develop the various capabilities.

Digital currency’s contribution to economic efficiency can also be derived from being established on innovative infrastructure that would solve a large portion of the built-in

frictions in the existing payment systems. For instance, a system that operates 24/7 and would not be based on isolated settlement windows that are typical of the existing settlement systems, would reduce the liquidity costs to which participants and users of the payment systems are exposed.

- c. Ensuring the redundancy of the payment system and its proper functioning during emergencies or breakdowns.** The payment system is a critical system in the economy, and its proper and continuous functioning is a necessary condition for economic activity and the prosperity of the economy. In general, the payment system in Israel is stable and has not suffered failures or shutdowns in recent years. However, such instances have occurred in various places around the world. In Israel, the payment card settlement system may be a weak point, since a large portion of retail activity is based on this system, and some of the new means of payment that have been developed in recent years are also based on payment cards. A CBDC that is built as a separate infrastructure that is independent or has limited dependence on the existing payment systems, will support the redundancy of the payment system and the public's ability to continue making payments even if one of the existing systems encounters a breakdown.
- d. Creating an efficient and inexpensive infrastructure for cross-border payments.** Payments that are transferred from one interface to another, and particularly if they involve currency conversion, are complex, slow, and expensive. In order to charge a bank account in one country and credit an account in another, the payment order must pass through a correspondent bank, and frequently through a number of them. Various banks use different technological systems, and sometimes even different messaging systems, which confuses and delays the transfer, and payment transfers can only be done during work hours such that time differences between countries may lead to further delays. Another difficulty is due to differences in regulation and in money laundering prohibition rules in various countries.

The World Bank estimates that the average cost of sending remittances is about 6.5 percent (World Bank, 2020), and that the duration from the time the transfer is made until the final settlement can last a few days. In wholesale transactions, the costs are apparently lower and the time frames are shorter, but they are still much slower and more expensive than domestic transfers. In Israel, the cost of using a debit card abroad or in paying for a purchase from abroad is between 2.5 and 3 percent (including the foreign exchange conversion fee), and even higher for cash withdrawals abroad. As a small and open economy, Israel can derive considerable benefit from reduced cost of cross-border payments, increased efficiency and speed of such transactions, and reduced uncertainty and risk in making such transactions.

The Financial Stability Board (FSB) and the Committee on Payments and Market Infrastructure (CPMI) presented a roadmap for improvement of the cross-border payments infrastructure as part of the G20 work plan (FSB, 2020). As part of the roadmap, the ability of CBDCs to streamline and lower the cost of these payments will

be examined. The BIS recently presented a number of possible models for how digital currencies can provide the infrastructure for streamlining and lowering the costs of cross-border money transfers (BIS, 2021c), and its innovation hub is leading a number of projects in conjunction with central banks on this matter. If such a global infrastructure is actually developed, a Bank of Israel digital currency that is developed in accordance with the standards that will be developed around the world will help streamline and lower the costs of cross-border payments for Israeli residents.

- e. **Maintaining the public’s ability to use digital means of payment while maintaining a certain level of privacy.** Another feather of cash is that using it does not leave any “digital signature”. The use of cash is completely anonymous. Not only can no third party—financial entity or government authority—know who paid, how much, or for what, even the parties to the transaction can, if they wish, maintain their anonymity from each other when making the transaction. It is common to think of this feature of cash as a disadvantage from the authorities’ standpoint, and the fact that there is no way to keep track of cash payments is an opening for tax evasion, money laundering, and criminal activity, particularly regarding large-scale transactions. In view of this, the Reducing the Use of Cash Law was passed in Israel (see more in the next section). However, the right to privacy is a value in and of itself, and the ability to make **legitimate** payments with cash, in small amounts that do not require reporting to the authorities, while maintaining the privacy of the payer, the receiver, or both, can be important for some people. On one hand, the information stored among financial entities can have value for the citizen. Based on this information, they can offer him various products that meet his preferences, offer him credit, and so forth. However, the citizen has the right to purchase products without commercial entities making use of the information regarding the customer’s purchases or payments. In accordance with the characteristics set out for it, a CBDC can maintain some of the features of cash in the context of maintaining the payer’s privacy. While this new means of payment is designed in keeping with the rules set out by the State authorities regarding the prohibition of money laundering and the financing of terrorism and reporting to the tax authorities beyond a certain level, it will be possible to set out that in small transactions, the payer will be able to maintain his privacy should he wish to do so.

- f. **Support of the government’s policy to reduce the use of cash and in the struggle against the unreported economy.** In 2018, the Knesset passed legislation to reduce the use of cash, in order to reduce unreported capital in Israel and to help in the struggle against criminal activity, including serious crime, money laundering, and the financing of terrorism. Mainly, the law limits the use of cash to NIS 11,000 in a single transaction where the payer or payment receiver is a business, and to NIS 50,000 when both parties are individuals. Receipt or payment of cash for wages, donations, or loans is limited to NIS 11,000, except for a loan provided by a supervised financial entity. In addition, the law restricts the use of checks and check endorsements. The law sets out that in the

future it will be possible to lower the transaction benchmarks from NIS 11,000 to NIS 6,000, and from NIS 50,000 to NIS 15,000.¹⁵

In parallel with the implementation of the law, the Bank of Israel worked to advance, implement, and provide access to alternative means of payment. The Bank worked to expand the use of immediate debit cards and prepaid cards, and led to a reduction in the fees imposed for the use of such cards; it implemented the use of the EMV standard and contactless payments; it permitted the banks to launch payment applications that would allow for convenient payments between individuals and recently between individuals and businesses; and it advanced the use of faster payment systems.¹⁶ In addition, the Bank of Israel is working on the launch of a digital standing order service, regulating the activity of payment service entrepreneurs as part of the open banking project, and more.

The existing alternatives to the use of cash are mainly based on the existence of a bank account and/or payment card, and some of them require basic digital literacy as well as access to the Internet. As such, they may not be accessible to certain segments of the public, and cannot serve them as a complete alternative to cash. People with no bank account, children, tourists, foreign workers, people with various limitations, and others, will continue to use cash as long as they have no other alternative. Cash provided by the central bank has advantages over bank money: Beyond the fact that the use of it involves no financial risk, and that when the payment is made it is immediate and final, the use of cash is very simple and does not require any electronic gadget, cellular signal, or any other condition. Its main disadvantage is that cash payment requires a physical meeting between the payer and the receiver.

A digital shekel that exists **alongside existing means of payment** but is available to all—even those who have no bank account, access to the Internet, or a smart phone—can make it easier for those segments of the public who find it difficult to use other means of payment to adapt their activity and how they make transactions to the situation that has been created due to the policy to reduce the use of cash. It can also accelerate the reduction of the use of cash in transactions with small amounts, and further increase the Israeli economy's trend of moving toward the use of many digital means of payment. For that purpose, the digital shekel must be based not only on smart phones, but also on some universal means of payment—such as a smart card—and must enable payment even under certain restrictions, as well as with no connection to the Internet or cellular signal. **In any case, the Bank of Israel will continue to issue cash in the form of banknotes and coins**, as long as there is demand from the public and as long as the Bank believes it is necessary in order to support the redundancy and efficiency of the payment system in Israel.

¹⁵ More information on the law (in Hebrew) can be found on the Money Laundering and Terrorism Financing Prohibition Authority website.

¹⁶ See footnote 7.

3.3 Additional possible reasons for issuing a CBDC

The Steering Committee examined additional potential benefits mentioned in the literature or in the reports from other central banks, and found that at this stage, they seem less relevant for the Israeli economy. These include:

- a. Maintaining public access to means of payment that constitute a central bank liability in a world without cash.** In some countries, the main motivation for considering the issuance of digital currency is the accelerating decline in the public's use of cash (Sveriges Riksbank, 2020). While the central banks do not intend to stop issuing cash, as the use of cash declines, a greater number of businesses are refusing, or may refuse, to accept cash payments.¹⁷ The central banks view themselves as committed to continue providing the public with a dependable and secure means of payment that constitutes a central bank liability, for instance for citizens who are excluded from the banking system or for emergencies in which the ordinary payment systems do not function well. They are therefore considering the issuance of digital currency that will be available for use at any time, even in the absence of the widespread use of cash. This motivation is not currently relevant for Israel, where the balance of cash in circulation continues to increase, the use of cash remains common, and anyone who wishes to can pay in cash at any merchant. However, cash usage habits may change rapidly, and various technological or social developments may lead to a situation where in Israel as well, the use of cash declines rapidly. In such a scenario, this motivation for issuing CBDC may become a major consideration in Israel as well.

- b. Digital currency as an additional monetary policy tool.** The economic literature on CBDCs has in recent years discussed whether there is a need or logic to having digital currencies bear interest. This issue is particularly relevant for central banks that have in recent years conducted a negative interest rate policy. Various entities such as foreign investors, financial bodies, firms, and households may “flee” to the digital currency if it bears zero interest, because that would be preferable to the negative interest currently in place for other financial instruments. This may have a negative impact on the efficacy of monetary policy in those economies.

Cash, by its very nature, does not bear interest, and insofar as a digital shekel should serve as a means of payment and not as a means of savings or value retention, there is no logic in having it bear interest. Monetary policy in Israel functions well through the existing tools, and there is no need for an additional monetary policy tool. Another important point is that when monetary policy returns to a positive and higher environment, then should the digital shekel bear interest, it could increase the flow of

¹⁷ There are countries that are acting to increase the public's access to cash, such as the UK: <https://www.gov.uk/government/news/government-outlines-approach-to-protect-future-of-cash>

public savings from bank deposits and force the banks to find more expensive sources for the provision of credit.

At this stage, the Steering Committee believes that should a decision be reached to issue a digital shekel, it should bear zero interest and not serve as a tool for monetary policy. However, it is wise to maintain the technological possibility of changing this feature in the future in order to enable a digital shekel to bear positive or negative interest as necessary. It may also be necessary to impose a certain interest rate on certain types of users of a digital shekel (such as foreign investors, for instance), and a different interest rate on other users (such as households, for instance). Such a model was proposed, for instance, by Bindseil and Panetta (2020).

- c. Increasing financial inclusion.** Another motivation for many countries in considering the issuance of digital currency is the need for increased financial inclusion. In many emerging economies, as well as a number of advanced economies, a high percentage of citizens do not have access to a bank account or do not receive basic payment services (World Bank, 2017). These citizens make broad use of cash, and are thereby exposed to the risk of theft or loss, while being prevented from using advanced means of payment, such as the ability to make purchases on the internet. While there are also challenges in Israel regarding financial inclusion, according to the Banking (Service to the Customer) Law, 5741–1981, every citizen is entitled to open a bank account with no credit facility, and Banking Supervision Department directives set out that the bank must offer every citizen the option of obtaining an immediate debit card. Thus, from the standpoint of the law and directives, every citizen who wants to can use noncash means of payment. Someone who, for whatever reason, prefers to use cash over a debit card, would not necessarily use a digital shekel should it be available.
- d. Reducing the cost to the economy of a cash system.** The physical features of cash lead to costs in its issuance and use. The “Printing money” item in the Bank of Israel’s financial statements has totaled an average of about NIS 100 million per year over the past decade, during which time a new series of banknotes was issued. However, the costs for shipping and handling cash that are imposed on the banking system, are in the end passed on to the public, which occasionally also bears the cost of loss of cash. In contrast, a CBDC system would also involve considerable costs. Beyond the one-time cost of development and establishment, on-going maintenance, cybersecurity, and similar costs will also apply. In general, the transition from a paper-based system to a computerized system leads to streamlining and cost-savings, but it seems that in this case, the savings would not be on a macroeconomic scale, and that this motivation on its own is not a main motivation for such a significant reform in the financial system.
- e. Advancement of the fintech industry.** There is a lively and advanced fintech industry in Israel. More than 500 companies are operating in the field, many of which are in the world of payments and blockchain technology. A CBDC could form the basis for many developments in the fintech industry. However, the Bank of Israel’s function is to

regulate the payment systems in the economy and to ensure their efficiency and stability. Establishing a new payment system to contribute to the development of a specific economic industry is not part of the Bank of Israel's mandate.

4

Draft model of a Bank of Israel digital currency, and issues to be examined

4.1 Draft model of a digital shekel—a Bank of Israel digital currency

In order to examine the various implications of a potential issuance of a digital shekel by the Bank of Israel, and in order to analyze the business and technological challenges and opportunities, the Steering Committee outlined a draft model, in general terms, of a Bank of Israel digital currency. It is important to emphasize: **This draft model does not represent any decision on the part of the Bank of Israel** regarding the features of a digital shekel, should one be issued, and in any case does not reflect a decision by the Bank of Israel to issue a digital currency. **The draft model is a basis for the discussion and examination of alternatives** by the work teams dealing with the issue within the Bank of Israel, and following the publication of this document, we intend that the draft model also serve as the basis for discussion in the professional community in Israel regarding the necessary characteristics of a digital currency. We emphasize that the principles in the draft model come in addition to the 14 principles published by the BIS and seven central banks, which are listed in Section 2.1 of this document.

a. Structure of the system

The approach that seems to be gaining acceptance among central banks worldwide is that the central bank will not provide the digital currency directly to the public, but will do so through private-sector institutions. This approach is known as the two-tier model. Contrary to the central banks, these institutions are able to manage the required interfaces with millions of households, conduct the necessary examinations as part of the money laundering prohibition rules, provide the necessary consumer services, and develop advanced capabilities and innovative user interfaces in a competitive environment.

- i. The Bank of Israel will provide digital shekels to private sector “payment service providers”. These could be banks, credit card companies, fintech firms, or international or domestic technology and/or financial firms, provided that they meet the legal and regulatory requirements that the Bank of Israel and other authorities put in place.
- ii. Customers from the general public—households and businesses—will receive digital shekel payment services from the payment service providers. The payment service providers will bear the responsibility for carrying out a “Know-Your-Customer” (KYC) process as necessary, and for fulfilling the money laundering and terrorism financing prohibition requirements. The payment service providers will build the user interfaces and will develop advanced payment applications on the basic system that the Bank of Israel will build.

- iii. On both levels—between the Bank of Israel and the payment service providers, and between them and the customers—the system could be based on an account-based model or a token-based model.
- iv. The payment service providers will not develop a balance-sheet exposure. Every digital shekel they receive from the Bank of Israel will be transferred directly to their customers, and vice-versa. In a scenario where one of the providers experiences a technological failure, the balance of digital shekels in the hands of its customers can be restored and customers will be able to use their money through another supplier.

b. Technology and payment interface

The digital shekel will need to serve the Israeli economy for the coming decades, during which time there will be technological developments that we cannot currently foresee. It is therefore important that the system be built to enable easy and efficient future adaptation to new technological developments. The payment interface may operate similarly to those of cellular payment applications, but in order for the digital shekel to cover various business uses, it will need to have a wide variety of features and capabilities that will require additional payment interfaces.

- i. The registration technology at the core of the system may be based on DLT or on centralized ledger technologies.
- ii. The Bank of Israel will provide the minimal infrastructure required for fast, secure, and convenient payments. More sophisticated technological developments (such as “programmable money”, smart contracts, micropayment interfaces, payments in the IoT environment, and so forth) will be carried out by payment service providers based on the basic infrastructure that the Bank of Israel establishes.
- iii. The digital shekel system will enable full and immediate conversion (interoperability) between the digital shekel and cash and deposits with the bank or with other payment service providers, should any be developed. It will be possible to load the digital shekel wallet through a bank transfer, by debit card, from another digital wallet, with cash, and so forth.
- iv. The digital shekel system and the payment interface will be secured at the highest possible level and will be resilient to hacking, cyberattacks, and so forth, throughout all parts of the system.
- v. The system will be specified to support conversion between the digital shekel and CBDC of other countries, or another method of converting foreign exchange to CBDC and vice-versa.
- vi. Some or all of the payment service providers will develop various platforms for making payments: by computer, cellphone, smart watch, and so forth, as well as means that are accessible to all—easy-to-use instruments such as calculator-like instruments or cards—that enable payment for those who do not have a cellphone or in situations where they cannot use one.¹⁸

¹⁸ For more information, see: “Designing a CBDC for Universal Access”, Bank of Canada (2020b).

- vii. Offline payment capability will also be necessary, perhaps for limited amounts, with the implementation of advanced technologies to prevent credit risk on the part of the payment receiver, prevent counterfeiting, prevent double spending, and so forth.

c. Privacy

The issue of privacy in the use of means of payment in general, and the digital shekel should one come into existence in particular, is an issue that requires in-depth discussion. The extent of privacy that will be enabled when using the digital shekel will, in the final analysis, reflect a societal decision. This section of the draft model presents the basic principles and foundation for public discussion that will take place in the future in this regard.¹⁹

- i. The digital shekel will be designed in keeping with the money laundering prohibition rules and in a way that will not harm the government's efforts to collect taxes. Therefore, in contrast with cash, it will not be possible to enable absolute privacy of the payer or the receiver.
- ii. It will be possible to decide in the future on the extent of users' privacy vis-à-vis payment service providers, and on the commercial use that providers will be permitted to make of users' information—for instance, a model in which the default is that the digital shekel is similar to cash in terms of privacy vis-à-vis commercial entities, but where users can enable certain use of information in return for various services.

d. Economic characteristics

- i. The digital shekel will bear zero interest, but the technological possibility of implementing interest payments (or collecting negative interest) in the future will be maintained. This possibility may be differential. For instance, it may apply only above a certain level of holdings, or only for certain customers (such as financial institutions or foreign investors, as opposed to households).
- ii. Limitations may be imposed on the volume of holdings or of use of digital shekels. Restrictions may differ for different users, such as households, businesses according to turnover volume, and so forth. These restrictions, should they be imposed, will be meticulously designed so that they will fulfill their purpose of preventing significant harm to the banking system's sources of financing and liquidity (disintermediation), particularly in crisis situations, and prevent damage to the monetary pass-through mechanisms, while not affecting ease of use or the efficiency of the system. A possible model is one that enables the automatic transfer of surplus balances from the digital shekel wallet to the bank account.
- iii. The cost of making a simple payment with the digital shekel will be negligible or free. The payment providers' business model will be based on offering additional services,

¹⁹ A sample model that was presented for the Bank of Canada by McGill University can be viewed in "[Central Bank Digital Currency with Asymmetric Privacy](#)"

whether in terms of payments (such as smart payments or credit offers) or through other industries.

- iv. All citizens, and possibly tourists, nonresidents, and others, will be able to hold and use digital shekels.

4.2 Main issues being examined by the Steering Committee

A central bank digital currency is an innovative concept that, until recently, did not exist in any country. Even today, it still doesn't exist in any advanced economy. Despite the fact that there is already wide-ranging academic literature on the topic, as well as many policy papers written by central banks and international bodies, there is still no agreement on many of the issues, and a lot of further study is required to design a digital currency system whose advantages outweigh the costs and potential risks it poses. While we can learn quite a lot from the research and professional discussion being conducted around the world, there are also specific issues that are relevant to the nature of the Israeli economy. As part of the digital shekel project, the Bank of Israel is currently focusing on an analysis of the following issues:

a. Economic issues

- i. The financial stability implications of adopting a Bank of Israel digital currency, particular regarding the Israeli banking system, its stability and profitability, and its ability to continue fulfilling its essential functions (provision of credit, financial intermediation, and so forth), including an analysis of the potential macroprudential implications.
- ii. The implications for monetary policy, the monetary aggregates, and the Bank of Israel's balance sheet, including the possibility of having the digital currency bear interest.
- iii. The implications of the possibility that one or more major central banks will issue a digital currency for the foreign exchange market and the monetary system in Israel, as well as the implications of the broad adoption of private currencies by the public and the ability to respond to these implications by issuing a digital shekel.

b. The payment system

- i. How to design the digital shekel system so that it has the desired effect on the development of existing initiatives in the Israeli payment system, and particularly on competition, and on the efficiency of the payment system. In particular, how can the digital shekel support lowering the costs and increasing the efficiency of payments within Israel?
- ii. How would the issuance of a digital shekel contribute to the welfare of consumers and merchants? What benefits would consumers derive that do not currently exist or that are not expected to exist in the current and future Israeli payment systems?
- iii. How should the digital shekel system be planned so that it will be adopted by households and businesses?

- iv. How can the digital shekel support lowering the costs and increasing the efficiency of cross-border payments?
- v. What features must the digital shekel have in order to support the objectives of the Reducing the Use of Cash Law?
- vi. Can the issuance of a digital shekel contribute significantly to the resilience and redundancy of the payment system?

c. Technological issues

- i. The various technological alternatives that could form the basis for building a digital shekel system—from the central bank ledger to the end system and user interfaces, including possibilities of making offline payments.
- ii. The potential benefits of using DLT technologies compared with existing centralized register technologies, in various segments of the system.
- iii. The dependence of issuing a digital shekel on the existence of other supporting technological developments, such as digital identification.
- iv. The various opportunities that a digital shekel could generate for innovation in the Israeli payment system, such as smart contracts, programmable money, and so forth.
- v. The potential benefit of conducting practical trials (POC, and later a pilot) for examining the relevance of a digital shekel for the Israeli economy, and the risks and benefits involved in issuing it.

Conclusion

A Bank of Israel digital shekel, should one come to fruition, may generate many advantages for the Israeli economy, but could also involve many risks. First and foremost, the issuance of a digital shekel may undermine the stability and efficiency of the financial system if it is adopted so widely by the public that the public's deposits with the banks become diluted. In such a scenario, the banks' ability to fulfill one of their basic functions—to serve as financial intermediaries between savers and borrowers in the economy—may suffer, and there may be changes in the monetary policy pass-through mechanisms. If the system is not meticulously designed, it may result in cyber risks, risks to privacy, and risks to the central bank's reputation. Therefore, the Bank of Israel must conduct an in-depth examination of the issues involved in a potential issuance of a digital currency, with constant attention to the changes in the economic and technological environments, developments in the global payments industry, and decisions made by other central banks regarding the issuance of digital currencies. Preparations for the issuance of a digital shekel in a way that would maximize the potential benefits and minimize the risks will take some time. As such, despite the fact that no decision has yet been made on the subject, the Bank of Israel has already begun making such preparations.

This document maps the potential advantages that the Israeli economy may derive from the issuance of a digital shekel. While it is reasonable to assume that none of them are, in and of themselves, sufficient reason to decide to launch such a significant project, all of them together may shift the center of gravity toward a future decision to issue a digital shekel. In contrast, it may be possible to achieve those benefits by improving the existing payment systems. The Steering Committee will continue studying the added value that a Bank of Israel digital currency could provide for the Israeli economy, will continue examining the variety of issues involved in a potential issuance, and will update the public on its findings from time to time. The Steering Committee will consider developments in the payments field both in Israel and abroad, technological developments, decisions made by other central banks, and the insights that will be shared with it by various parties in Israel.

The objective of this publication is to update the professional community—the payments, finance, and technology sectors, academia, relevant government agencies, and various organizations—regarding progress in the Bank of Israel's examination of CBDC issues, in order to encourage these entities as well to think about the issue. In order for the action program that the Bank of Israel is preparing to be as informed and comprehensive as possible, it will be important for the Bank of Israel to track the thinking that will develop among various entities in the Israeli economy, even if it is decided in the end not to put the plan into action. The Bank of Israel calls on these entities to provide the Bank with written comments on the contents of this document and on the relevant aspects of a possible future issuance of digital currency by the Bank of Israel. Guidelines regarding how to send these comments can be found on the Bank of Israel's website at: <https://bit.ly/3tAqwBN>

References:

- Bank of Canada (2020a, 02). “Contingency Planning for a Central Bank Digital Currency”, <https://www.bankofcanada.ca/2020/02/contingency-planning-central-bank-digital-currency/>
- Bank of Canada (2020b, 06). “Designing a CBDC for Universal Access”, <https://www.bankofcanada.ca/2020/06/staff-analytical-note-2020-10/>
- Bank of Canada (2021, 02). “Canadian Universities Propose Designs for a Central Bank Digital Currency”, <https://www.bankofcanada.ca/2021/02/canadian-universities-propose-designs-central-bank-digital-currency/>
- Bank of England (2019, 12). “Financial Stability Report”, <https://www.bankofengland.co.uk/financial-stability-report/2019/december-2019>
- Bank of England (2020, 03). “Central Bank Digital Currency: Opportunities, Challenges and Design”, <https://www.bankofengland.co.uk/paper/2020/central-bank-digital-currency-opportunities-challenges-and-design-discussion-paper>
- Bank of Israel (2018). “Report of the Team to Examine the Issue of Central Bank Digital Currencies”, <https://www.boi.org.il/en/NewsAndPublications/PressReleases/Documents/DigitalCurrency.pdf>
- Bank of Japan (2020, 10). "The Bank of Japan's Approach to Central Bank Digital Currency", https://www.boj.or.jp/en/announcements/release_2020/rel201009e.htm/
- Bank of Korea (2019, 02). “Central Bank Digital Currency and Financial Stability”, BOK Working Paper No. 2019-6. <https://www.bok.or.kr/imerEng/bbs/E0002902/view.do?nttId=10049898&menuNo=600342>
- Bank of Korea (2020, 12). “Central Bank Digital Currency, Tax Evasion, Inflation Tax, and Central Bank Independence”, BOK Working Paper No. 2020-26, <https://www.bok.or.kr/imerEng/bbs/E0002902/view.do?nttId=10061575&menuNo=600342>
- Bindseil, U. and F. Panetta (2020, 10). “Central Bank Digital Currency Remuneration in a World with Low or Negative Nominal Interest Rates”, <https://voxeu.org/article/cbdc-remuneration-world-low-or-negative-nominal-interest-rates>
- BIS (2020a, 09). “Central Bank Digital Currencies: Foundational Principles and Core Features”, <https://www.bis.org/publ/othp33.htm>
- BIS (2020b, 11). “Stablecoins: Risks, Potential and Regulation”, <https://www.bis.org/publ/work905.htm>

- BIS (2020c, 08). “Rise of the Central Bank Digital Currencies: Drivers, Approaches and Technologies”, BIS Working Papers No. 880. <https://www.bis.org/publ/work880.htm>.
- BIS (2021a, 01). “Ready, Steady, Go? – Results of the Third BIS Survey on Central Bank Digital Currency”, <https://www.bis.org/publ/bppdf/bispap114.pdf>
- BIS (2021b, 02). “Central Banks of China and United Arab Emirates Join Digital Currency Project for Cross-Border Payments”, <https://www.bis.org/press/p210223.htm>
- BIS (2021c, 03). “Multi-CBDC Arrangements and the Future of Cross-Border Payments”, BIS Papers No. 115 <https://www.bis.org/publ/bppdf/bispap115.htm>
- Bjerg, O. (2017). “Designing New Money - The Policy Trilemma of Central Bank Digital Currency”, CBS Working Paper No. 57, <https://dx.doi.org/10.2139/ssrn.2985381>
- Bloomberg. (2020, 10 19). “Powell Says Fed Has Made No Final Call on Digital Currency” <https://www.bloomberg.com/news/articles/2020-10-19/powell-says-fed-has-made-no-final-decision-on-digital-currency>
- BoC, BoE, MAS (2018, 11). “Cross-Border Interbank Payments and Settlements”, <https://www.bankofengland.co.uk/news/2018/november/boe-boc-mas-joint-report-digital-transformation-in-cross-border-payments>
- Bordo, M., and A. Levin (2017, 09). “Central Bank Digital Currency and the Future of Monetary Policy”, <https://voxeu.org/article/benefits-central-bank-digital-currency>
- Central Bank of the Bahamas (2019, 12). “Project Sand Dollar” <https://www.centralbankbahamas.com/publications/main-publications/project-sand-dollar-a-bahamian-payments-system-modernization-initiative>
- Central Banking (2020, 04). “Some Thoughts on CBDC Operations in China” <https://www.centralbanking.com/fintech/cbdc/7511376/some-thoughts-on-cbdc-operations-in-china>
- ECB (2020, 10). “Report on a Digital Euro” https://www.ecb.europa.eu/pub/pdf/other/Report_on_a_digital_euro~4d7268b458.en.pdf
- ECB (2021, 04). “Report on the Public Consultation on a Digital Euro”. https://www.ecb.europa.eu/paym/digital_euro/html/pubcon.en.html
- Federal Reserve (2021a, 02). “Preconditions for a General-Purpose Central Bank Digital Currency” <https://www.federalreserve.gov/econres/notes/feds-notes/preconditions-for-a-general-purpose-central-bank-digital-currency-20210224.htm>
- Federal Reserve. (2021b, 03). Should the Fed Issue Digital Currency? Retrieved from Federal Reserve Bank of Richmond: https://www.richmondfed.org/publications/research/economic_brief/2021/eb_21-10
- Federal Reserve Bank of Boston (2020, 08). “The Federal Reserve Bank of Boston Announces Collaboration with MIT to Research Digital Currency”,

<https://www.bostonfed.org/news-and-events/press-releases/2020/the-federal-reserve-bank-of-boston-announces-collaboration-with-mit-to-research-digital-currency.aspx>

FSB (2020, 10). “Enhancing Cross-Border Payments: Stage 3 Roadmap”,
<https://www.fsb.org/2020/10/enhancing-cross-border-payments-stage-3-roadmap/>

IMF (2021, 03). “Finance and Development. Digital Dollars for Online Tea”,
<https://www.imf.org/external/pubs/ft/fandd/2021/03/fighting-pandemic-disruption-with-innovation-dorst.htm>

Mechkaroska, D., V. Dimitrova, and A. Popovska-Mitrovikj (2018). “Analysis of the Possibilities for Improvement of Blockchain Technology”, TELFOR 2018.

Sveriges Riksbank (2020, 10). “Cash is losing ground”,
<https://www.riksbank.se/en-gb/payments--cash/payments-in-sweden/payments-in-sweden-2020/1.-the-payment-market-is-being-digitalised/cash-is-losing-ground/the-use-of-cash-is-declining/>

Sveriges Riksbank (2021, 04). “E-krona Pilot Phase 1”,
<https://www.riksbank.se/globalassets/media/rapporter/e-krona/2021/e-krona-pilot-phase-1.pdf>

The World Bank (2017). “The Global Findex Database”,
<https://www.worldbank.org/en/topic/financialinclusion/overview>

The World Bank (2020, 12). “Remittance Prices Worldwide Quarterly”,
https://remittanceprices.worldbank.org/sites/default/files/rpw_main_report_and_annex_q42020.pdf

Veneris, A., A. Park, F. Long, and P. Poonam (2021). “Central Bank Digital Loonie. Final Report for the Bank of Canada’s Model X Challenge
<https://www.rotman.utoronto.ca/FacultyAndResearch/ResearchCentres/FinHub/Research/BoCModelXReport>

VISA (2020, 12). “Towards a Two-Tier Hierarchical Infrastructure: An Offline Payment System for Central Bank Digital Currencies”, <https://arxiv.org/pdf/2012.08003.pdf>