


Responses to the Bank of England's March 2020 Discussion Paper on CBDC

 Discussion Paper



Published on 07 June 2021

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Foreword

Paper money has a long history. In 7th Century China the bark of mulberry trees was used to issue the first widely used paper money and four mulberry trees stand in the Bank of England's courtyard to commemorate this innovation. However many other forms of money have been used in different places and at different times, reflecting available technology and the way in which people choose to transact with each other.

Today, new technologies, evolving customer preferences and further innovation are increasingly driving digitalisation of the economy and changes in the way we make payments. More spending is occurring online or through electronic means, while use of banknotes for making payments is declining. The private sector is also exploring new technologies to create novel forms of money. The Bank supports private sector innovation if safe and supported by effective regulation and rigorous public policy frameworks. A [Discussion Paper](#) released today on new forms of digital money sets out the Bank of England's recent work on this issue in order to promote further debate around a wide set of public policy issues.

Public confidence in money is central to the Bank of England's objectives. It is the foundation of both monetary and financial stability in the UK: low and stable inflation, accompanied with a safe and well-functioning financial system. Ensuring that the money and payment services used by households and businesses are safe, effective and meet the evolving needs of the economy is central to achieving those objectives.

Given the fast pace of change in the payments landscape, the public sector must also consider the role it plays in 'retail' payments (ie made to and from households and businesses). The Bank of England, like many other central banks, is exploring Central Bank Digital Currency (CBDC): a new digital form of central bank money used to make payments. A CBDC could contribute to a more resilient, innovative and competitive payment system, but it would also raise significant questions for the economy and financial system. The Bank has not yet made a decision on whether to introduce a CBDC. Were it to do so, any CBDC would complement, rather than replace, banknotes.

In March 2020, the Bank released a [Discussion Paper](#)  on the opportunities and risks associated with a CBDC. We received a large amount of rich, insightful and carefully considered feedback and would like to thank the many individuals and organisations who took the time to respond.

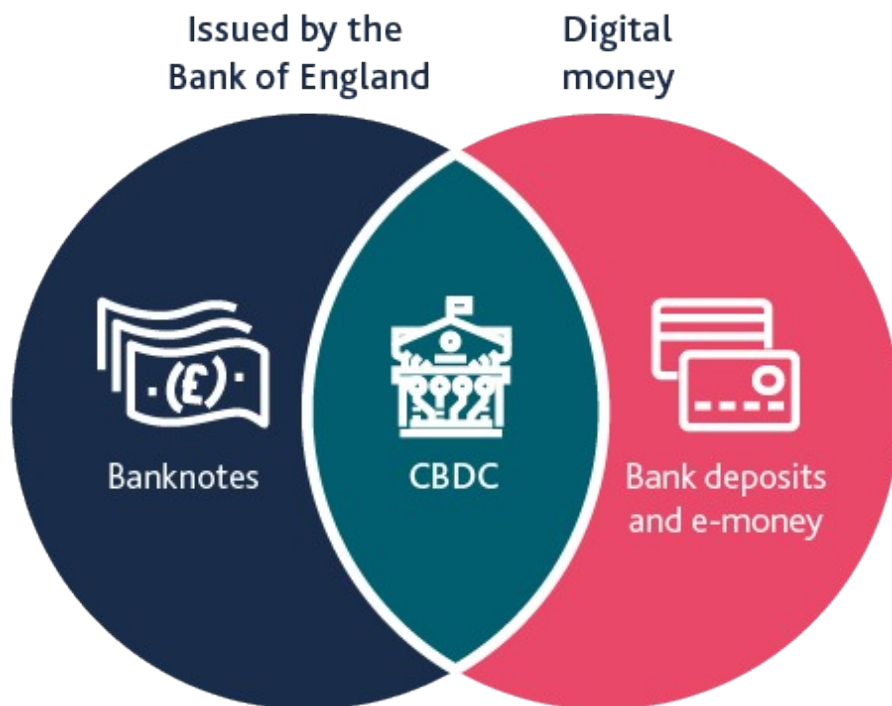
The Bank is committed to openness and transparency in its exploration of CBDC. This document summarises the key themes in the responses we received to the Discussion Paper. In short, the feedback we received has encouraged the Bank of England to continue examining the case for a CBDC. But at the same time, the Bank received clear feedback that the 'use case' for a CBDC, which might justify its introduction, needed further research, refinement, and articulation, to inform a comprehensive assessment of the pros and cons of what would be a major decision. Additionally, some respondents expressed doubt that a CBDC was needed at all, given they considered that the intended benefits could be achieved through other forms of payments innovation.

To support continued exploration of CBDC, the Bank is taking forward a variety of [initiatives](#). The Bank has announced a new joint Taskforce with HM Treasury to ensure a strategic and co-ordinated approach to CBDC exploration by UK authorities, in line with their statutory objectives. The Bank is also pursuing further engagement with stakeholders across industry, academia and civil society. A CBDC Engagement Forum will engage senior stakeholders on the practical challenges of designing, implementing and operating a CBDC. And a CBDC Technology Forum will gather input on all technology aspects of a CBDC.

A decision on whether to proceed with a CBDC will be a profound one. Reaching such a decision will require thorough analysis and research, as well as close engagement with all aspects of society. The Bank looks forward to continued dialogue with all stakeholders as we work towards this decision.

Jon Cunliffe

Deputy Governor for Financial Stability




Executive summary

The Bank of England's objective is to maintain monetary and financial stability. Central to that objective, the Bank provides 'central bank money': the safest and most trusted form of money to the financial system, and also households and businesses. But declining transactional use of banknotes and increasing use of privately issued forms of money means that the payments landscape is changing. In light of these developments, the Bank of England is actively considering the role it should play within payments and the forms of money it should issue for use in the economy and financial system.

At the moment, the public can only hold money issued by the Bank in the form of banknotes. Only commercial banks and certain financial institutions can hold central bank money in 'electronic' or 'digital' form, through 'reserves' held in the Bank of England's Real-Time Gross Settlement (RTGS) service.

A Central Bank Digital Currency (CBDC) would represent a new form of money in the economy and be available to the public for general use. Unlike banknotes, CBDC would be electronic. And unlike reserves, which are electronic money holdings by financial institutions at the central bank, CBDC would be available to households and businesses. For this reason, CBDC is sometimes described as being similar to a 'digital banknote'. Issued by the Bank of England, CBDC would be the safest form of digital money available for use by the general public.

The Bank of England has not made a decision on whether to introduce CBDC but is committed to engaging widely on the benefits, risks and practicalities of doing so. To that end, the Bank published a [Discussion Paper](#)  in 2020 which set out a number of opportunities and risks associated with CBDC, as the basis of further research and dialogue with stakeholders. The paper outlined an illustrative 'platform' model for CBDC where the Bank would provide the core technology infrastructure and minimum necessary functionality for CBDC payments. This would then serve as a platform for private sector Payment Interface Providers (PIPs) to connect to in order to provide customer-facing CBDC payment services and any additional value-added services as part of a competitive and diverse payments landscape.

The Bank received a large number of responses to that Discussion Paper and is grateful for the quality of engagement from the individuals and organisations who shared their views. The decision on whether to proceed with CBDC is a profound one so input from stakeholders throughout our economy and society will continue to be an essential part of our exploration of CBDC.

Respondents to the 2020 Discussion Paper showed strong agreement that the Bank should, at the very least, be carefully studying CBDC, even if there was a range of views on whether one was ultimately likely to be needed or desirable. The Bank now intends to deepen its exploration of CBDC. It will do so through three new initiatives. First, a joint Taskforce has been established with HM Treasury to ensure a coordinated approach to exploring the public policy issues around CBDC by UK authorities. Second, a CBDC Engagement Forum is being established to engage senior stakeholders across industry, academia and civil society on the practical challenges of designing, implementing and operating a CBDC. And, third, a CBDC Technology Forum will be set up to ensure the Bank understands the state-of-the-art when considering all technology aspects of CBDC.

In addition, the Bank continues to work closely with the international community on CBDC exploration. The Bank collaborates with a group of advanced economy central banks and the Bank for International Settlements.[1] The Bank is also contributing to the G20's roadmap to improve cross-border payments.

While views on opportunities, risks and design choices associated with CBDC of course varied among respondents, there were some areas of significant agreement where a large majority expressed a similar view. From these, the Bank of England has identified five core principles from the responses. These principles will be given particular regard in the Bank's future exploration around CBDC.



Principle 1: Financial inclusion should be a prominent consideration in the design of any CBDC.

Feedback from respondents emphasised that, were the Bank to decide to go ahead with a UK CBDC, financial inclusion considerations should be prominent in its design. The benefits of CBDC could only be harnessed if it is widely used. And in turn that would mean that CBDC should be easily accessible to a broad range of groups in society, and have simple and user friendly features. Any CBDC should have a high degree of accessibility to people, regardless of their geographic location within the UK, age, socioeconomic status, digital skills or disability. Additionally, the Bank's work on digital currency should be a complement to, and closely coordinated with, cross-authority work on access to cash.



Principle 2: A competitive CBDC ecosystem with a diverse set of participants will support innovation and offer the best chance to deliver the benefits of CBDC.

Feedback to the Discussion Paper has underlined the importance of private sector involvement in a CBDC system. Respondents agreed the Bank should provide the minimum level of infrastructure for the system to be reliable, resilient, fast and efficient. But the private sector should take a leading role in responding to the needs of the end users, including by competing to provide them with innovative 'overlay' services using the core CBDC infrastructure. The Bank will continue to refine and develop the idea of a 'platform model' in its CBDC exploration. Interoperability – the ability of users to switch

with minimal cost in time or money – between CBDC and other forms of money, including innovations like stablecoins, is likely to be an essential requirement.



Principle 3: In assessing the case for CBDC, due recognition should be given to the value of other payments innovations, and their ability to deliver the benefits the Bank of England seeks.

Respondents to the Discussion Paper noted that private sector innovations may potentially deliver many of the same benefits as CBDC, for example making payments more efficient and supporting the digital economy. In particular, respondents highlighted existing initiatives to improve the current UK payments architecture as well as new proposals such as stablecoins. An assessment of the net benefits of CBDC should therefore consider to what extent they can instead be delivered by private sector proposals and whether this would change the profile of risks. This is particularly relevant as some of these initiatives might come about earlier than CBDC could be launched. Put differently, any assessment of the case for CBDC should be forward looking and recognise that the UK payments landscape is changing rather than simply consider the status quo. Assessment of CBDC should also consider how the costs of building and running a CBDC system might compare to alternative initiatives.



Principle 4: CBDC should seek to protect users' privacy.

A CBDC would need to comply with regulations around anti-money laundering (AML), countering the financing of terrorism (CFT) and sanctions. Feedback from respondents has, however, emphasised the importance that users place on having privacy in their transactions. Subject to meeting compliance requirements and government objectives around tackling financial crime, any CBDC should ensure that users would have a strong level of privacy around their transactions.




Principle 5: While CBDC should 'do no harm' to the Bank of England's ability to deliver monetary and financial stability, opportunities to better meet our policy objectives should also be considered in CBDC exploration.

It is an essential requirement that a CBDC, and new forms of digital money more generally, should not impede the Bank's ability to carry out its remit for monetary and financial stability. For example, the Bank will carefully consider any risks associated with the outflow of deposits from the commercial banking sector. The feedback from some respondents to the Discussion Paper did, however, also note that, even if the Bank was primarily focused on possible benefits CBDC might bring for 'payments', it was also important to give due weight to the possible *opportunities* that CBDC may offer for monetary and financial stability. This included the possibility that CBDC might enable new tools and policy options for

central banks. Even if these policy opportunities are not primary considerations for central banks when deciding whether or not to proceed with CBDC, respondents were clear that they should at least feature in the exploratory process.

Our approach to reviewing responses

The [2020 Discussion Paper on CBDC](#)  invited feedback from readers on 35 broad questions. These questions were structured around the four key themes of the paper (impact on payments, impact on monetary and financial stability, functionality and provision, and technology considerations).

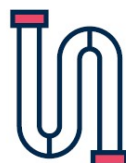
Our discussion themes were...



Impact on payments



Impact on monetary and financial stability



Functionality and provision of CBDC



Technology

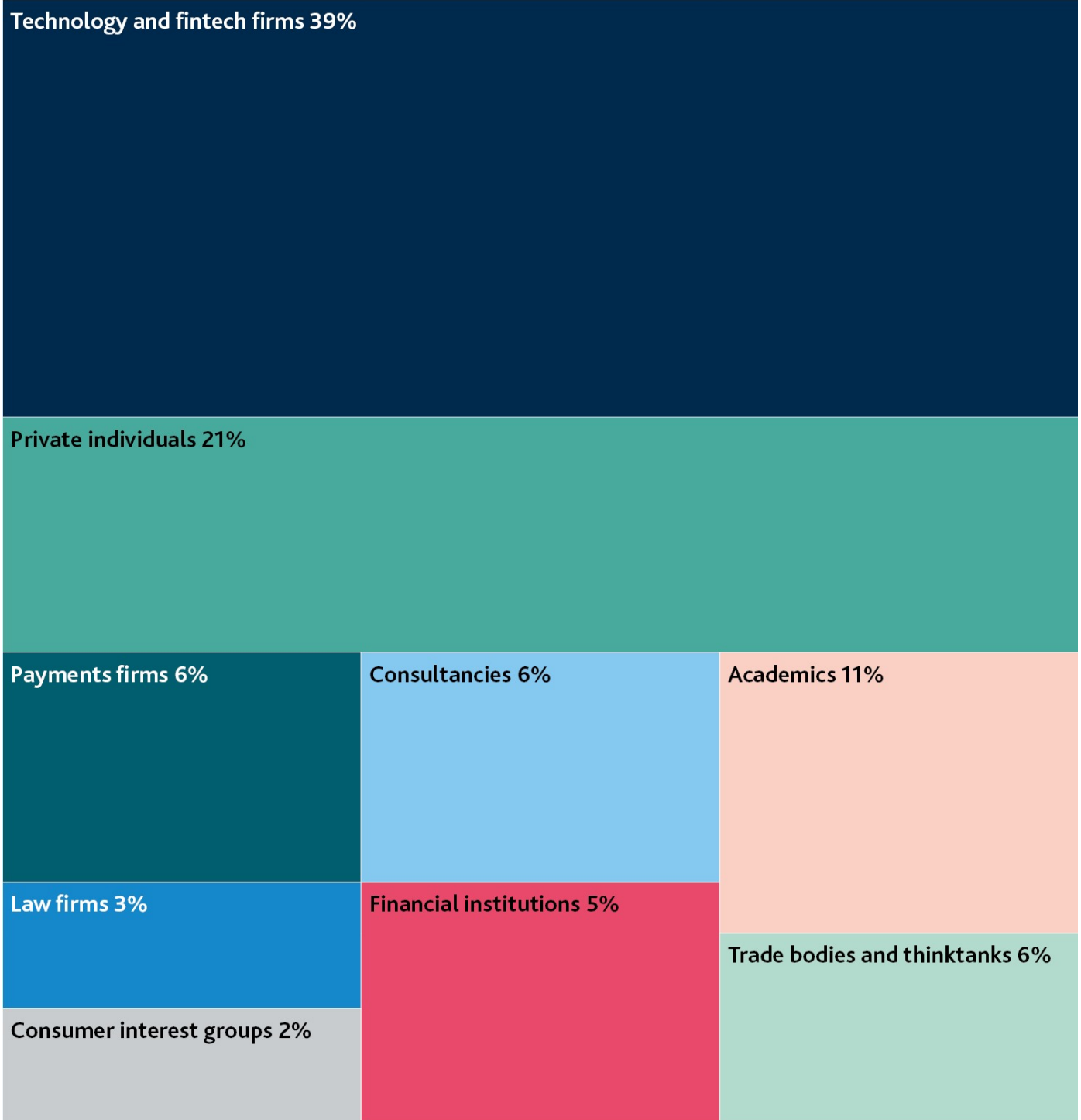
Responses took many formats but the majority were detailed submissions covering most, and generally all, of the questions and issues posed in the Discussion Paper. This summary paper takes into account 132 received responses which aimed to tackle these questions.

The feedback we received showed the significant interest in CBDC and in the Bank's work in particular. We would like to thank the organisations and individuals for the quality of their responses. These submissions have played an important role in informing the Bank's thinking on CBDC, and have helped shape the next steps in our work.

The Bank received feedback from the following groups; a breakdown of the volume of responses is shown in Figure 1 and commonly occurring responses in Figure 2:

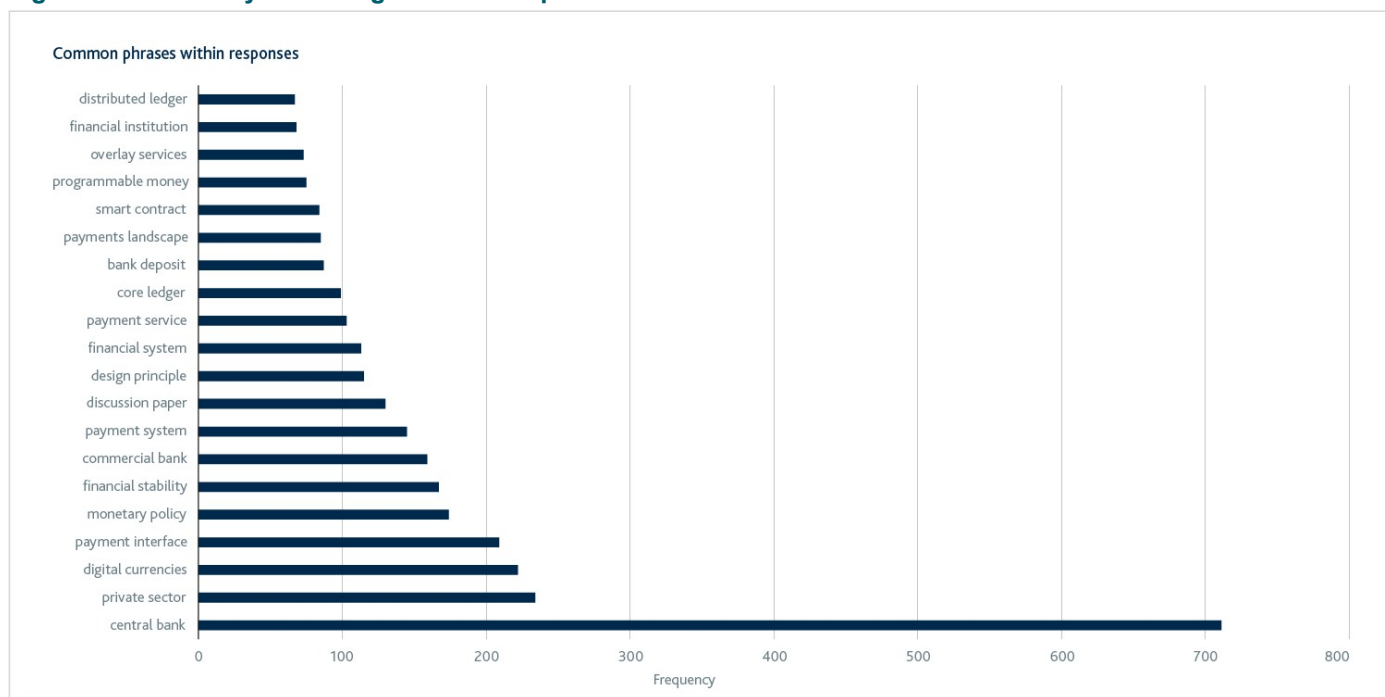
- Academics
- Consultancies
- Consumer interest groups
- Financial institutions
- Law firms
- Payments firms
- Private individuals
- Technology and fintech firms
- Trade bodies and thinktanks

Figure 1: Split of responses to the Discussion Paper on CBDC by group



N.b includes respondents who offered a response to at least 1 question raised in the discussion paper.

Figure 2: Commonly occurring terms in responses



To respect the confidentiality of the responses, and safeguard any commercial or propriety information provided by respondents, this paper does not discuss the detail of individual submissions.

Our 2020 Discussion Paper aimed to demonstrate our early thinking around the various opportunities, risks and design choices associated with a possible UK CBDC. Given the early stage of our exploration, we asked many open-ended questions to our readers to solicit views. As expected, the feedback we received reflected a spectrum of opinions, both affirming and challenging our preliminary views.

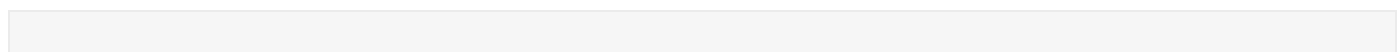
We took a two-pronged approach when analysing these responses. First, the Bank has examined each of them carefully and, in many cases, had follow-up meetings with the organisations that submitted them to fully understand the feedback. Second, where possible, we have undertaken textual analysis of the responses to better identify frequently recurring themes.

In line with the broad and open format of questions, responses to nearly all questions showed diversity of opinion and perspectives. Given the qualitative nature of the responses, this summary paper does not quantify responses to each individual question, nor does it seek to definitively judge overall sentiment (for/against); instead it is largely thematic. We focus on identifying key and common themes from responses, both areas of agreement or consensus, as well as issues where respondents were more varied in their views.

Given the sample size, we are mindful that these findings should not be considered as representative of the attitudes to CBDC of the UK as a whole.

Building on the 2020 Discussion Paper, the Bank has today also released a [new Discussion Paper](#) which further explores some of the key public policy, financial stability and regulatory questions around new forms of digital money. Looking ahead, the Bank and HM Treasury will coordinate exploration of CBDC across UK authorities. And our recently announced CBDC Engagement and Technology Forums provide us with the opportunity to better understand stakeholders' perspectives ahead of any decision on the case for CBDC.

Impact on payments



There was broad agreement that CBDC could deliver benefits for payments.

The Bank's exploration around CBDC is focused around retail payments, ie for day to day use by households and businesses, rather than financial institutions. In this retail context, respondents provided feedback on where CBDC might improve payments in the UK. The mostly commonly cited general benefits of CBDC were the potential to provide additional resilience to the existing UK payment landscape and through promoting greater diversity and competition. Though in both cases there was an acknowledgement this would depend on the specific design selected for CBDC. A key factor in determining the benefit for competition from CBDC would be the extent of the openness in the network and the ease of entry of new participants, particularly in comparison to existing UK payments.

However, many respondents urged the Bank to better articulate the 'use case' for CBDC, and some offered their own suggestions.

Many respondents were interested in understanding further what the specific use case for CBDC could be. They noted that consumers, and as well as other participants in the CBDC ecosystem, such as merchants, would need a more comprehensive articulation of the 'use case' for CBDC in order to fully understand whether or not one might be needed.

Other respondents developed this point further, suggesting their own use cases. A number of respondents focused on the potential for CBDC to enable innovation in payments and to support the needs of a more digital economy. Proposals around micropayments and programmable money were particularly common. Others considered financial inclusion as a primary use case for CBDC, and in particular the importance of helping CBDC to be accessible to all, including those who are currently excluded or underserved by the financial system.

In its CBDC exploration the Bank will consider a range of benefits and use cases. But it is clear that any decision to go ahead with CBDC would need to be justified on a clearly set out use case, communicated in a way that helps stakeholders understand the Bank's thinking.

Some respondents suggested that, as a form of public money, CBDC could offer unique benefits which could not be achieved by other, private forms of money.

Like cash, CBDC would be a liability of the central bank or, put differently, a public form of money. This contrasts to other forms of money, such as commercial bank deposits or stablecoins, which are a claim on a private issuer. The Discussion Paper noted that CBDC could improve the availability and utility of central bank money, a point also made by many respondents. The clear majority of respondents agreed that CBDC, as a form of public money, might offer benefits that cannot be achieved by private forms of money and other payments innovations.

For those who discussed the benefits of CBDC as a form of public money, two particular themes were common. First, a number of respondents talked about the potential role of CBDC in supporting and promoting financial inclusion. This might be particularly important as private sector innovation and provision of new forms of money and payments could leave some groups in society at risk of financial exclusion. Second, the potential for CBDC to provide an additional payment option, which can help promote competition, and choice, as part of a diverse payments landscape. Some respondents also suggested that CBDC had a role to ensure end users maintained access to low or no cost payment services, either via the CBDC directly, or because the presence of the CBDC would encourage operators of other payments innovations to offer a competitively priced product. Respondents also noted that, in contrast to other forms of money, CBDC would be risk-free, and this is an important benefit for both users and the wider economy.

The Bank will continue to analyse the unique role of public money and the potential benefits it may offer in the form of



CBDC, including its interactions with the private sector. How these benefits may change as transactional use of physical cash declines is also important.

In contrast, some respondents were sceptical and suggested that many benefits of CBDC could, or were already, being achieved by other payments initiatives.

Some respondents were sceptical about whether CBDC was needed to achieve the intended benefits given. They suggested that many of the outcomes sought from CBDC might already be captured through existing or emerging initiatives. For example, the New Payments Architecture (NPA) is an initiative by the operators of the UK's retail payment systems to upgrade the UK's infrastructure to support faster and more resilient settlement.

A further group of respondents saw some value in CBDC, but overall thought the benefits were relatively limited. They suggested existing regulations to ensure the safety and soundness of commercial banks, and schemes such as deposit insurance (FSCS), already did a good job in guaranteeing the safety of the public's money. As such, the case for a public form of money may be less strong. These respondents also argued that most of the public did not see or understand any difference between public and private money.

The Bank remains supportive of current and future initiatives to improve payments within the UK, where they are safe, viable and well understood. A CBDC should only be introduced if it adds sufficient value and delivers net benefits, and if launched, should be designed to co-exist with other payments innovations. When exploring CBDC, the Bank will also give full recognition to the potential of private sector alternatives to deliver the outcomes sought.

Our design principles for CBDC were seen as comprehensive, but challenging to deliver.

In its Discussion Paper, the Bank set out various design principles for retail CBDC, noting that it should be reliable and resilient, fast and efficient, promote innovation and support competition. Most respondents considered these design principles comprehensive, and were supportive of them.

Respondents particularly emphasised the importance of extensibility, ie that the design of CBDC should not constrain the range of services that can be provided in the future, as there will be emerging payments needs, and innovative use cases for CBDC, that we cannot currently foresee. Extensibility was highlighted in the Discussion Paper, but was given particular weight and emphasis in the responses we received.

Many respondents placed weight on CBDC being low or zero cost for individuals to use. A large number of respondents also highlighted the need to ensure the highest standards of consumer protection for users, in the event of fraud or other criminal activity.

However, most respondents felt that achieving all of these design principles would be difficult in practice including because some might need to be traded off against each other. Indeed, the Bank itself noted this challenge in the Discussion Paper.

Security and privacy were often cited as aspects on which there should be little or no room for compromise. But in the view of respondents this might have implications for speed and efficiency, support for competition and the ability for CBDC to support innovation. For example, CBDC security requirements might increase the time taken to process a transaction, as well as add barriers to entry for payment interface providers (PIPs) looking to enter the CBDC ecosystem.

The imperative to protect privacy was also regularly cited by respondents as potentially having implications for transparency and financial inclusion. Design choices around privacy, and the ability to validate identity, might have implications for who can participate in the CBDC ecosystem, as is already the case for people with limited documentation who face challenges in a bank account or other financial services products today. At the same time, some respondents pointed to the possibility that CBDC, combined with a system of Digital Identity, might enhance inclusion and support the avoidance of financial crime, by helping people prove their identity.




Finally, resilience of the CBDC system was cited as potentially having implications for the Bank's objective to support competition and to enable innovation. Some respondents noted that the desire to have an innovative and dynamic CBDC system might have implications for network performance and stability.

Managing competing design principles would be a key consideration for the Bank in any future design work on CBDC. And careful functional design and technology choices will be required, with a view to optimising any trade-offs. In most cases, there is not a binary choice between any of these trade-offs. Rather, there is instead a spectrum of options that have different positives and drawbacks for each given design principle. But there are also fundamental requirements on security, resilience, and user trust and confidence, on which there will be no room for compromise.

Box A: CBDC and stablecoins

One proposed new form of digital money are so-called 'stablecoins', issued by private companies. In order to seek a one-to-one exchange rate with cash, they would be 'backed' by financial assets denominated in sterling. Both CBDC and stablecoins would be electronic forms of money but they differ in that CBDC would be a risk-free form of money issued by the *central bank*, while stablecoins would be the liability of a *private issuer*.

The [March 2020 Discussion Paper](#)  asked respondents whether the potential benefits of CBDC could alternatively be achieved by enabling new innovative private sector arrangements, such as stablecoins, to develop.

Most respondents agreed that private sector innovations could achieve some of the potential benefits of CBDC. Those in favour of new private forms of money pointed to what they considered to be the stability of stablecoin (versus other cryptoassets), their potential to support programmability, the importance of serving the needs of the digital economy and supporting improved cross-border payments.

Some respondents also discussed the potential for a positive dynamic between stablecoins and CBDC. For example, if central banks could learn from the experience of stablecoin operators, then stablecoins might positively influence and support the development of CBDC. Alternatively, central bank innovation through CBDC may foster development of standards and promote public-private collaboration in a way that would support stablecoin development.

In contrast, a number of responses argued that private sector arrangements, such as stablecoins, would be inferior to a CBDC offered by a central bank. Private forms of money could not eliminate credit and liquidity risk, unlike risk-free central bank money. Substitution by households and businesses toward forms of money denominated outside of sterling could also limit the Bank's ability to influence UK monetary and financial conditions, which would be detrimental to the Bank's objectives of monetary and financial stability.

Some respondents also noted that the private sector could have fewer incentives than a central bank to meet some societal needs. They argued, for example, that a public sector CBDC could be better at promoting financial inclusion, prioritising resilience and protecting consumers' data.

Some responses focused on highlighting potential risks from stablecoins. For instance, if stablecoins exploit eg 'network effects', that might result in them gaining significant market share in payments and risk an anti-competitive outcome. In the absence of a deposit insurance-like mechanism, failure of a stablecoin might result in losses to money holders.

As discussed in its [Discussion Paper on new forms of digital money](#), the Bank supports innovations, including stablecoins, but only if there is confidence that they are safe and operating within a framework of effective regulation. Since late-2019, the Financial Policy Committee (FPC) has set out its expectations that:

Payment chains that use stablecoins should be regulated to standards equivalent to those applied to traditional payment chains. Firms in stablecoin-based systemic payment chains that are critical to their functioning should be regulated accordingly.

Where stablecoins are used in systemic payment chains as money-like instruments they should meet standards equivalent to those expected of commercial bank money in relation to stability of value, robustness of legal claim and the ability to redeem at par in fiat.

Impact on monetary and financial stability

The Bank will need to be vigilant to the impact of outflows from the commercial banking system for financial stability.

The Bank received limited feedback on financial stability issues. This perhaps reflected the relatively small share of responses from the banking sector. Respondents who did discuss financial stability generally focused on the risks to banks' funding through disintermediation of the banking system, particularly during times of stress. While disintermediation was generally seen to be a risk, some respondents instead viewed it as a desirable feature of CBDC being introduced. That was because of the potential to encourage more competition in banking and credit markets. Issues relating to the financial stability implications of new forms of digital money are covered in more detail in the [June 2021 Discussion Paper](#).

Remuneration is an important economic design choice for CBDC.

Many respondents shared views on the appropriate approach to remuneration of any CBDC, ie whether it should be interest-bearing or not and, if so, to what degree. They also recognised that the significance of any decision around remuneration would also vary depending on the wider macroeconomic environment: for example, whether CBDC was interest-bearing or not would be less important when interest rates on deposits are low.

Some respondents thought that CBDC should not be remunerated. This would allow it to mirror the zero-interest property of cash. It might also make CBDC simpler to understand and, potentially, easier to develop. If unremunerated, CBDC would in this view perform more as a means of payment than a store of value.

Other respondents discussed the case where CBDC was remunerated and would therefore perform a store of value role. In this scenario, several respondents thought that the interest rate for CBDC holders should be slightly lower than the rate paid to holders of commercial bank deposits, in order to limit outflows from the banking system.

More complex approaches to remuneration were also discussed. Several respondents noted the possibility of 'tiered' remuneration, where individuals' balances would receive a positive rate up to a certain level and, beyond that, a lower interest rate, perhaps even zero or negative.^[2] Such a tiered approach might help to promote the use of CBDC as a means of payment rather than store of value.

In its CBDC exploration, the Bank will consider the role that remuneration might play. The Bank also recognises the importance of having the option in technological terms to change its approach to remuneration over time should it judge that appropriate or necessary.

Respondents discussed various potential opportunities for monetary stability.

Respondents highlighted areas where CBDC could support monetary stability, predominantly through the potential to strengthen the monetary policy transmission mechanism. If it was remunerated, CBDC would mean that the Bank could directly affect the interest rate on a greater proportion of funds held by households and businesses. An interest-bearing CBDC would also have an indirect effect in influencing the deposit rates offered by banks and the cost of credit.

Respondents also identified areas where CBDC could contribute to unconventional monetary policy.^[3] The most frequently given examples were:



- **Implementing negative interest rates.** At present, negative interest rates could be set through imposing the relevant rate of interest (Bank Rate) on reserve holdings by financial institutions at the Bank of England. But as a new form of money provided by the central bank, some respondents noted that the interest rate on CBDC would present an additional means and technology to implement monetary policy. This could include the potential for setting negative rates and perhaps relaxing the effective lower bound. Respondents, however, acknowledged that the extent to which interest rates can fall below zero depends on the convenience, storage costs and availability of other assets, in particular cash, which is zero-yielding. As set out in the Discussion Paper, as long as demand for cash remains, the Bank is committed to meeting it and so any current potential for relaxing the effective lower bound may be limited.
- **'Helicopter money'**. CBDC could be used for direct distributions of newly issued CBDC to citizens. For this mechanism to be effective, recipients of 'helicopter money' would require a CBDC account. This in turn might require universal adoption of CBDC by households. Direct distribution to citizens falls in the remit of government, as a fiscal policy, rather than for the Bank. As such, these motivations are not within scope of the Bank's work on CBDC, but could be considered by government. The Bank is committed to working with, and taking its lead from, government on such issues.
- **Implementation of quantitative easing (QE).** Quantitative easing currently involves the purchase of assets from the private sector with newly created central bank reserves. In the UK, QE purchases are intermediated by a small group of banks and broker-dealers known as Gilt Edged Market Makers (GEMMs) who are eligible to participate in the operations and can hold reserves. Therefore, some respondents noted that if CBDC was introduced and was widely accessible to the non-bank private sector, asset purchases for QE could instead be carried out directly with non-banks, potentially making it more targeted and direct. The Bank's Discussion Paper had focussed on a 'retail CBDC', which would be designed to meet the payments needs of households and businesses outside the financial sector, rather than financial institutions. Such design choices will affect the scope for any CBDC to affect the implementation of QE.

Some respondents also noted that CBDC may allow the Bank to access more aggregate data on where money is flowing around the economy. This in turn might support a better understanding of the transmission mechanism. This function was highlighted predominantly by respondents from the FinTech sector. However, this is not seen as a primary motivation for CBDC by the Bank, in part due to the successful use of existing transactional level data such as [CHAPS payments](#) and other [high-frequency indicators](#), and the high priority that respondents placed on protecting users' privacy.

A minimum requirement for CBDC is that it does no harm to the Bank's ability to deliver monetary stability. But in light of the feedback received, the Bank will also continue to examine potential opportunities for monetary policy in its CBDC exploration.

Respondents also discussed macroeconomic opportunities associated with a more efficient payment system.

Almost all of the respondents agreed that a more efficient payments system would have the potential to be a positive force for the macroeconomy. Some respondents noted that lower payment costs would be a particular benefit for small businesses. The Bank will further explore the size of these macroeconomic benefits in its CBDC exploration, as well as through the new CBDC Engagement Forum and Technology Forum.

The level, and nature, of demand for CBDC will determine the extent of opportunities and risks.

There was general consensus that the extent to which opportunities and risks are realised would depend on the level, and nature, of demand for CBDC.



A significant proportion of respondents who answered the relevant question thought demand for CBDC could be large. But almost all respondents acknowledged that demand for a new innovation is hard to predict. They agreed that take-up and use of CBDC would ultimately depend on the functional, economic and technological design of CBDC. In particular, ease of use was deemed to be an important factor in the determining the steady-state level of demand.

Respondents thought that demand would be influenced, and if appropriate controlled, by varying the interest paid on CBDC (if remunerated). As set out in the Bank's [2021 Discussion Paper](#), there is significant uncertainty on the economic impact of new forms of digital money, such as CBDC. For this reason, the Bank will consider whether there is a case for using tools to limit or influence demand for CBDC in any transitional period following its introduction. The choice of remuneration is just one of the ways in which that could be achieved. But other more direct forms of limits on holdings or transactions can also be considered.

As discussed above, the decision about whether or how to remunerate any future CBDC would have macroeconomic implications beyond simply controlling demand for it and will be a major consideration for the Bank's ongoing explorations of CBDC.

The Bank has not yet come to a view on the potential economic design of any future CBDC but will actively consider many of the issues raised by respondents in its exploration.

Functionality and provision

Respondents supported the involvement of the private sector in the provision of CBDC.

Overall, respondents agreed that a public-private approach to delivering CBDC was appealing, with the private sector providing payment services to end-users. Some advantages cited of involving the private sector included faster and more flexible implementation of CBDC, with scope for greater competition and innovation, and the ability to enhance privacy by limiting access to, and avoiding the concentration of, sensitive data. This included the desirability of the CBDC architecture avoiding the central bank having access to any personal data. While private sector involvement was welcome, some respondents noted the risk of a small number of Payment Interface Providers (PIPs) dominating the provision of CBDC payment services, and challenges around incentivising PIPs to serve vulnerable customers. Most respondents recognised the important role standards would play in a CBDC system given the difficulty of coordinating the private sector around operating practices. And some respondents saw the possibility of the roles of the public and private sectors changing over time.

Various options were put forward on whether, and how, the business models of private sector intermediaries might be commercially viable.

Suggestions on commercially viable business models for CBDC Payment Interface Providers (PIPs) ranged from more direct revenue sources such as wallet subscription fees for consumers or sale fees for merchants, through to indirect sources of revenue such as charging fees or commission for additional, related financial services. Some respondents noted that PIPs could be incentivised to provide CBDC services as a loss-leader to attract new customers or enhance the value of other products that they offered. These considerations will have important implications for CBDC system resilience and long-term sustainability, plus significant bearing on broader public policy considerations such as competition, privacy, data protection and reputational risk.

Respondents emphasised the importance of CBDC being widely accessible.

There was a range of views on how to ensure that CBDC would be inclusive for, and accessible to, all. Respondents recognised the challenge of meeting this objective given the multiple potential channels for financial and digital exclusion. Some respondents felt that a primary use case of CBDC should be to serve currently financially underserved constituencies. Various ideas were put forward as to how this could be achieved (see Table A below). Others were more sceptical that CBDC could ever be highly inclusive, due to its digital form and the associated need for smartphones and devices.

Table A: Respondents' views on overcoming barriers to inclusion

Channel for exclusion	Respondents' suggested mitigants/solutions
The cost to end-users of using CBDC	Make CBDC free to end-users (eg free to convert to/from other types of money, free for small-value transactions); public authorities to provide or subsidise an 'inclusive' CBDC wallet if too expensive for PIPs to service low-income users.
Ownership of, or access to, a device that can provide the interface for CBDC	Provide devices for free; ensure CBDC compatibility with basic mobile phones rather than only smartphones; ensure access to CBDC via public computers at eg libraries; ensure a device is not required eg access to CBDC via pre-paid cards.
Ability to use said device	Voice-controlled CBDC wallets for the visually impaired or with other forms of disability. Use of devices may separately require efforts to support digital skills among those who would otherwise find it difficult to do so.
End-users' access to the internet or the system's capability for offline payments	CBDC payments via SMS.
Ability to prove identity	Restricted CBDC payments still available to those who lack ID documents.
Access to an existing bank account	No requirement to hold a bank account, allow CBDC to be acquired using cash at specified intermediaries.

Although exploration is ongoing, the Bank will seek to ensure that any future CBDC is widely accessible to the general public, regardless of their geographic location in the UK, age, socioeconomic status, digital skills or disability.

Respondents recognised the importance of user data being handled appropriately.

Views varied on the degree of privacy that would be necessary or desirable for a CBDC system. Of those who felt that CBDC should be highly private or even anonymous, some respondents grounded their privacy expectations in the example of cash. Others pointed to the principles and technologies underlying decentralised cryptocurrencies as benchmarks for privacy for CBDC.

But other respondents recognised the challenges of balancing anonymity with the need to tackle financial crime. These

respondents felt that the Bank should be guided by current and future regulations on data protection and Know Your Customer (KYC) in determining the appropriate level of privacy.

Suggestions on how to ensure CBDC promotes privacy incorporated ideas about technology as well as the roles of different stakeholders in accessing or handling user data. Some stakeholders pointed to the ability to use technology in a CBDC system, or design the architecture to enhance, rather than detract from privacy. Some respondents noted that the central bank has no commercial incentive to gather or use personal data, and as such would have reason to uphold strong standards of privacy across a CBDC network.

The Bank recognises that privacy is a critical consideration in any CBDC system, and that appropriate privacy must be ensured if CBDC is to command users' trust and confidence. The Bank also recognises that privacy is an issue which extends well beyond the relatively narrow remit of the central bank, and as such will work closely with, and take its lead from, HM Government. The Bank also commits to engage widely, and openly, with stakeholders to understand perspectives on these issues.

Technology

The Bank of England outlined in the 2020 Discussion Paper that we do not presume that CBDC is dependent on the use of distributed ledger technology (DLT) or blockchain. There will be a wide range of potentially viable technology approaches, and the ultimate choice of design will be determined by the features and functionality CBDC would need to possess.

Respondents to the Discussion Paper outlined a wide range of often contrasting views. They also advocated a range of very different approaches to the technology design for any CBDC.

Degree of centralisation

Respondents held a range of views: a decentralised ledger approach could provide benefits in relation to resilience, but a more centralised approach would have performance and security advantages.

Some respondents advocated a decentralised approach to the design of a CBDC ledger. The most common benefit suggested in favour of decentralisation was the potential for enhanced resilience, by avoiding the risk of a single point of failure that a centrally operated system might present. Other commonly cited benefits arose from data being more widely shared, and available to multiple parties, leading to greater auditability, transparency, integrity and immutability (ie being unable to be changed).

However, several respondents also advocated a more centralised approach, often citing the benefits of higher performance, throughput, and scalability of centralised ledgers. The potential cyber-security benefits of centralised approach were also noted, as it would reduce the potential number of points of attack. Several respondents noted that the particular scenario for CBDC, with a trusted central party in the central bank, reduced or eliminated the case for pursuing a more decentralised approach.

Some respondents also noted a CBDC system might incorporate elements of both models in a hybrid approach. For example, a network of decentralised nodes, but which are all operated under the control of the Bank.

Token versus account based approaches

There was a mix of support for 'token' and 'account' based approaches. But the definitions

and distinctions varied, and the choice may not be so binary.

The design of CBDC is often presented as a choice between two discrete models – either ‘token’ based or ‘account’ based. However, the term ‘token’ is often used to describe a range of different, and sometimes unrelated, characteristics which can sometimes lead to a confused debate. For example, some people use the term ‘token’ to refer to the digital equivalent of a physical bearer instrument, implying that ownership is would be determined by whoever ‘holds’ the item, rather than proof of identity.^[4] Others may use the term to refer to a specific technology approach, describing anything which is recorded using DLT as a ‘token’. An ‘account’, by contrast, generally refers to an approach which records a list of accounts each of which has a corresponding balance which is increased or decreased when transactions occur.

There was significant discussion of this in the responses to the Discussion Paper. On the one hand, respondents who advocated ‘token’ approaches often suggested that it might offer a more ‘cash-like’ solution with better anonymity or privacy, while providing traceability and potential for local storage on devices. On the other hand, those proposing ‘account’ based solutions suggested they would enable better performance, lower cost, more secure systems, with clearer definitions of ownership. Many also suggested that the choice was not so binary, and that hybrid models, adopting features sometime ascribed to either model, should be considered.

Many respondents supported the position outlined in the Discussion Paper, that no approach would automatically enable anonymity and, in particular, that no digital system can fully replicate the anonymity of physical cash. Many respondents were of the view that the real technical distinction between accounts and tokens is at the data level. Many also noted that for both token and account approaches it is likely that a ledger would be required in order to determine authenticity and ownership.

Some respondents also suggested that the implementation of either approach would not fundamentally differ in terms of the overall system architecture, nor in the range of functionality that could be possible (eg including offline payments and programmability).

The Bank’s approach to this topic will be to look beyond the ‘token’ and ‘account’ labels, and instead to focus on the range of underlying characteristic and features, and to further explore the approach(es) that best deliver the necessary functionality for CBDC.

Offline payments

Offline payments would present a major technological challenge. Potential solutions would likely involve using secure physical devices to ‘store’ CBDC, but these would inevitably still involve a degree of risk.

There was widespread acknowledgement that ‘offline’ payments, where users are able to transact in CBDC even when neither the payer nor payee were connected to a network, would present a significant technology challenge. In addition to discussing solutions to offline payments, several respondents noted ways in which the need for offline functionality could be avoided or minimised, often by making use of multiple different types of communication network. For example, in addition to CBDC transactions relying on an internet connection, it may be possible to enable transactions to be submitted via SMS. Having multiple routes to submit transactions would limit the impact of outages in any one network, and may also provide greater coverage.

Many of the potential suggested solutions were based around approaches where CBDC is stored locally on a device (eg on a smartphone), often where users would need to ‘download’ CBDC to the device in advance, whilst they are online. These devices would then have a mechanism to allow transfers directly to another device in close proximity. And this could be enabled using a range of existing technologies, such as Near-Field Communication (NFC), Bluetooth or QR codes.

However, many respondents noted that this device-based approach would lead to a ‘double spend’ risk – ie the risk that a user transfers the same units of CBDC to multiple recipients. Therefore solutions would require some form of secure hardware device (eg via a secure chip in a smartphone, or a bespoke smart card device), which prevents the spending of the same units multiple times.

Many noted that, regardless of the technology approach, offline transactions would not be fully final until one of the parties reconnects to network, and therefore that they would inevitably pose some degree of credit risk in the intervening period. As a result there were many suggestions from respondents that offline payment use should be limited, for example payments would only be possible for transactions below a certain value. They also noted that a key consideration will be ensuring there is clear agreement on who bears the liability in case of any issues.

Programmability

Programmability could enable a wide range of interesting future applications. But respondents did not think this functionality should necessarily be a part of the core architecture.

Respondents proposed a wide range of interesting applications for programmable payments. A small (non-exhaustive) selection of examples of these are shown in Table B.

Table B: Suggested applications for programmable payments

Category	Respondents' examples
Device to device payments, or Internet of Things applications	<ul style="list-style-type: none"> • Utilities smart meters paying providers directly. • Smart cars automatically paying for fuel directly with the dispensing pump, or paying for motorway tolls automatically.
The ability to impose restrictions or limits on spending	<ul style="list-style-type: none"> • Parental controls for children's use of CBDC. • Restrictions on how certain funds can be spent, eg charitable donations. • Restricting economic stimulus payments to be used for certain goods/services/sectors. • Pre-emptive controls to detect and prevent money laundering etc.
Payments which are triggered by certain conditions being met	<ul style="list-style-type: none"> • Automated payment on insurance policies, for instance if a flight is delayed beyond a certain amount of time. • Automated refunds. • Payment on delivery of goods or services.
Routing of transactions to different recipients	<ul style="list-style-type: none"> • Automated taxation routing at point-of-sale. • Automated charitable donations, for example rounding transactions up to the nearest pound and routing the difference to a chosen charity.

The majority of respondents thought any functionality for programmable money should sit outside the core architecture in a layered approach. Such functionality could either be provided by the Bank as a separate part of the system, or instead provided by Payment Interface Providers (PIPs). This approach would help to minimise potential security risks to the ledger and also help to keep minimise the complexity of the ledger, minimising any impact on performance and efficiency. Such an approach would imply a simple core ledger enabling more flexibility and extensibility for future.

While some respondents suggested that programmability would have a dependence on token or blockchain approaches, several others also noted that this was not strictly the case. For the latter group, programmability could equally be enabled on centralised infrastructure, with some even noting that a centralised approach would be cheaper and simpler.

Future technology trends

Future technology trends, including the Internet of Things, artificial intelligence, and quantum computing, should be factored into the design of any CBDC.

Respondents outlined some of the future trends in technology that could be important factors in the design and operation of CBDC. These included:

- The emergence of the 'Internet of Things' (IoT) and how this will change how people interact with devices and manage their finances, for example leading to devices initiating CBDC payments, or even payments between devices.
- The potential integration and application of artificial intelligence (AI) and machine learning (ML) into CBDC, for example to provide more efficient and effective tools to prevent and detect unlawful activity (eg money laundering)
- Advances in quantum computing, which could have significant implications for the security of any CBDC system.

A common theme among responses was that these examples of future developments clearly highlight the need for any CBDC to be designed with future flexibility and extensibility in mind, so that it could continue to meet the needs of users, and provide a reliable and resilient service.

Another common theme was the need for interoperability. Any design of CBDC would need to allow users to interact between CBDC and the current financial system in a seamless fashion. This would also need to include interoperability with potential future developments, including enhancements to existing payment systems, or the emergence of new payment services, such as stablecoins. The need to consider interoperability with other national CBDCs, for cross-border applications, was also noted by several respondents, and this should be factored into the respective designs of CBDC at an early stage.






Next steps

The Bank of England received a large number of responses to the 2020 Discussion Paper and is grateful for the engagement and input of all those who shared their views.

While the Bank of England has not yet made a decision around CBDC, the feedback we received has showed strong support for the Bank to continue exploring CBDC. That said, respondents were clear about the need for the Bank to set out clearly the 'use case' for a UK CBDC that might justify its introduction.

In light of the feedback it received, the Bank of England has alighted upon five principles to guide its exploration of CBDC going forward (Table C):

Table C: Principles for CBDC

	1. Financial inclusion should be a prominent consideration in the design of any CBDC.
	2. A competitive CBDC ecosystem with a diverse set of participants will support innovation and offer the best chance to deliver the benefits of CBDC.
	3. In assessing the case for CBDC, due recognition should be given to the value of other payments innovations, and their ability to deliver the benefits the Bank of England seeks.
	4. CBDC should seek to protect users' privacy.
	5. While CBDC should 'do no harm' to the Bank of England's ability to deliver monetary and financial stability, opportunities to better meet our policy objectives should also be considered in CBDC exploration.

The Bank will progress its CBDC exploration through several initiatives.

- A joint **Taskforce** with HM Treasury to ensure a strategic and coordinated approach to CBDC exploration by UK authorities, in line with their statutory objectives.
- A **CBDC Engagement Forum** will engage senior stakeholders on the practical challenges of designing, implementing and operating a CBDC. This will include stakeholders across industry, academia and civil society.
- A **CBDC Technology Forum** to gather input on all technology aspects of CBDC from technical specialists.

The decision on whether to proceed with a CBDC is a profound one given the many public policy issues it raises. The Bank is committed to openness and transparency in its exploration of CBDC, and looks forward to continued dialogue with all stakeholders as we progress our work.

Annex: Questions asked in the March 2020 Discussion Paper

Understanding the impact of CBDC on payments

CBDC poses a number of potential opportunities for improving the payments landscape in the UK, as discussed in Chapter 2.4 of the 2020 Discussion Paper. However, each of these opportunities also come with challenges that require careful consideration.

1. How could CBDC be designed to support a more resilient payments landscape in the UK?
2. How could CBDC be designed in a way that improves the efficiency and speed of payments, while also facilitating competition and innovation?
3. How could CBDC be designed to meet future payment needs? How might future innovations and evolutions in

technology (eg the Internet of Things) change these needs?

4. As usage of cash as a means of payment declines, is it important to preserve access to central bank money for households and businesses?
5. Does CBDC pose other opportunities or challenges with respect to the payments landscape that we have not discussed?
6. What factors would determine the level of adoption of CBDC as a means of payment in the UK?
7. Are the design principles described in Chapter 3.2 comprehensive? What are the most significant trade-offs between some of these design principles?
8. There are significant initiatives underway in the UK to facilitate improvements in both electronic and cash payments. These initiatives are outlined in the appendix. The Bank will continue to fully support these initiatives, recognising the significant benefits they could provide for the UK payments landscape. It is essential to understand how CBDC would work alongside these existing initiatives, and how CBDC fits into the wider payments landscape.
9. How could CBDC be designed to complement other public and private sector initiatives to improve payments in the UK?
0. Could CBDC provide unique benefits, over and above existing initiatives, to improve UK payments?
 1. Could the potential benefits of CBDC alternatively be achieved with policy levers to (a) influence the private sector to deliver a better payments landscape, or (b) address market failures or co-ordination problems in the private sector?
 2. Could the potential benefits of CBDC be alternatively achieved by enabling new innovative private sector arrangements (eg stablecoins) to develop?

Understanding the impact of CBDC on monetary and financial stability

As discussed in Chapter 5 of the 2020 Discussion Paper, CBDC could impact the structure of the banking system and the way that the Bank achieves its primary objectives to maintain monetary and financial stability. It is important to fully understand these impacts, and ways to mitigate any risks through the design of CBDC.

1. What opportunities could CBDC provide to enhance monetary or financial stability?
2. How much demand would there be to hold CBDC? How would that demand vary depending on the economic design choices outlined in this paper?
3. To what extent might CBDC lead to disintermediation of the banking system? How would the degree of disintermediation vary with different economic, functional and technological design options outlined in this paper? How would different degrees of disintermediation affect the stability of banks and the rest of the financial system?
4. How would CBDC affect the monetary transmission mechanism and policy setting under existing monetary policy frameworks? What overarching analytical frameworks could be used for modelling how CBDC would affect the macroeconomy and monetary policy?
5. What are the most significant risks to monetary policy implementation, and how could those risks be addressed?
6. How could CBDC affect the portfolio of unconventional monetary policy tools available to the central bank? How effective would a remunerated CBDC be in relaxing the effective lower bound on monetary policy?
7. How would increasing the efficiency of payment systems affect the macroeconomy and monetary policy?

Functionality and provision of CBDC

In the platform model of CBDC, presented in Chapter 4 of the 2020 Discussion Paper, the Bank would build a fast, highly secure, and resilient technology platform — the 'core ledger' — which would provide the minimum necessary functionality for CBDC payments. This would serve as the platform to which private sector firms, called Payment Interface Providers, could connect in order to provide customer-facing CBDC payment services.

1. What are the advantages and disadvantages of this public-private payments platform approach? What alternative approaches might be considered?
2. Are there viable business models that would incentivise firms to offer CBDC-related payment services in this

approach?

3. What are the respective advantages or disadvantages of (a) the pooled accounts model described in Chapter 4.2, and (b) the alternative approach described in Box 3 in Chapter 4?
4. In the platform model, Payment Interface Providers would build ‘overlay services’ — additional functionality that is not part of the Bank’s core ledger, but which could be provided as a value-added service for their users.
5. What kind of overlay services would be most useful? What functionality would a CBDC core ledger need to provide to enable these?
6. How could CBDC be designed to ensure businesses are able to easily accept CBDC payments at the point of sale?
7. What would be needed to ensure that CBDC would be inclusive and accessible by all sectors of society in the UK?
8. What is the appropriate privacy model for CBDC? Is it necessary, or feasible, to replicate any of the privacy aspects of cash?
9. Would offline payments functionality be required in CBDC?

Technology, infrastructure and further innovation

As discussed in Chapter 6, the technology used to power CBDC should be chosen on the basis of what best meets our design principles. It will therefore be necessary to understand the potential of a range of different technologies, and the trade-offs each of these presents.

1. The paper describes a core ledger, operated by the Bank, which supports a range of Payment Interface Providers through an API layer. What are the advantages and disadvantages of this architecture? What are the alternative architectures that we should consider?
2. What are the main trade-offs that arise in deciding on a technology approach? What should we be prioritising in these trade-offs?
3. The core ledger for this model of CBDC could be centralised, or operated through a consensus-driven distributed approach. Which is the optimum approach, and why?
4. What are the merits, or challenges, of either ‘token-based’ or ‘account-based’ approaches to a CBDC ledger? Are there particular use cases that are better supported by either approach? Are there alternative approaches?
5. What are the key use-cases for programmable money?
6. What architecture choices would best support programmable money functionality in a CBDC? Would it be preferable to build this functionality into the core ledger, via a separate module, or to enable the functionality to be provided by third parties? Are there alternative approaches?
7. How could CBDC support offline functionality? Are there technology solutions that can enable this without exposing any party to credit risk?
8. What dependencies would CBDC have on other innovations, such as digital identity solutions?
9. What other future technology and digital economy innovations should we be factoring into the potential design of CBDC? How might these impact the future demands placed on CBDC, and potential approaches to designing a CBDC?

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1. Bank of Canada, Bank of Japan, European Central Bank, Federal Reserve, Sveriges Riksbank, and Swiss National Bank.
 2. Such a proposal is discussed by [Bindseil \(2020\)](#)
 3. [Meaning, Dyson, Barker and Clayton \(2018\)](#) discusses the link between CBDC and unconventional monetary policy and was referenced by several respondents.
 4. Discussion of a digital token in this way tends to draw parallels with the physical world, where for example possession of a banknote confers ownership. This parallel may not be accurate, however, due to inherent differences between digital tokens



and physical assets. Digital data can be replicated and many people could possess the same digital information, and so digital tokens may still need a mechanism to determine ownership and authenticity. The nature of digital tokens is a complex and evolving area which, in addition to these technology considerations, raises important legal questions. The Bank will keep this area under review as its work on CBDC progresses.



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