



FPWG

**THE IMPACT OF DIGITAL
CURRENCY ON THE FUTURE
OF PAYMENTS**

CONTRIBUTING AUTHORS

Antony Welfare
NEM Software

Geoff Goodell
UCL Center for
Blockchain
Technologies

Jane Gamble
Payment Horizons

Jannah Patchay
Markets Evolution

Nick Davies

Jeremy Wilson
Whitechapel Think
Tank

Jim Ford
JR Payments
Consulting

Lee Schneider
Block.one

Nikhil Vadgama
UCL Centre for
Blockchain
Technologies

Phil Kenworthy
Payment Systems
Consultancy

Victoria Thompson
FourAid



The City of London Corporation and
Innovate Finance provide secretariat
support for the Whitechapel Think Tank



INNOVATE
FINANCE

TABLE OF CONTENTS

A.	Executive Summary	04
B.	Money, Digital Currency, and their Social and Economic Roles	10
C.	The Case for a UK Central Bank Digital Currency	16
D.	Requirements Underpinning a UK CBDC	28
E.	Design and Architectural Considerations for a UK CBDC	36
F.	The Impact of a CBDC on the UK's Payments Infrastructure	46
G.	The Road to Adoption of a CBDC	56
H.	Conclusions and Recommendations for a Well-Designed Digital Pound	66
	Appendix – Selected Resources	70



A. Executive Summary

1. THE WHITECHAPEL THINK TANK

The Whitechapel Think Tank (**WTT**) is an independent, not-for-profit body created to represent and advance the global FinTech and Distributed Ledger Technology (DLT) community in the UK. Supported by the City of London Corporation and Innovate Finance, its mission is to accelerate the UK's leading role in the financial services sector by directly supporting its stakeholders across the public and private sectors.

The WTT's membership ranges from global financial institutions and seed-stage start-ups through to investors, professional services firms, regulators and government departments. By bringing together and connecting the most forward-thinking participants in financial services, the WTT, alongside Innovate Finance and the City of London, is helping to create a more informed, transparent, diverse and inclusive financial services sector in the UK.

With this objective in mind, and with an eye to the accelerating pace of developments in this space, the WTT created the Future of Payments Working Group (the FPWG) in early 2020. The FPWG consists of a sub-group of WTT members and external participants, including academic and other industry participants, who collaborate to research and develop thought leadership and advocacy around the themes of digital economies, and the future of money and payments.

2. INTRODUCTION

Money is the indispensable lubricant of our modern global economy and society. The emergence of Central Bank Digital Currencies (CBDCs) as a new form of money is therefore a development of profound importance. It will transform a key element upon which the livelihoods of peoples around the world depend. This is a global phenomenon. The engines of its progress are, in the early stages, being ignited by and within individual jurisdictions. From these starting points, its impact will extend beyond physical boundaries, to be felt across the emerging digital landscape.

This paper is one of the first of its kind to bring together subject matter experts across different disciplines, in understanding and assessing the foundations of this digital transformation of the British Pound and its associated infrastructure. The FPWG has drawn on the expertise of a wide range of specialists, from leading edge pathfinders in the private and public sectors, including academia, to seasoned practitioners in the world of extant payments infrastructure. Some are on the Whitechapel Think Tank's Future of Payments Working Group itself; others are cited as independent experts.

The paper focuses on the UK's implementation of a digital Pound; nevertheless, it is necessary to consider the global context in which that digital Pound will operate, and the requirements arising from this. The paper also acknowledges - and in some instances amplifies - the engagement of other initiatives and stakeholders around the world, in particular those charged with ensuring the stability of the financial system. The speech¹ by the Governor of the Bank of England to the Brookings Institution on 3rd September 2020 is a reflection of that engagement.

¹ "Reinventing the wheel (with more automation) – speech by Andrew Bailey, 3rd September 2020, <https://www.bankofengland.co.uk/speech/2020/andrew-bailey-speech-on-the-future-of-cryptocurrencies-and-stablecoins> (accessed 21st September 2020)

In the course of writing this paper, the FPWG identified a number of key policy considerations pertinent to the development and implementation of a UK CBDC:

1. As a new form of money, CBDC and its accompanying payments infrastructure, require universal standards that embed values common to all peoples in the protection of civil liberty and personal privacy according to the mores of individual nations and societies.
2. Governments - individually and collectively - should carefully consider the ethical and legal frameworks as well as the parameters within which CBDC will operate, taking account of, and with assistance from, all facets of the private sector and the general public.
3. The driving force behind the introduction of CBDC lies in innovation beyond - and within - established participants in the world's monetary systems, and its financial and payments ecosystem. This creativity should be encouraged. It promotes better solutions and implementations, and it empowers participants and it fosters greater economic inclusion.
4. The security of the world's monetary system calls for enlightened regulatory oversight at every stage, guiding but not stifling the benefits of the transformation enabled by CBDC.
5. New business models beyond the financial services sector are already emerging, that rely on deployment of digital currencies. In the absence of CBDC, these will be fulfilled by the use of privately issued forms of digital currency.
6. The geopolitical implications of large-scale adoption and interoperability between different CBDCs will require collaboration between the world's government agencies, as well as its global supranational institutions.

The authors of this paper strongly believe that the United Kingdom, as a world leader in the provision of financial services and innovation within that sector, both of which are enabled and supported by the certainty and protections afforded by its regulatory bodies, is well placed to lead, guide and support the transformation to a digital economy both domestically and globally.

3. THE CURRENT STATE – A GLOBAL VIEW OF CBDCS

Over the past year, since Facebook's announcement of its Libra project, momentum has increased in most major jurisdictions around the adoption of CBDCs². The numerous reports from central banks, governmental agencies and inter-governmental organisations attest to the level of interest and thought that the topic has attracted.

During this period, the Bank of England has published discussion and consultation papers on the subjects of both Retail and Wholesale CBDC during this period. Complementing this activity, the Bank for International Settlements (BIS) has recently announced the creation of a new hub³, consisting of the Bank of Canada, Bank of England, Bank of Japan, European Central Bank, Sveriges Riksbank and the Swiss National Bank. The group will share experiences in assessing the potential cases for CBDC in their home jurisdictions, considering economic, functional and technical design choices, including cross-border interoperability.

² Refer to selected resources in Appendix A.

³ BIS Innovation Hub, <https://www.bis.org/topic/fintech/hub.htm> (accessed 12th October 2020)

Many other central banks are also exploring the concept, with the People's Bank of China announcing the imminent roll-out of its digital Yuan (also known as the Digital Currency / Electronic Payment, or "DCEP"). The Sveriges Riksbank has run a successful proof-of-concept for its e-Krona Project. The Bank of Canada has undertaken fairly advanced research and design for a Retail CBDC via Project Jasper, enabling it to draw up contingency plans for execution in the event that a cryptocurrency or other private stablecoin achieves greater traction as a payment instrument. It has also undertaken some testing of cross-border interoperability with the Monetary Authority of Singapore (MAS) and its Project Ubin, a series of CBDC experiments. The Dutch, French and German central banks have all issued papers on the topic and the European Central Bank is studying various ideas for the implementation of a digital Euro.

The United Kingdom, as a world leader in the provision of financial services and innovation...is well placed to lead, guide and support the transformation to a digital economy both domestically and globally.

4. A CENTRAL BANK DIGITAL CURRENCY FOR THE UK

The FPWG's ultimate consensus is that that the global implementation of CBDCs is inevitable, particularly in light of recent developments around private global stablecoins (such as Libra). The level of resources now being devoted across the private and public sectors to CBDCs - or their private sector equivalents - will leave jurisdictions with no choice but to keep up. That will be especially true if governments choose to use CBDCs as a financial tool for trans-national influence. In addition, there is a national security consideration: as private global stablecoins grow in use, their operators' holding of underlying currency to back them has the potential to create exchange rate fluctuations. The introduction of CBDCs therefore provides a means for central banks to preserve the sanctity of sovereign monetary policy as a tool for national economic independence and management.

Through this paper, the FPWG adds its voice to the discussion and debate in regard to the desirability, positioning and impacts on the UK payments infrastructure of a multi-functional central bank digital currency for the UK. Whilst the focus is on a UK domestic retail CBDC, it is impossible to give this matter due consideration without also examining the wider global context in which it will operate, ranging from political and economic impacts, to infrastructural changes and industry viewpoints.

The paper addresses the following questions in relation to the introduction of retail CBDC in the UK:

1. Money, Digital Currency and their Social and Economic Roles

– What is the difference between money and currency? What is the current digital currency landscape? What is the role played by currency in society and economies, and how will a CBDC advance this role?

2. The Case for a UK Central Bank Digital Currency

– What are the implications of introducing retail CBDC, considered in the context of the preceding questions? What are the opportunities offered by the introduction of retail CBDC?

3. Requirements Underpinning a UK CBDC

– What are the essential user requirements and social benefits that must be delivered in order for it to succeed in implementation and uptake?

4. Design and Architectural Considerations for a UK CBDC

– What are the main design choices and options around implementing a CBDC, and what are the wider implications of each?

5. The Impact of a CBDC on the UK's Payments Infrastructure

– How will the introduction of digital currency / money impact existing firms' business models

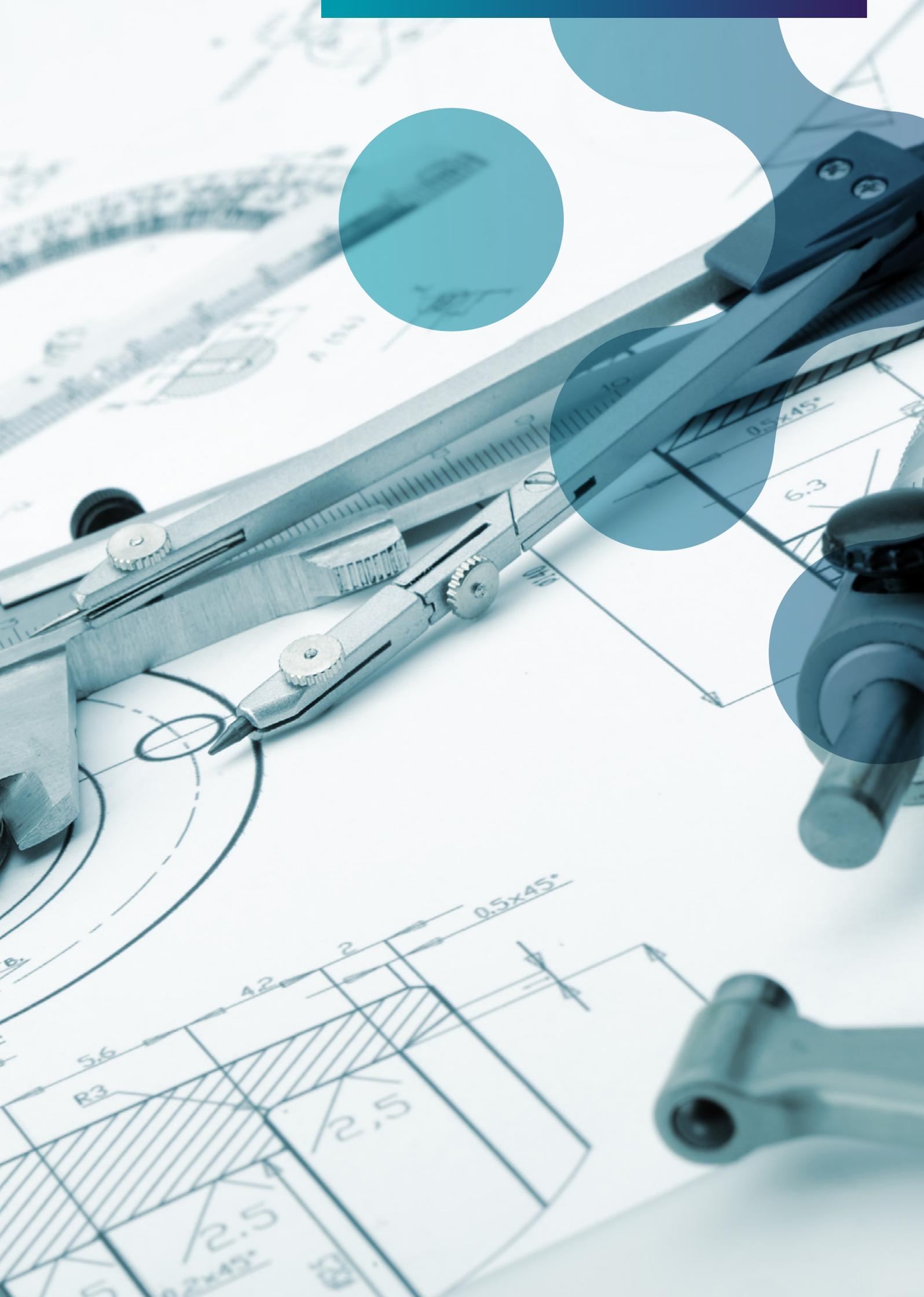
and operations, specifically within the financial services sector, but also considering the "real economy" clients of financial institutions? What do firms need to begin considering for a successful transition to a digital economy?

6. The Road to Adoption of a CBDC

– How does the UK plan for successful implementation and rollout of a digital Pound?

7. Recommendations for a Well-Designed Digital Pound

– In conclusion, what are the FPWG's recommendations for a successful UK CBDC that is able to deliver on the promised benefits?



B. Money, Digital Currency, and their Social and Economic Roles

1. THE ECONOMIC FUNCTION OF MONEY

Money serves as a medium of exchange, store of value, and unit of account. Our complex modern economic and financial systems are predicated on the existence of money. Of these, it could be argued that serving as a standardised medium of exchange – a universally understood method of payment for goods and services – is the most important function of money. As long as human civilisation has existed, the need to value goods and to make fair exchange for value has existed as well. Prior to the introduction of money as a concept, the barter system fulfilled this role. Barter, however, posed its own challenges and barriers due to the need for both parties to a transaction to firstly require the goods or services offered by the other, and secondly to then be able to evaluate the relative value of both their own, and each other's, goods or services. Money therefore introduces a necessary layer of abstraction between the two parties, allowing them to each value their goods and services independently against a common medium of exchange.

Expanded production of goods and services enables economic growth at a societal level, which in turn drives a rise in the incomes of individuals, and, if distributed fairly across socio-economic groups, the improvement of living standards across that society. In a modern capitalist economy, the primary means of capital allocation is via investment in businesses, which produce goods and provide services. Thereby creating more jobs and opening up new investment opportunities, and thus helping to distribute the gains of economic growth across socio-economic groups.

2. THE DEFINITION OF CURRENCY

Currency, or more specifically fiat currency, is the form of money that is issued and backed by a government, as opposed to being backed by or deriving its value from any physical asset such as gold or silver. As such, currency is the means by which any polity is organised, as well as being a reflection of that state's values and mores.

In liberal democracies, fiat currency issued by the state is freely exchangeable. In these jurisdictions, where power may be devolved and central government intervention is generally the exception rather than the rule, the national currency is a unifying, and indeed defining, aspect of the nation state. The expressions "pound sterling" or "almighty dollar" connote more than just the unit of account or store of value that is the traditional definition of money, but reflect those countries' pride and trust in their state and those aspects of it that are represented by having stable and reliable currencies.

That pride and trust are in turn derived from behaviours on both sides of the social contract, operating at both implicit and explicit levels in any given political system. The state takes measures to ensure the rule of law, the rights of property and social stability and cohesion, while the citizen in return agrees to abide by the law, pay their taxes and respect the rights of their fellow citizens. A national currency therefore represents, at the domestic level, a potent and real symbol of the relationship of trust and mutual support that exists between the state and its citizens. The strength of that trust relationship, as reflected in the health of

the currency, is also measured in the value of the currency on international markets, and the ease by which it can be exchanged for other currencies in cross-border transactions.

Based on this fundamental trust relationship, the national currency is also the means by which the practicalities of the social contract are given effect. Citizens - both individual and corporate - make the majority of their contributions to the state by paying taxes; the state in turn uses these funds, received in the national currency, to implement much of its re-distributive activity, the effectiveness of which will increase trust in government and governance as well as the currency that represents its effectiveness. Thus, the circle is completed, and currency may be viewed as both a reflection and a means of ensuring the overall amount of trust and effectiveness in any given political system.

Described in this way, the role of any given fiat currency goes far beyond merely enabling the simple transfer of value from one person or entity to another. Current developments in technology enable different relationships between individuals, legal entities and indeed nation state. Therefore, the role that currency plays in the establishment and maintenance of those interplays should be carefully considered. Traditionally, currencies have been passive responders to changes in political priorities. There have been occasions when the roles played by, and mechanisms underpinning fiat currencies have reached the top of the agenda – usually when a crisis occurs (for example, Bretton Woods post-WW2, the UK leaving the European Exchange Rate Mechanism, or ERM, in 1992, and, more recently, post-global financial crisis capital adequacy changes) – but the position is now very much different from all of those.

3. TYPES OF MONEY AND THEIR ROLES IN THE MONETARY ECOSYSTEM

Money takes two primary forms within modern global economies, namely:

- a. **Cash, including physical currency such as paper notes and coins.**
- b. **Digital money, represented in the first instance in the form Bank of England reserve accounts (“central bank money”), and then on the balance sheets of regulated financial institutions (“commercial bank money”, including bank deposits).**

Cash represents a direct central bank liability, and the majority of cash is held by individuals and businesses as a store of value. Banks also hold limited cash reserves to ensure that their customers can withdraw their bank deposits at any time. Cash is tangible, has a cost of production and a finite lifespan, but has strong properties of privacy and anonymity. It is noteworthy that cash usage, globally, is in a declining trend, and its decline in some countries has been accelerated recently by the Covid-19 pandemic, as individuals and businesses have been incentivised, and in some cases forced, to adopt non-cash payment methods.

Bank deposits represent the dominant form of commercial bank money, and indeed any money, used by individuals and businesses. In the UK, 97% of the money held by individuals and businesses is in the form of bank deposits⁴. Bank deposits are held in accounts that are tied to individual’s and business’s identities. Central bank reserves and linked settlement accounts are normally only available to commercial banks and are used to settle payments between these entities. In certain countries, including the UK, large payments providers are also able to hold funds at the central bank as reserves. Central bank reserves, like cash, are central bank liabilities and are risk-free. (This is different from bank deposits which carry some risk but are protected in most countries, up to a certain amount,

⁴ “Money creation in the modern economy”, Michael McLeay, Amar Radia and Ryland Thomas, <https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/2014/money-creation-in-the-modern-economy> (accessed 12th October 2020)

through government-backed insurance schemes such as the UK's Financial Services Compensation Scheme).

It is important to note that credit, debit and charge cards (and the payments services built on these) are not themselves forms of digital currency; they are mechanisms for effecting payments using digital money, with underlying credit facilities or corresponding bank transfers. Payments apps, such as Venmo, are labelled in some jurisdictions as "e-money"; they are functionally the same as cards, creating an electronic means for transferring digital money. E-money accounts are also provided by many challenger banks and offered by payment solutions providers.

Both cash and digital money currently play significant roles in commerce and trade, finance, education, taxation, distribution of government benefits and distribution of charitable aid and other funding.

Cash is tangible, has a cost of production and a finite lifespan, but has strong properties of privacy and anonymity. It is noteworthy that cash usage, globally, is in a declining trend...

4. THE SPECTRUM OF DIGITAL CURRENCIES

Digital currency can be seen as the next phase in the evolution of existing money (both cash and digital money). However, not all forms of digital currency are analogous to existing money. Cryptocurrencies, such as Bitcoin, are inherently unstable as they are effectively free-floating currencies not backed by any central bank or other guarantor (the value is based on perception rather than a promise (by a government) or a supporting asset). Stablecoins, of which Tether and Facebook's Libra coin are amongst the most well-known, derive their value by virtue of being pegged to an asset or underlying basket of assets, such as fiat currencies, gold and other commodities, or financial instruments. Cryptocurrencies are typically native to decentralised infrastructure (such as the Bitcoin blockchain) and have no central operator. Stablecoins are typically issued and operated by private corporate entities, with no 'social' contract between the parties holding (and transacting) in the digital currency, and the corporate provider of the currency.

A central bank digital currency (CBDC), however, is fiat currency underwritten by the government of the issuing country, in a digitally native form. It therefore represents a mechanism whereby individual consumers and businesses may hold Central Bank money. CBDCs may also incorporate additional and greater functional capabilities by design, such as the ability to operate on multiple platforms and to be distributed in new ways. A well-designed CBDC may be used like cash even though it exists only in digital form. It may also be exchanged for cash or other assets.

5. CENTRAL BANK DIGITAL CURRENCIES

CBDCs represent a new form of sovereign fiat currency: a legal tender that is digitally issued by a central bank or monetary authority. As a digital currency, CBDCs can be used to facilitate transactions between people (C2C), people and businesses (C2B and B2C), businesses (B2B) and both people and businesses and government (C2G and B2G and vice versa). In these contexts, the digital currency is typically referred to as a “retail CBDC”. Like existing central bank money, CBDCs have the capability to be used within the payments and settlement infrastructure that exists between central banks, commercial banks and other payments and financial institutions, as a “wholesale CBDC”.

A UK CBDC will need to address a range of use cases in different ways and across different systems, depending on the nature of the participants in these systems, and their requirements. This is reflective of the current split between wholesale and retail payments use cases and infrastructure. Wholesale payments infrastructure is accessible only by financial institutions that are able to demonstrate compliance with certain regulatory and prudential requirements. The primary purpose of wholesale infrastructure is to effect the settlement of transactions, be these payment vs. payment (PvP) or delivery vs. payment in securities settlements (DvP). Retail payments infrastructure, again regulated to ensure financial probity, primarily supports the needs of non-financial businesses and individual citizens.

The benefits delivered by a CBDC vary depending on the nature of its usage. For example, addressing wholesale use cases will support greater settlement efficiencies in the wholesale cross-border markets as well as underpinning the development of both UK and global digital asset markets. Retail payments use cases, on the other hand, have greater potential for transforming the relationship between government, businesses and individual citizens, providing a foundation for building a more digital economy and to be leveraged as drivers of greater financial inclusion.

These potential benefits have piqued the interests of central banks globally, not to mention the role played by CBDCs in maintaining the ability for central banks to influence and execute monetary policy in an increasingly cashless world, where new forms of digital money are emerging in response to the use cases presented by the transition to a digital economy (private stablecoins in particular). The Covid-19 pandemic has also highlighted the shortcomings with the UK’s current payment systems and infrastructure in terms of their ability to deliver aid and financing to both individuals and businesses quickly and effectively. This has led to a closer examination of the potential that CBDCs might have in facilitating rapid and direct social and monetary policy transmission throughout the economy.

As previously stated, this paper focuses on the rationale for, and considerations around design, requirements and architecture of, a UK retail CBDC.





C. The Case for a UK Central Bank Digital Currency

The FPWG firmly believes that there are many potential benefits to be harnessed through the adoption of a well-designed CBDC within the UK. There are also undoubtedly significant challenges associated with the introduction of a new form of currency, and many questions require resolution in order to understand the full extent of the impacts to business and society - and the opportunities created - when introducing a CBDC.

This section explores the case for a UK CBDC, framed in terms of both the external and internal drivers for a CBDC, as well as the benefits that may be realised by various actors and participants within the UK economy.

A well-designed CBDC has the potential to bring the UK fully into the digital age, allowing UK citizens to participate as full members of the digital economy, and readying the UK for the future as digital platforms continue to grow in usage and capabilities. The FPWG sees the potential benefits as falling into a number of categories, including but not limited to, monetary policy, economic and social benefits, enabling the growth of the digital economy, and facilitating greater financial inclusion.

The IMF outlines the following potential benefits associated with adoption of retail CBDCs⁵:

• Monetary policy

- CBDC may improve monetary policy effectiveness to implement targeted policy, or to tap more granular payment flow data to enhance macroeconomic projections.
- An interest-bearing CBDC may enhance the transmission of monetary policy, by increasing the economy's response to changes in the policy rate. Such a CBDC could be used to break the "zero lower bound" on policy rates to the extent cash were made costly.

• National security and monetary sovereignty

- CBDC would help reduce or prevent the adoption of privately issued currencies, which may threaten monetary sovereignty and financial stability, and be difficult to supervise and regulate.
- CBDC may help improve traction of local currency as means of payments in jurisdictions attempting to reduce dollarisation.

• Economic and social policy - CBDC could play a role in distributing fiscal stimulus in times of crises, with a potentially wider reach than existing mechanisms operating via the banking system i.e. to the unbanked and other financially excluded or underserved recipients.

• Payments infrastructure - CBDC may enhance payment system competition, efficiency, and resilience in the face of increasing concentration in the hands of few very large companies.

• Enabling the digital economy - Introduction of a digitally native fiat currency will help drive greater adoption and innovation of transformative technology paradigms such as artificial intelligence, decentralised systems and applications implemented via distributed ledger technology, and the internet of things.

• Financial inclusion - CBDC may be a means to support financial digitisation, reduce costs associated with issuing and managing physical cash, and improve financial inclusion, especially in countries with underdeveloped financial systems and many unbanked citizens.

⁵ "Central Bank Digital Currencies: 4 Questions and Answers", Tobias Adrian and Tommaso Mancini-Griffoli, <https://blogs.imf.org/2019/12/12/central-bank-digital-currencies-4-questions-and-answers/> (accessed 12th October 2020)

THE FPWG'S CASE FOR A UK CENTRAL BANK DIGITAL CURRENCY

The FPWG has identified seven key focus areas in the case for a UK CBDC, building on its members' own research and expertise, as well as drawing on current research such as the previously referenced BIS report:

- i. **The global political context**
- ii. **National Security and Monetary Sovereignty
– The rise of "stablecoins"**
- iii. **The bank of England and monetary policy**
- iv. **The UK Payments infrastructure**
- v. **Enabling a digital economy**
- vi. **Programmable money**
- vii. **Financial Inclusion**

The remainder of this section explores these seven focus areas in greater depth.

1. THE GLOBAL POLITICAL CONTEXT

There is a growing universe of digital currencies in use by, or under development to serve, emerging digital ecosystems and the use cases to which they give rise. All have a similar objective - to overcome transactional and settlement inefficiencies which are major issues in the current global multi-currency structure. They are also seeking to address other issues such as reduction in cash and financial inclusion. Bitcoin, for example, serves as a hedge against weaker conventional fiat currencies. Facebook's Libra has been designed as a currency to settle transactions across a global digital marketplace. China is sponsoring and deploying a CBDC that will run in parallel to its existing fiat currency, for use both domestically and beyond its borders, (albeit focused, for the time being, on its growing sphere of influence within its Belt and Road project).

For central banks, there is a need to reconcile the technical liberation from sovereign boundaries inherent in a digital currency, with their imperative to manage and control domestic money supply and, ultimately, to manage the health and standing of their economies within and beyond their borders. The need to reconcile this conflict is particularly acute in those jurisdictions whose currencies are commonly used beyond their borders as a means of settling transactions in which the local domestic currency is not fit for purpose. The US dollar is by far the largest of those currencies, by virtue of its reserve currency status, which in turn continues to preserve US economic dominance on the world stage.

For central banks, there is a need to reconcile the technical liberation from sovereign boundaries inherent in a digital currency...

The political stakes in this dynamic are especially high at present, as China's burgeoning economy threatens to over-shadow – and potentially soon eclipse – the world's incumbent dominant economy. Historically, one reserve currency has ceded its status to another off the back of the rising wealth of the new reserve currency's issuing nation. If China does indeed assume global economic dominance, precedent would suggest an ultimate transfer of reserve currency status from the US dollar to the renminbi. Such transfers have previously been accompanied by domestic and international political trauma and contention, which have often resulted in military conflict.

Given the valid use cases that already exist for digital currencies, it is becoming ever more possible to envisage a world in which non-fiat digital currencies – whether privately issued or decentralised – compete with fiat currencies. Countries that do not actively begin to explore the potential for introduction of a digital fiat currency may find themselves losing control of their monetary policy, as their citizens and businesses turn to other digital currencies in order to meet their requirements. There is also scope for a first-mover advantage here; the country or countries that are earliest in issuing well-designed CBDCs will likely experience rapid uptake of those CBDCs both domestically and internationally.

2. NATIONAL SECURITY AND MONETARY SOVEREIGNTY -THE RISE OF “STABLECOINS”

In the absence of central bank-backed alternatives, the growing global market for digital assets and digital currencies is and will continue to be fuelled by the use of private stablecoins (e.g. Facebook’s Libra) and cryptocurrencies for the effecting of payments and settlements associated with transactions in these mediums. Their use is not without associated risk to governments, businesses and individuals. The use of private stablecoins, in particular, exposes users to the issuer of the stablecoin. A privately issued stablecoin may be (depending on its jurisdiction) wholly unregulated, potentially insecure, open to all parties including bad actors, and only backed by the guarantee of the issuer that they are holding an adequate reserve of underlying currencies and assets.

These “global stablecoins” may be issued in only one or two jurisdictions but used on a global basis. They have been the specific subject of several recent regulatory consultations given their potential for systemic disruption, lack of consumer protections, and the risk they are capable of posing to monetary sovereignty. The Financial Stability Board consulted in April 2020 on global stablecoins⁶, and the EU published its draft Markets in Cryptoassets Regulation in September 2020⁷.

The great disadvantage of privately issued stablecoins, especially as a means of facilitating payment on-ledger for digital assets and for enabling smart contract execution, is that they create counterparty exposure to the private issuer. The creation of a large number of private stablecoins that are themselves not necessarily interoperable, may also lead to greater market fragmentation, which hinders rather than helps the evolution of digital markets. There are also many undesirable effects of large-scale stablecoin use from a monetary policy perspective – including the potential for public money to be moved from general circulation and onto closed, private networks, and for private companies to (inadvertently or not) manipulate currency value through large movements in the currency or assets backing the stablecoins.

The use of unregulated stablecoins and cryptocurrencies for fraudulent purposes, money laundering, terrorism financing and other criminal activities has largely been addressed by the FATF, with stringent new AML and KYC requirements introduced via local regulations such as the EU’s 5th Anti-Money Laundering Directive (5AMLD). Nevertheless, there remains potential for private stablecoin providers to replace banks and payments institutions in terms of holding value and processing transactions, and the rules governing the former are not as strict in terms of conduct or prudential requirements as they are for banks. In light of these risks, many regulators are moving swiftly to bring stablecoins into the regulatory perimeter (typically treated as either e-money or as financial instruments, depending on the composition of their underliers). The EU’s draft Markets in Cryptoassets Regulation, or MiCA⁸, addresses all of these issues with respect to stablecoins in a very specific and targeted manner.

There are also consumer protection concerns associated with the widespread use of stablecoins and cryptocurrencies in payments and settlements. In the UK, under the Financial Services Compensation Scheme (FSCS), deposit-holders are currently protected to a limit of £85000 should their bank fail. In contrast, the future failure

⁶ “FSB consults on regulatory, supervisory and oversight recommendations for “global stablecoin” arrangements”, <https://www.fsb.org/2020/04/fsb-consults-on-regulatory-supervisory-and-oversight-recommendations-for-global-stablecoin-arrangements/> (accessed 12th October 2020)

⁷ “Proposal for a Regulation of the European Parliament and of the Council on Markets in Cryptoassets, and amending Directive (EU) 2019/1937”, https://ec.europa.eu/finance/docs/law/200924-crypto-assets-proposal_en.pdf (accessed 12th October 2020)

⁸ Ibid

of a popular stablecoin, or a crash in a widely used cryptocurrency, could have a damaging impact on financial stability, with both retail customers and businesses at risk of losing their holdings in these assets.

The introduction of a well-designed CBDC would disincentivise the use of private stablecoins and cryptocurrencies for payments and settlements in digital asset markets, by providing a central bank-backed alternative digital currency that preserves consumer protections whilst also enabling the benefits associated with digital assets and the smart contracts that govern them. The extent to which these alternatives will be adopted remains to be seen. However, central banks must be open to the risk of the market moving in this direction and equip themselves with the means of replicating the utility of cryptocurrencies and private stablecoins, so that their central and independent roles remain effective.



The introduction of a well-designed CBDC would disincentivise the use of private stablecoins and cryptocurrencies for payments and settlements in digital asset markets...

3. THE BANK OF ENGLAND AND MONETARY POLICY

The introduction of a CBDC promises a number of potential benefits for central banks. The approach to management of monetary and financial stability in the UK has been to place primary responsibility for this in the hands of the independent Bank of England. The Bank, in turn, discharges its responsibilities through robust governance systems such as the Monetary Policy Committee. As discussed in the previous section, the advent and wider use of cryptocurrencies, and of private digital currencies such as Libra, would potentially undermine the effectiveness of that centralised approach to financial stability. As a central bank-backed national digital currency becomes widely accepted as a payment method, it will ultimately act as a dam, preventing money flowing from the regulated fiscal environment into the non-regulated private landscape.

Beyond this basic protective aspect, further exploration of the “sovereign money” approach is required. At one extreme of the CBDC design spectrum, there is potential for the complete disintermediation of banks, should all money creation and liquidity control mechanisms reside, via the CBDC, in the central bank. This scenario is not without its advantages, as it could potentially reduce the overall monetary system’s reliance on the banks and lessen the chances of a repetition of the last decade’s global financial crisis. The FPWG considers that there remains a role for well-regulated commercial banks and other payment infrastructure providers. However, the ability for individuals and businesses to transact and settle directly in central bank money, as a complement to doing so via commercial bank money, would provide an additional protective buffer against the systemic risk and counterparty risk posed by commercial banks and other financial institutions.

CBDCs may also contribute to improvements in monetary policy transmission and allow central banks to deploy highly reactive monetary policy measures. In the event that a CBDC is designed to be interest-bearing, it could directly enable interest rate policies to be transmitted more rapidly and efficiently to end-users. Innovative monetary policy measures may also be supported through the availability of more granular data on how the CBDC is being utilised within the economy. Collection of this data would need to be in compliance with local data protection regulatory requirements; at aggregated levels, this data could further policymakers’ understanding of the effectiveness of monetary policy measures, leading to more precise and targeted implementation of such measures in the future.

⁹ One of the potential benefits of CBDC is as an additional monetary policy transmission tool. In particular as: (1) a countercyclical tool; (2) “helicopter money”; (3) an interest-bearing instrument; (4) a floor-system instrument; and (5) a QE instrument. These are considered in detail in the paper ‘Digital Currency and Economic Crises: Helping States Respond’ which makes compelling arguments for the effectiveness of CBDC in all these areas (which are particularly relevant during a financial crisis). “Digital Currency and Economic Crises: Helping States Respond”, Geoffrey Goodell, Hazem Danny Al-Nakib and Paolo Tasca, <https://arxiv.org/abs/2006.03023> (accessed 12th October 2020)

In the face of extraordinary crises, such as the Covid-19 pandemic, fiscal stimulus could be more directly delivered to end-users in the form of “helicopter money” aimed at helping to mitigate the impacts arising from such crises. In particular, CBDCs have gained attention as a means to effectively distribute government aid and directly reach the financially excluded. Whilst there is no suggestion that the central bank should take on the role of direct aid distribution, a CBDC certainly may provide a more direct, cost-effective, efficient and transparent mechanism for the disbursement of fiscal stimulus and government aid – a concept that will be explored further in this paper⁹. CBDCs may also reduce the costs associated with the management of cash. Cash management costs in developed economies

¹⁰ "The Cost of Using Cash and Cheques in Uruguay", M Alvez, R Lluberas and J. Ponce, Documento de trabajo del Banco Central del Uruguay 004-2019.

amount to 0.2% of GDP in Norway, 0.5% in Canada and 0.6% in Belgium, and can be much higher in developing economies, for instance, 2.5% in Guyana¹⁰. Although the implementation and rollout of a CBDC system involves substantial fixed costs and upfront investment, the marginal cost of operating the system is anticipated to be very low.



4. THE UK'S PAYMENTS INFRASTRUCTURE

The introduction of a CBDC would not supplant the existing UK payments infrastructure. Rather, it would ensure that the payment infrastructure remains relevant, improve payment system competition and provide a fiat, central bank-backed competitor to non-fiat digital currencies. It would also support innovation in the payments space, in the face of the general decline in cash usage. As a fiat currency, and a part of the overall digital money landscape, the CBDC would be fully usable by individuals and businesses in any type of commercial activity and wherever a payment can be made. An interoperable CBDC would become a means of payment on all types of digital platforms.

CBDC, if designed properly, can provide a far more complete and comprehensive payments service for both individual and business users, enabling the legal and regulatory requirements arising from any given payment or transaction to be met in real time. For example, and in line with the Bank of England's own proposition for an Open Banking Platform for the SME sector (<https://www.bankofengland.co.uk/research/future-finance/champion-a-platform>), transactions in a programmable CBDC that is supported by smart contracts could include all the details required for tax and accounting purposes and for regulatory reporting and could even automatically comply with these reporting requirements.

5. ENABLING THE DIGITAL ECONOMY

Introduction of a CBDC will help drive greater adoption and innovation of transformative technology paradigms such as artificial intelligence (AI), decentralised systems and applications implemented via distributed ledger technology, and the internet of things (IoT). Combining the power of AI and DLT can give rise to a diverse set of new business models and applications associated with internet-enabled, networked hardware devices that can act as digital agents for their owners.

For example, a car with an internet connection could also have DLT-based wallet software installed, allowing the car's owner to store digital money in the wallet. The owner can then instruct the car to automatically make payments for fuel as the petrol tank is being filled, as opposed to using cash or a credit / debit card to make payment. Another example might be a refrigerator with an internet connection that automatically detects low stock on shelves and orders groceries for delivery, paying with an embedded software wallet. IoT, when combined with CBDC, can be expected to generate significant new business models, limited only by human imagination (and security considerations).

AI represents another emerging area of technology that is anticipated to leverage a CBDC for development of an array of use cases. In a simple form, as previously mentioned, AI-powered digital agents could include wallet software that stores CBDC tokens and uses them to pay for goods and services based on the owner's instructions. For example, the owner might instruct the digital agent to buy a train ticket with the CBDC monies in the wallet software. Multiple different IoT devices and digital agents could access the CBDC balance in a single owner's wallet or account – although the security offered by support for separate wallets held by each device or agent might be preferable.

Finally, understanding the usage of a CBDC - when and where the currency is used, and for what purposes, will provide vast amounts of behavioural data for analysis by central banks and governments (although this must be balanced against the privacy requirements associated with a CBDC). This involves combining Big Data, AI and DLT technologies to seamlessly and securely use the data available to analyse trends, issues and best practice for the CBDC.

An enhanced understanding of how and where CBDC is used enables further refinement of payment systems to better address the needs of individuals and businesses. The Bank of Lithuania's LBCOIN provides a case study in which the trial of the CBDC launch was also used as a means of understanding how and where users interacted with the currency and its underlying distributed ledger platform, built using the Symbol platform¹¹.

¹¹ "The world's first CBDC (Central Bank Digital Currency)?", Antony Welfare, <https://medium.com/nem-hub/the-worlds-first-cbdc-central-bank-digital-currency-92ea53eeec47> (accessed 12th October 2020)

6. PROGRAMMABLE MONEY

There have been a number of references in this paper to the benefits associated with a programmable CBDC. Programmable money is a form of digital money that, by design, allows for the execution of certain software code in the course of a transaction (using that money). For example, cryptocurrencies are programmable money, as the distributed ledger technology on which they are built inherently supports the development and execution of smart contracts. These smart contracts can execute previously agreed and approved uses – such as “only use this payment type in a shop” or “use these funds for electricity payments only”. Furthermore, the potential for a CBDC user to issue and / or be awarded loyalty points or ratings creates new areas of opportunity, which current physical currencies cannot match.

... the potential for a CBDC user to issue and / or be awarded loyalty points or ratings creates new areas of opportunity, which current physical currencies cannot match.

The FPWG is a strong advocate of programmability as a design feature of a UK CBDC, given the numerous benefits that programmable money can deliver in terms of:

- Predetermined payments made across the trade life cycle of a financial instrument e.g. dividends, subscriptions, coupon payments).
- Facilitating payments in financial derivatives.
- Facilitating payment factoring.
- Conditional payments e.g. on completion of certain contracts conditions, escrow payments.
- Trade finance – payments made on successful presentation of shipping documents.
- Taxation – taking tax at the point of a transaction rather than deferring reporting, processing and payment. (This could be especially useful for customs payments).
- Benefit and “helicopter money” payments.
- Enabling Internet of Things (IoT) devices to become wallets and payment devices.
- Regulatory and legal compliance e.g. automation of regulatory reporting at the point of transaction or payment.
- Ringfencing of certain benefits paid to recipients for specific usages and enforcement of these restrictions e.g. childcare credits, housing benefit, grants.

7. FINANCIAL INCLUSION

The use cases and benefits associated with CBDC have gained significant traction in the context of the current global COVID-19 pandemic, particularly with respect to the potential applications around financial inclusion and government distributions, and the achievement of existing and future public policy.

A well-designed CBDC that encompasses principles of universal account access has the potential to enable greater financial inclusion. This does not necessarily equate to a scenario in which individuals hold CBDC accounts directly with a central bank (nor is that a scenario advocated by the FPWG). In a future payment market structure, payment service providers could provide the account infrastructure (or digital wallets) needed to support this sector, as these firms are more interested in transaction volumes as a driver of revenue generation (they do not 'create' money) whereas banks, the gatekeepers to account access in the current market structure, derive their profits primarily from fractional reserve banking activity (i.e. lending).

Given that the financially excluded are an untapped area in terms of transaction volume, payment service providers could be incentivised to offer accounts or wallets to those customers that are excluded from conventional banking services, regardless of their eligibility for traditional accounts. Greater financial inclusion, and more universal access to accounts, can generate wider social benefits. It can lead to improved credit ratings (building on the PockIt model¹²), lower costs of transactions (to the users of the services) and access to cheaper credit.

¹² <https://www.pockit.com>
(accessed 12th October 2020)

8. CONCLUSION – THE CASE FOR A UK CBDC

Having articulated the significant new opportunities and potential benefits that a CBDC creates for the UK's government, citizens and business, the FPWG believes that the case for a UK retail CBDC, or digital Pound, is clear. These range from enabling greater financial inclusion and facilitating the secure distribution of "helicopter money", to the innovation opportunities afforded by programmable money, to enhanced monetary and economic understanding arising from analysis of how and where the CBDC is used.

The FPWG therefore strongly advocates for the UK Government and Bank of England to embark on a programme of CBDC adoption.



D. Requirements Underpinning a UK CBDC

The FPWG has identified a core set of requirements for a UK CBDC in order to deliver the benefits identified in the previous section. The requirements are listed below with key characteristics the FPWG consider should be included in the design:

1. It must be a type of fiat currency, but also supporting additional functionality, therefore it must:

- a. have a strong legal foundation
- b. have the trait of digital uniqueness
- c. be programmable
- d. support future innovations and evolution of technology in the emerging digital economy.

2. Trust, in terms of both transparency and trust in the implementation, must be implicit in the design, therefore it:

- a. must be secure
- b. should have protections for privacy built in by design
- c. must be resilient and include support for offline transactions or transfers during power and internet outages.

3. It must be easy for individuals and businesses to access and use, therefore it must:

- a. be designed with interoperability; both in terms of interoperability with concurrent non-CBDC payments infrastructure, and interoperability with other CBDCs (and potentially non-fiat digital currencies) globally
- b. contribute to the improved efficiency and speed of payments
- c. be highly liquid
- d. support universal inclusion and access.

1. A FIAT CURRENCY WITH ADDITIONAL FUNCTIONALITY

The true benefits of a CBDC will be realised through the additional, digital-native functionality and use cases that it can support; it should be more than merely a digital 'copy' of cash¹³. It is therefore more useful to benchmark CBDC utility against other existing means of electronic and digital payment. For example, if a business transacts using CBDC and all the consequences of that transaction (audit, reconciliation, tax reporting, balance assessment) are dealt with automatically, instantaneously and at lower cost than today, then take up of CBDC is likely to be higher in the commercial world. Similar benefits and use cases will also accrue to the individual account or token holder.

For these benefits to be realised, the following must be in place and true of the CBDC:

a. Legal foundation

In order for a digital Pound to deliver the benefits outlined in Section C, it must be legal tender of the United Kingdom, usable for the payment of all debts, whether

¹³ If a CBDC only supports instant and atomic settlement of liabilities, then there is a direct behavioural correlation between the use and holding of CBDC and that of cash. Therefore there is a question about the relevance of a CBDC especially with respect to retail usage.

public or private, including, perhaps most importantly, tax obligations to the government. The Bank of England has a clear mandate with respect to all matters concerning the monetary policy and fiat money of the United Kingdom. Within this mandate is included the issuance of all forms of fiat money. Without such breadth of authority, the Bank would not be able to appropriately and responsibly oversee the stability of the UK financial system and engage in its core functions of issuing currency, administering the banking system's engagement with central bank money (including reserves), and otherwise undertaking activities that it deems necessary for the effective implementation of monetary policy.

It is from this foundation that the FPWG believes that a CBDC or digital Pound created and issued by the Bank of England will have full status as legal tender in the United Kingdom. The FPWG nevertheless recognises that the Bank of England will need ensure that the legal basis for the CBDC is sound, particularly in light of the new functionality enabled by a programmable CBDC.

It is also incumbent upon the UK government and its various departments, including HMRC, to ensure that the status of the digital Pound as legal tender is sound, and is not open to question prior to its issuance. Other aspects of the CBDC may also require analysis to ensure compliance with applicable laws, including those relating to privacy and other sensitive personal issues. The FPWG anticipates that all of these matters will be part of the design process, in order to ensure that the eventual implementation is free of any doubts on these crucial points of law.

b. Digital uniqueness

As money controlled and issued by the Bank of England, albeit in digital form, CBDC will effectively act like a secure digital equivalent to cash. CBDC can be used when making payments, is a store of value and is a unit of account. Today, a paper-based currency note carries a unique serial number and therefore, should a token-based CBDC be adopted, each CBDC unit should also be identifiable and distinguishable from every other, in order to prevent imitation. Additionally, CBDC must be securely protected in order to prevent tampering and alteration.

c. Programmability

The FPWG has identified programmability as one of the core benefits of a CBDC, allowing it to support the development of use cases and innovations far beyond the current capabilities of existing digital currency. Automatic payment of taxes, monetary policy support, and new business models involving micro-payments are all examples of potential innovation via a programmable CBDC.

Due care and attention must be given to ensuring adequate security and anti-fraud measures within the APIs and other frameworks supporting the programmability. This must prevent, for example, the same capabilities that enable such features as automatic tax deductions or at the point of payment from being used by unscrupulous actors to automatically skim transactions. Consideration should therefore be given to awarding a form of accreditation or performing a verification process for firms or developers which are given access to the programmability features of the CBDC.

d. Support for innovation

The CBDC and its supporting infrastructure should be designed to facilitate greater access and innovation by new entrants, thus enabling a more competitive payments ecosystem. The existing payments infrastructure has developed organically and, to a large extent, exists as a series of modernisations and improvements to a processing landscape that was originally put in place to support paper-based money. There is now an opportunity to design something brand new, that looks ahead to the new use cases opened up by technology advances and the digital age, unencumbered by legacy requirements.

The CBDC infrastructure must therefore be sufficiently flexible and modular in order to enable quick reactions to changing needs such as IoT or other, as yet unidentified, horizons such as advancements in technology. A programmable CBDC, as mentioned previously, will provide opportunities for payment interface providers (PIPS) to compete and innovate with potential replacements for existing digital payment mechanisms, which could reduce costs and improve payment efficiencies, leading to further improvements in B2B, B2C and peer-to-peer payments.

2. TRUST BY DESIGN

A high degree of transparency for system operators, including their permissions, rights, responsibilities, liability (or limitations thereon) and compensation, is required, in order to create trust in PIPs, operators and the CBDC as a whole. Additionally, a high degree of transparency for the rules and algorithms that define how the system operates is required in order to increase public confidence and trust in the implementation of the CBDC. In order to build that level of trust, the following must be built into the CBDC and its underlying platform:

a. Security

Holders and processors of the CBDC must have certainty that their data is secured against hacking either in the form of extracting or altering the data in any way. As previously stated, they must also be comfortable that anonymous transactions remain private. The next section expands on aspects of privacy in more detail.

b. Privacy

Privacy, and the ability to balance privacy concerns against the capabilities afforded for fraud reduction and anti-money laundering, constitute a major topic to be addressed in the design of any retail CBDC. It is an area that has been discussed at great length by the FPWG, and one on which it has proven challenging to form a consensus view.

Privacy and data protection are very different concepts:

- Privacy involves the retention of a degree of anonymity when using CBDC for payments.
- Data protection refers to the controls around retention and sharing of any personal data collected in the course of such transactions.

Cash, at present, allows broadly anonymous transactions, and as Yves Mersch has noted, any system that fundamentally alters the ability for individuals to conduct transactions privately will 'inevitably raise social, political and legal issues'¹⁴. It is necessary, when considering the protection of privacy, to also consider the extent to which a CBDC, and the infrastructure on which it is built, may be required to support built in AML / CTF prevention and detection capabilities. If CBDC, or its usage, can be made as anonymous as cash (or as close to that as possible, AML/CTF issues and requirements notwithstanding), but certainly not more so, this will strengthen the case to the public for its adoption and ultimate replacement of cash. This perhaps becomes an even stronger factor if large multinational corporations become major players in the payments arena, with their appetite for data.

¹⁴ "An ECB digital currency – a flight of fancy?"
Speech by Yves Mersch at the Consensus
2020 virtual conference, <https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200511~01209cb324.en.html>

The FPWG recognises that the twin demands of data privacy and prevention of illicit activity will need to be managed. It also posits the presumption that individuals have a right to a degree of privacy in their day-to-day transactions. CBDC infrastructure should, therefore, accommodate the ability to transact without the need for both counterparties to be associated with every transaction (following applicable KYC and AML checks on users of CBDC).

Understandably, a CBDC system that supports fully disintermediated peer-to-peer transactions may not be within the appetite of regulators. However, it is also not the case that the only alternative is a fully traceable system requiring full identification of both counterparties to every transaction. Other intermediate and hybrid options should be considered. For example, if the necessary privacy and digital inclusion issues can be addressed, then it may be possible to create products that enable consumers to have a means of “withdrawing” CBDC onto a device or wallet, and to be able to spend it anonymously (subject to appropriate KYC / AML checks when on-boarding to these devices and wallets). Alternatively, transactions below a certain value threshold could be subject to a higher degree of privacy.

c. Resilience

Resilience is less an inherent property of different types of payments systems than it is a feature determined by the back-up, recovery and business continuity measures put in place to protect such systems. These systems can, and do, fail and therefore all of them have disaster recovery measures in place (for example, RTGS is backed up by MIRS). CBDC will be based on different technology to the existing DNS and RTGS infrastructure, and whilst some degree of interoperability is anticipated, it is unlikely to extend to the level necessary for CBDC to rely on the resilience mechanisms in place for existing forms of fiat currency. Therefore, the PIPs and the Bank of England will need to collaborate in determining appropriate contingency measures for disaster recovery and business continuity. Fortunately, most PIPs and other financial institutions are well-rehearsed on these topics.

...it may be possible to create products that enable consumers to have a means of “withdrawing” CBDC onto a device or wallet, and to be able to spend it anonymously...

There are two different aspects of resilience: firstly, the likelihood of an underlying payment system failing and the ways in which that can be mitigated (e.g. current RTGS and FPS active sites); and secondly, whether other means exist to undertake payments if that payment system is down (interoperability). The former is easier to resolve as it is a necessary component of any technology infrastructure. With respect to the latter, however, additional complexities arise. In order for interoperability to be truly effective, an identical membership set is required between each payment system, plus the lifting of relevant system restrictions

that might prevent interoperability from taking place. (For example, in the current payments infrastructure, the FPS system limit of £250K would prevent many CHAPS payments from being redirected across that system). Once again it is the PIPs who would likely need to identify the back-up payment mechanisms that could be triggered in the event of a systemic failure of CBDC infrastructure and remove the obstacles to users accessing these. Advocates of a DLT-based CBDC infrastructure argue that, by adopting a distributed ledger design, complete systemic failure of CBDC cannot occur.



3. EASE OF ACCESS AND USE

End-user utility is crucial to the successful adoption of a retail CBDC. The design and implementation of CBDC must take into account the needs and potential benefits for the full gamut of end-users, including but not limited to UK citizens, taxpayers, businesses, and welfare and pension recipients. CBDC should therefore be available to all individuals and businesses to use, with minimal or, preferably, no inhibitors to access and usage. The creation of open, standardised APIs for interface with PIPs will encourage innovation in the development of mobile device apps, wallets and other on-ramps and off-ramps, allowing for competition in the provision of access to the CBDC. New mobile devices, and indeed networks, may even appear.

To support the above tenets the following principles must be followed:

a. Interoperability

Two forms of interoperability are required to support a successful CBDC. The first form of interoperability involves the ability for the CBDC to be used interchangeably with existing forms of currency and payment mechanisms. This is essential for successful and widespread adoption of a retail CBDC. There is also a second form of interoperability - the ability for different national CBDCs to interact at a technical level, which will be essential for realising some of the benefits associated with improved cross-border payments efficiencies. Depending on the design of the CBDC and the cross-border infrastructure that supports interoperability, this may of lesser relevance for retail CBDC and greater relevant with respect to wholesale CBDC, assuming that a model of intermediated cross-border payments continues into the future. On the other hand, it should be noted that peer-to-peer cross-border payments systems would require interoperability of retail CBDCs at a technical level.

It is anticipated that a CBDC which is interoperable with existing domestic and global payments infrastructure will incentivise the creation of new products and services. It is possible that these products and services could be created in the absence of a CBDC, however it is likely they would then be built on privately-issued single-currency stablecoins. This could lead to greater fragmentation of services across stablecoin silos, as well as increasing the implicit threat such large-scale stablecoin usage poses for the economy and for monetary policy. Additionally, due to the emergence of new IoT platforms, message types and protocols, CBDC may be impacted in areas such as integration, interoperability and capacity. Volume may increase flows across the CBDC platforms, and such scalability considerations will have an impact on the non-functional requirements associated with the CBDC infrastructure.

b. Improved efficiency and speed of payments

At present, the UK has six payments infrastructures, most of which operate on different standards and use different networks (e.g. SWIFT for CHAPS). The Bank of England has yet to decide on how it might implement dual networking on RTGS Renewal, and the same could well apply for the New Payments Architecture (NPA). These initiatives will shrink the domestic networks to two which are based on the same messaging standard. It is likely that, due to the technical requirements of the design, particularly if a distributed blockchain concept is adopted, a separate network will be required to support CBDC. As this is designed it would be optimum to have an ultimate goal of a single 24/7 payments infrastructure to support all domestic payments with standardised interfaces to the global networks – both CBDC and e-money etc. As soon as the CBDC infrastructure is in place – and interoperable with the other two domestic networks – PIPs can then provide value-add overlay services with confidence of the usability and expansion in the future.

c. Liquidity

In order to function effectively, the CBDC infrastructure needs to have a strong liquidity management feature, or to be fully fungible with existing GBP payment systems. Central bank money provides finality, security and privacy and therefore liquidity is a vital consideration in terms of maintaining access to a steady supply under varying demand conditions. It is important to recognise that central bank liquidity also represents the mechanism for underpinning the settlement for the main UK payment systems, and it will be equally important that it underpins the CBDC payments landscape. With respect to the liquidity requirements around PIPs, commercial banks today in the UK are strongly capitalised and liquid due to robust regulation which in turn reduces the risk of the payments systems. However, non-bank providers, such as payment service providers, do not exhibit these characteristics to the same extent, and the option of a CBDC therefore could represent a stronger business case for a more competitive and open market whilst still ensuring fiscal security.

d. Universal inclusion and access

Due consideration must be given to the access requirements of financially and / or technologically excluded and under-served sectors of society. The potential for CBDC to help drive the transition to a digital economy can only be realised if it enables wider access than that currently afforded by the incumbent payments and banking infrastructure. Whilst PIPs may identify potential market opportunities and develop accessible on and off-ramp applications as well as devices to access, store and use CBDC, it would be prudent for government incentives to be available to ensure that these gaps are addressed by the private sector, in the form of short-term grants and subsidies. The recent Access to Cash Review¹⁵ has shown that there remain a number of key challenges (including but not limited to digital inclusion and communications infrastructure), that must be addressed in order to enable a more widespread and inclusive switch from cash to digital payments. The same challenges would equally apply to a CBDC. The creation of a CBDC should therefore address these existing challenges, as well as looking ahead to how CBDC might seamlessly link into a range of other instruments and channels (e.g. smartphones, tablets, watches, wearable devices and the IoT) to enable further payments innovation.

¹⁵ "Access to Cash Review – Final Report", <https://www.accesstocash.org.uk/media/1087/final-report-final-web.pdf> (accessed 12th October 2020)

E. Design and Architectural Considerations for a UK CBDC

The FPWG characterises CBDCs as legal tender that is issued by a central bank or monetary authority in a digitally native form and which incorporates innovative technological features and functionality.

Beyond this, there are many different permutations of how a CBDC may be designed. For instance, would consumers and businesses be required to hold accounts directly with the central bank, or would access be intermediated by commercial banks or other payment service providers? Would a CBDC be interest-bearing or not?

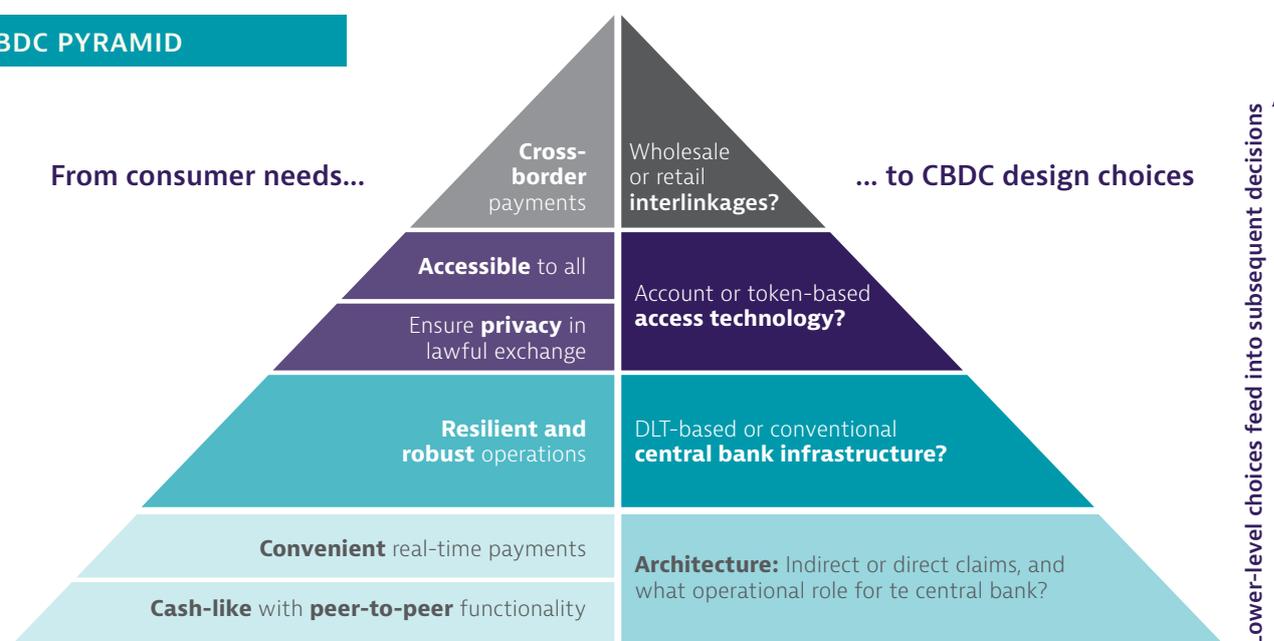
One implementation of a CBDC would be as a digital representation of underlying fiat currency (backed by fiat currency, but not itself representing a direct claim on the central bank). It would be separately maintained in much the same way as existing digital money and accessed purely via intermediaries (this is often referred to as a “synthetic CBDC” design). Another implementation represents a CBDC as a type of fiat currency that co-exists with other types of fiat currency such as physical money and existing forms of digital money. The FPWG, in line with most central bank thinking on the matter globally, favours the latter to reduce complexity, improve trust and strengthen security. The following design suggestions are therefore based on the digital fiat currency model.

A key CBDC technical implementation decision is whether to run it on a decentralised (DLT) platform, as opposed to a traditional centralised database. Central banks continue to debate the advantages and disadvantages of each approach, assessing parameters such as security, resilience, performance or long-term tokenisation strategy. This section briefly considers the main design choices associated with CBDCs, and the FPWG’s preferred options, when judged against the requirements associated with a UK CBDC.

Auer and Böhme¹⁶ have illustrated the design choices associated with a CBDC, and the impacts of these on the CBDC’s usability by consumers and businesses including the use cases that can be supported. The scope therefore covers:

- The architecture and operating model of a CBDC.
- The infrastructure used to implement the CBDC.
- Whether or not access is account-based or token-based.
- Whether access is direct with the central bank, or indirect via intermediaries.
- Whether the CBDC is designed for utilisation at a retail, wholesale and international level or not.

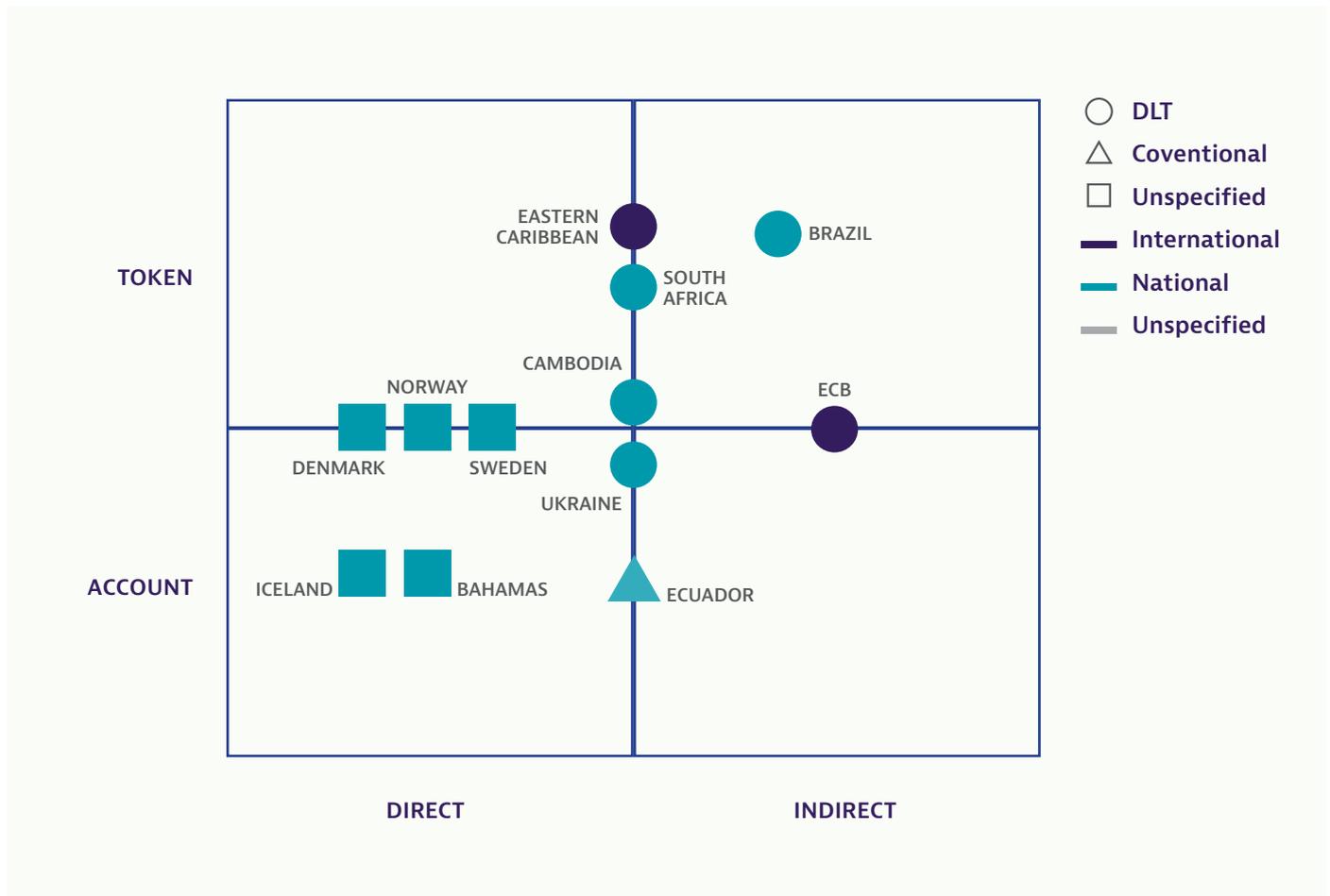
THE CBDC PYRAMID



The CBDC pyramid maps consumer needs (left-hand side) onto the associated design choices for the central bank (right-hand side). The four layers of the right-hand side form a hierarchy in which the lower layers represent design choices that feed into subsequent, higher-level decisions. **Source: Authors’ elaboration.**

¹⁶ “The Technology of Retail Central Bank Digital Currency”, Raphael Auer and Rainer Böhme, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3561198 (accessed 12th October 2020)

The following illustrates the stages of various CBDC projects in flight globally, and the design choices that are being utilised.



1. DIRECT VS. INDIRECT CLAIMS ON THE CENTRAL BANK

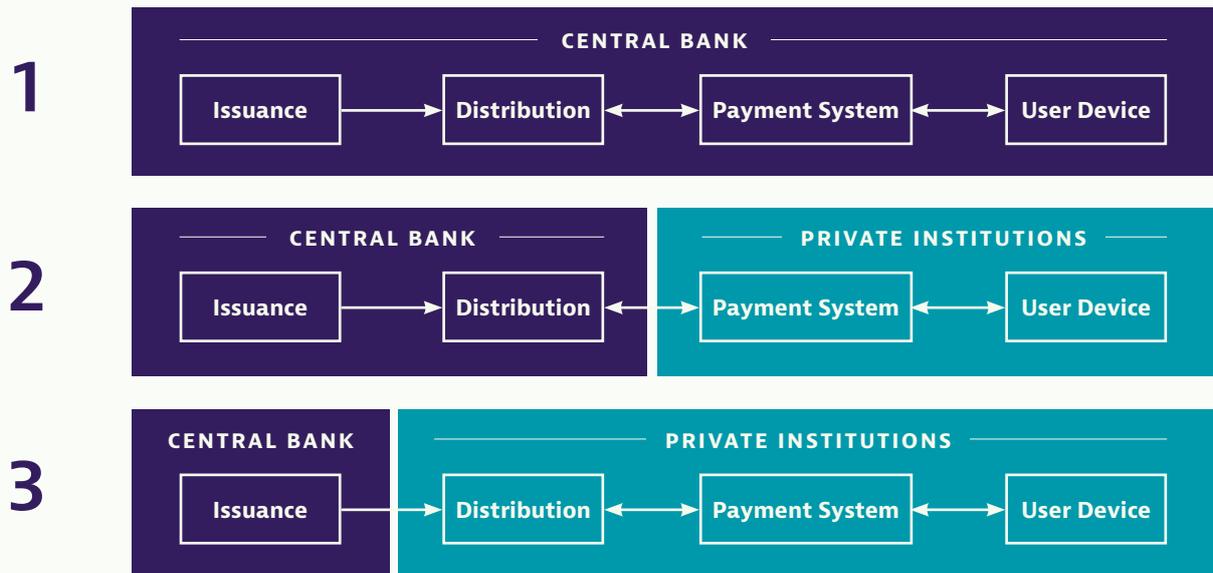
There are two primary models for interaction between the central bank and the end users of a CBDC:

- a. **A direct model** - whereby the central bank interacts directly with the end user, and in which the central bank is itself responsible for the issuance, distribution, payment system and devices on which CBDC's are held.
- b. **An indirect model** - whereby intermediaries (private institutions, most likely commercial banks and other payment service providers) have direct access to the central bank CBDC infrastructure, but then intermediate access with retail end-users via accounts, payments systems and user devices.
- c. **Hybrid models** can also be considered, whereby an indirect model governs the majority of transactions, but a direct model may be used for certain specific use cases, such as direct central bank application of economic and monetary policy.

The foundational question, with respect to these models, concerns whether the CBDC implementation will include accounts at the Bank of England for all eligible corporate and individual end users, or if only regulated financial institutions will maintain direct Bank of England accounts, and provide onward access to retail users. The latter represents a continuation of the current UK payments market structure, whilst the former would require a realignment of the existing architectures in this space. The answer to this question will ripple across many of the subsequent operational and system choices that must be made.

The FPWG broadly favours the indirect model for a number of reasons – not least of which is that it mirrors the current distribution model for physical cash and is aligned with the existing UK payments market structure. However, some hybrid features may be applied; for example, granting certain government agencies direct access to the CBDC without the need for an intermediary.

Central Banks Can Adopt Different Degrees of Responsibilities



Source: Roberto Giori Company

In the direct model, the CBDC would represent a direct claim on assets at the central bank and the latter would be accountable, as they currently are for RTGS and CHAPS, for the design, build and maintenance of the infrastructure underpinning the CBDC. This represents a significant undertaking of additional responsibilities by the central bank, such as the development and maintenance of new infrastructures capable of supporting direct retail business and consumer access on a 24/7 basis. In addition, off-line capabilities (with the accompanying risk profiles), will be required. The other activities, such as onboarding and KYC and AML/CTF monitoring already undertaken for CHAPS would need to be enhanced and would increase significantly in volume to cover businesses and

individuals. This would indeed represent a step change, as the direct participants in CHAPS number some thirty, with some five thousand accessing transacting indirectly, whereas the potential retail user base of CBDC would be in the tens of millions.

In contrast, the indirect model would see the central bank outsource all functions, except the issuance of the CBDC, to the private sector. The CBDC would be distributed to commercial banks and payment service providers (collectively, payment interface providers, or PIPs), which would then distribute, via their payment systems, to end-users. Claims would remain on the central bank as with fiat cash. The PIPs could also create innovation in services that overlay the CBDC; for instance, new advanced functionality could enable micro-payments and programmable money.

It is possible as well that certain government departments such as HMRC and DWP, could themselves be either treated as PIPs or given direct access to the central bank infrastructure, for certain limited purposes, such as allowing them to disburse government payments, and enabling direct collection of transaction-based taxes. Indirect models represent incremental innovation on existing market structures, as opposed to a wholesale change of distribution process, without compromising the ability to deliver very positive outcomes in terms of innovation and the move towards a fully inclusive digital economy.

2. ACCOUNTS VS. TOKENS

Moving to access considerations, the primary design choice around access to retail CBDCs is between account-based and token-based models. Account-based schemes require accounts tied to an individual's or business's identity, between which CBDC can be transferred. The alternative is to base access on digital tokens, which allow value to be transferred between individuals and entities on a peer-to-peer basis, as long as both have access to a wallet, other software or device allowing them to hold and transact in CBDC tokens.

Cash possesses many of the characteristics of a token, being a standalone unit of value that is also a bearer instrument. A token is a store of value analogous to physical cash, whereas an account is a means of holding a store of value analogous to a bank account today. In general, the FPWG regards that, in order to solve many of the use cases benefiting from the introduction of a CBDC, a token-based design provides greater benefit. It should also be noted that, once tokens are stored in a private wallet, their usage displays characteristics more akin to the privacy and security (or otherwise) of cash transactions, whereas transactions between accounts bear a closer resemblance to e-money transactions. The value, held in tokens on a wallet, is therefore underwritten by the central bank whereas there is a limit today to the value underwritten by banks providing accounts. None of this precludes the creation of accounts, by PIPs, which can hold tokens as a store of value. A token also does not have to be held in an account; it may be held in a wallet, or on a bespoke device such as a car wallet (as suggested previously), for the purposes of automated, smart payment for petrol via the internet of things.

Token-based systems could also enable a higher degree of privacy with respect to users and transactions, whereas account-based systems allow for a greater degree of activity monitoring and law enforcement capability. Nevertheless, it is possible to consider account-based systems that are designed with a balance between anonymity and privacy, (when replicating the features of cash), and the prevention of criminal activity. It is also possible to build in capabilities into token-based systems which will identify suspicious activity.

It is notable that some central banks such as Sweden's Riksbank are considering hybrid models in which tokens may be used on a peer-to-peer basis for small transactions, below a certain predefined size, whilst accounts will be required for larger transactions. This provides a balance between anonymity and privacy in day-to-day transactions, against the financial crime and money laundering concerns that can potentially arise with larger transactions. The FPWG might also be supportive of such a model, which would deliver many of the benefits associated with a token-based model.

3. DLT-BASED VS TRADITIONAL CENTRALISED ARCHITECTURE

The next question to be answered concerns whether or not the CBDC system should be centralised or decentralised, and whether it is advantageous to adopt DLT or to utilise conventional systems when building the infrastructure underpinning a UK CBDC. The FPWG favours a decentralised, DLT-based infrastructure for a number of reasons:

- a. DLT enables a decentralised authority in the operation of the CBDC system and this governance model can enhance end-user trust in the system.
- b. With a DLT based system, a central bank could choose to decentralise the level of control and authority across trusted node operators.
- c. Security is improved through having multiple replicated copies of the ledger throughout the CBDC network, making it far more difficult to tamper with.
- d. By virtue of their distributed nature, DLT-based systems are more resilient and offer new opportunities for programmability and tokenisation.

Given the scalability, settlement finality and resilience requirements of a CBDC, the FPWG believes that a permissioned DLT should be given due consideration. However, this may impact the extent to which interoperability of CBDC with existing fiat currency infrastructure can be implemented and requires more careful analysis.

The key question for central banks considering DLT-based CBDC is whether or not the purported benefits of partially or fully decentralising the authority to adjust claims on their balance sheets outweigh the risks.

- a. Centralised vs decentralised authority:** The key question for central banks considering DLT-based CBDC is whether or not the purported benefits of partially or fully decentralising the authority to adjust claims on their balance sheets outweigh the risks. These risks are discussed below, along with some of the ways that they can be mitigated. However, distributed ledger technology was developed primarily in response to a lack of trust in a central authority, and so there may be aspects of a DLT-based CBDC design that could be deemed incompatible with some of the tenets of central banking and central bank money.
- b. Security:** Central banks already have mature security frameworks for management of centralised databases and infrastructure. Their internal systems are typically secured via multiple protection layers, such as audits, middle-tier services, authentication/authorisation and firewalls. DLT-based platforms keep multiple copies of databases across a number of participants or “nodes”, making it considerably more difficult for bad actors to alter the data. Nevertheless, DLT-based platforms may experience attacks against the network or applications layer, which includes the consensus mechanism by which database updates are approved. This is the same issue faced today by centralised systems relying on networks to deliver transactions. Most central banks considering issuing DLT-based CBDC are opting for “permissioned” platforms, which limit access to themselves and selected, authorised financial institutions that are participants in the permissioned network as node operators.
- c. Resilience:** Neither centralised platforms nor DLT-based CBDC offer complete resilience. Both face cybersecurity risks, hardware issues, power or network outages or cloud service interruptions. DLT architectures offer enhanced resiliency by reducing single points of failure. Furthermore, in the event of a widespread outage impacting multiple nodes, data loss at one node can be recovered through replication of the ledger from other nodes when it comes back online.
- d. Performance:** Centralised platforms currently process transactions more quickly than DLT-based systems. For reference, the VISA network can theoretically handle up to 65,000 transactions per second (TPS), whilst current private DLT platforms are far slower at, around 20 TPS. Rapid technological progress is expected to address this issue with networks provided by new entrants achieving up to 10,000 TPS¹⁷. In a system of indirect claims on the central bank, where access to the DLT infrastructure is limited to PIPs, then depending on the specific design chosen (transaction-by-transaction processing on the central bank infrastructure, or “netting” by PIPs with periodically netted transactions processed on the underlying system), throughput demands could theoretically be decreased or otherwise managed for more efficient performance.

¹⁷ “MIT, Stanford and others to build blockchain payments network to rival VisaNet”, Lucas Mearian, <https://www.computerworld.com/article/3334542/mit-stanford-and-others-to-build-blockchain-payments-network-to-rival-visanet.html> (accessed 12th October 2020)

The FPWG believes that a DLT-based architecture would offer a set of benefits including but not limited to the following¹⁸:

- a. Avoid direct costs and risks of having a central government agency run the system.
- b. Improve efficiency and service delivery through competition and scope for innovation.
- c. Implement 'sousveillance' by ensuring that any changes to the rules are explicitly shared with private-sector operators.
- d. Vest accountability for system operation in operators who are incentivised to perform.
- e. Potentially address financial inclusion and non-discrimination objectives through private-sector incentives (e.g. supporting local banks) rather than top-down political decision-making and policies.

The FPWG is comfortable with a decentralised architecture, defined as a network of independent, private actors operating a decentralised, DLT-based ledger of transactions, provided that it possesses the following characteristics:

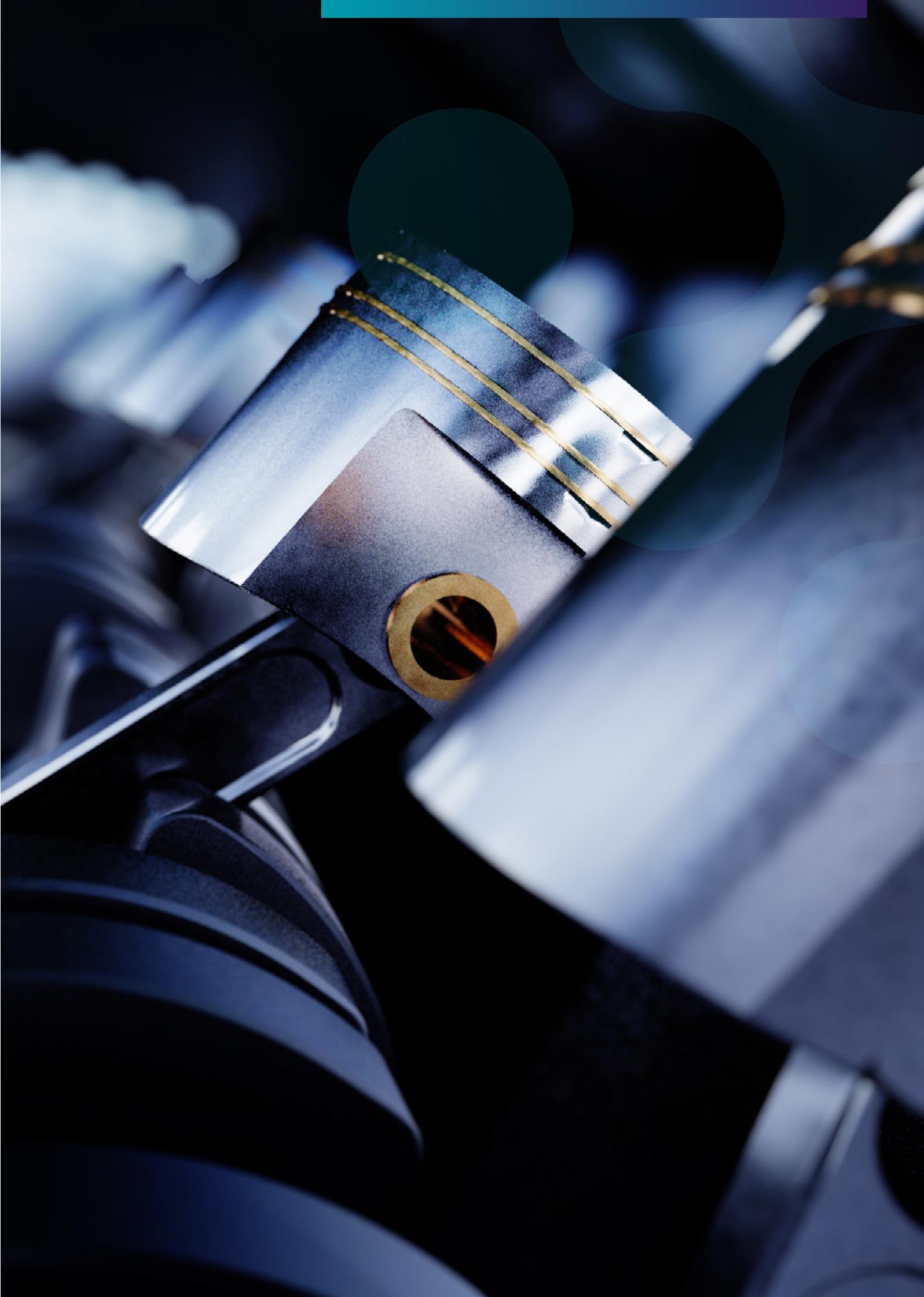
- 1. The central bank is the sole issuer of the CBDC.
- 2. The operators are independent but closely regulated.
- 3. There is a single distributed ledger for transactions. "Distributed ledger" in this context means a ledger that requires ex-ante consensus among participants to record transactions and implements synchronisation of the ledger entries to all participants.
- 4. There are strict eligibility requirements for being able to participate in ledger consensus and write to the ledger.

¹⁸ Geoffrey Goodell, Hazem Danny Al-Nakib, Paolo Tasca, "Digital Currency and Economic Crises: Helping States Respond", June 2020, <https://arxiv.org/pdf/2006.03023.pdf>

There remain open questions around regulatory oversight, the potential requirement for tokens to be held outside accounts, and how node operators would be paid or incentivised for providing this service. In principle, it is possible to achieve all three of these objectives without a centralised operator.

DLT's consensus approach also carries with it a high level of security, given the cryptographical technology that is used. It also eliminates the back-office reconciliation issues that often arise in PIPs, as consensus will enable transactions to be agreed upfront. The decentralised approach is therefore a good option, however the issue of privacy will need to be addressed, as transaction information will be available to all on the audit trail. This is by no means insurmountable for example, the R3 Corda platform has already found a solution to this by restricting information to the parties involved in a transaction. There are also pilots taking place in the industry, looking at how some transactions could be anonymised at central bank level. It may be useful, in the design of a CBDC infrastructure, to explore the on-going developments in the digital identity space, in order to ascertain whether any thinking might inform and apply to the work here.





F. The Impact of a CBDC on the UK's Payments Infrastructure

Disparate groups of stakeholders will be impacted by the introduction of a retail CBDC, and their needs and interests must be considered.

The main market participants within the payments and financial landscapes include:

1. The Bank of England.
2. Regulated financial institutions, including banks payment institutions (the PIPs of the CBDC world).
3. Payment processors, such as card companies and payment apps.
4. Consumers, both natural persons and legal entities.
5. Businesses.
6. FX providers.
7. Other payment service providers, including those already utilising or specialising in cryptocurrencies and other digital forms of money.

1. THE UK'S PAYMENTS INFRASTRUCTURE – CURRENT STATE

The current UK payments infrastructure revolves around the Bank of England's Real Time Gross Settlement System (RTGS), and the associated subordinate account structures and balances held at the Bank of England. As part of the Bank of England's Sterling Monetary Framework, eligible financial firms are able to hold reserve accounts at the Bank of England, which are remunerated at the prevailing Bank of England base rate and can be counted as High Quality Liquid Assets (HQLA) towards their prudential liquidity requirements.

In order to participate directly in one of the main UK payment systems (CHAPS, BACS, FPS, LINK and ICS), eligible firms must hold both a reserve account and a settlement account (funded to/from the reserve account). Separate eligibility requirements apply to a settlement account¹⁹. Non-bank financial institutions (NBFIs) can also hold settlement accounts at the Bank of England. They do not require reserve accounts of their own, although funding must be available to settle any liability (across any scheme in which they participate). Separate criteria apply to these institutions²⁰.

Firms wishing to directly participate in FPS, BACS or ICS must additionally hold funds in a reserve collateral account (RCA). This "pre-funding" is equal to the Net Sender Cap, and provides the necessary central bank liquidity to underpin the system in the event of a liquidation event impacting a direct participant. Additionally, for FPS, pre-funding underpins the ability for guaranteed payments to be made at times when the RTGS system is closed.

¹⁹ "Bank of England Settlement Accounts", Bank of England, <https://www.bankofengland.co.uk/-/media/boe/files/payments/boesettlementaccounts.pdf> (accessed 12th October 2020)

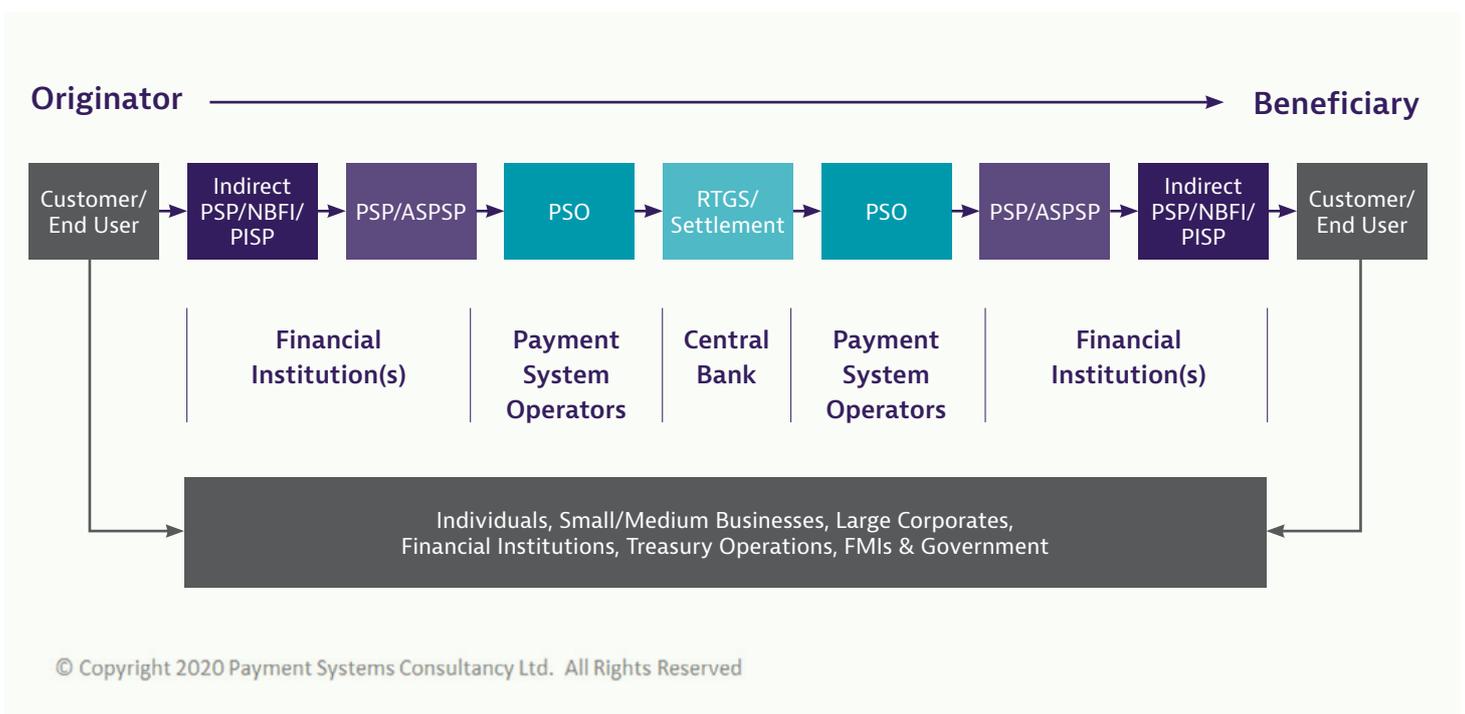
²⁰ "Access to UK Payment Schemes for Non-Bank Payment Service Providers", Bank of England, <https://www.bankofengland.co.uk/-/media/boe/files/markets/other-market-operations/accessfornonbankpaymentserviceproviders.pdf> (accessed 12th October 2020)

When payments are made, aside from those transactions that might settle on a bank's own books (where both the sender and beneficiary of the payment bank with the same institution), they always settle across the settlement and reserve accounts held at the Bank of England.

For CHAPS, these payments, which have no upper limit in value, settle in real time across the Bank of England settlement accounts for the relevant banks. For FPS, BACS, LINK and ICS, these systems operate on what is known as a deferred net settlement basis. Here, the central infrastructure nets the incoming and outgoing payments for each direct participant within the parameters of system and participant defined limits. Either once a day (for BACS, LINK and ICS) or three times a day (for FPS), the netted obligations between the participants are then settled across their relevant settlement accounts at the Bank of England.

Many financial institutions are not direct participants in the UK payments systems and operate on an indirect participation basis. This means that payments initiated by their customers will be routed through a direct participant, selected and appointed by the indirect participant to act on their behalf. This is known as an agency arrangement. Agency arrangements are used by smaller UK financial institutions, and are also the basis of correspondent banking arrangements for international banks transmitting payment instructions from abroad. Agency arrangements typically require the indirect participant to lodge collateral at their agency bank, in order for payments to be effected on their behalf. Such agency arrangements will also apply on the beneficiary side of a payment transaction, where the beneficiary themselves is not a direct participant.

The diagram below represents a typical payments chain.



2. RATIONALE BEHIND THE CURRENT PAYMENTS INFRASTRUCTURE

Why does the UK's payments infrastructure currently operate in the way that it does? To answer this, it is necessary to appreciate that the current payment systems comprises two main elements: transaction processing, and settlement. Transaction processing refers to the functionality of the relevant payment system through which the transaction is effected. Settlement (as described above) involves the debiting and crediting of the relevant settlement account balances held at the Bank of England by direct participants in the UK payment systems. For those participants that are regulated banking entities, the settlement accounts are funded and de-funded from their associated reserve accounts. As such, the current payments infrastructure is, to a large degree, confined to the design of the Bank of England reserve structures, rules and associated open market operations.

In the UK, there are many ways to make a payment, each of which is currently supported by a different payment scheme and associated processing infrastructure. The schemes include:

- Cheque and Credit Clearing (now the Image Clearing System) was the initial payment system with extensive manual clearing methods in place linked to the main banks. Cheques themselves stemmed from the original use of Bills of Exchange operating under the 1882 Bills of Exchange Act prior to the 1957 Cheques Act.
- BACS (the Bankers Automated Clearing System) was founded in 1968 and was the first main electronic system for payment processing using a batch three-day cycle.
- CHAPS (the Clearing House Automated Payment System) was the first same day payment system in the UK and was formed in 1984.
- In 1996, the Bank of England introduced the Real Time Gross Settlement System which was then used as the real-time payment mechanism for CHAPS and is also the settlement mechanism for the other payment systems.
- LINK was founded in 1985 to enable banks and building societies customers' access to cash across the UK. The LINK network consists of some 60,000 ATMs across the UK, most offer free cash withdrawal and some charge.
- In 2008, FPS was introduced to provide a mechanism for near-real-time, irrevocable, low-value payments on a 24x7x365 basis. The limit per transaction is currently £250,000.

3. THE IMPACT OF A CBDC ON THE UK'S PAYMENTS INFRASTRUCTURE

Following the introduction of these various payment systems, technology and global messaging standards have advanced considerably. Additionally, each payment system served a different purpose, resulting in a landscape of heterogeneous schemes. The New Payment Architecture (NPA) represents an attempt to rationalise and consolidate the retail payment systems, adopting ISO 20022, the current global messaging standard. ISO 20022 also underpins the re-engineering of RTGS/CHAPS, currently being undertaken by the Bank of England.

The introduction of a domestic retail CBDC will have a number of far-reaching and fundamental impacts for the UK's payments infrastructure. Firstly, as the FPWG has noted, successful introduction and adoption of a CBDC will require a degree of interoperability with existing payments infrastructures. Adoption of CBDC, in the early stages, is likely to be a gradual process, and not all stakeholders will enthusiastically embrace a new payments mechanism and form of digital currency.

Early adopters of CBDC will need to make payments to others who only use pre-existing payments mechanisms and forms of fiat currency, otherwise CBDC take-up will be impeded. It will be key that both the originator and beneficiary of a payment have a choice of which system, and form of currency, they use when paying and receiving. Interoperability could be piloted with a scheme such as FPS or CHAPS. An FPS pilot would maintain the real-time 24 x 7 digital experience and, if combined with the NPA changes, shorten time to market; a CHAPS pilot would minimise the impacts on other payment scheme operators by focusing on Bank of England scheme interoperability during the pilot; a pilot based on the ISO 20022 programme would be ideal.

CREST settlement accounts for approximately 50% of RTGS daily value flows, and therefore implications of a new CBDC on the CREST infrastructure may need to be considered. At present, in order to settle in central bank money, banks and payment institutions must ensure that they maintain a funded CREST settlement account at the Bank of England. This cash collateral allows them to settle their payment obligations across the various payments systems. Depending on the chosen design, and on whether access is direct or indirect, CBDC payments may need to be collateralised, as existing CREST payments are today. Complications may arise if the CBDC is not interoperable with CREST settlement accounts, or if the CREST settlement accounts do not support both CBDC and existing fiat currency. Additionally, if CREST accounts must support both CBDC and existing fiat currency or securities, then this will require fundamental changes to the processing and reporting infrastructure of Euroclear UK and Ireland (the operator of CREST).

Card issuers, including VISA and MasterCard, may wish to assess the potential for innovation on their own parts, particularly given that card schemes have the potential to become wallets for, or holders of, CBDC. RTGS may require an upgrade to accommodate the CBDC instantaneous settlement model. Similarly, SWIFT, the global messaging network for payments, may require some enhancements to support interoperability – or at least information exchange

– with CBDC infrastructures in respect of cross-border CBDC exchange. The London Processing Centre Irrevocable Payments System (LIPS) currently settles transactions for insurance companies, and brokers may also need, or wish, to accommodate payments in CBDC.

The Bank of England will also need to consider whether or not the retail CBDC should be interoperable with CBDC infrastructures in other countries. Central banks worldwide are engaging in similar projects, and it would be prudent to future-proof a UK CBDC by creating an architecture that would support interoperability at an international level. Otherwise, cross-border payments would always have to be effected in fiat currency or via a wholesale CBDC infrastructure. The Bank of England's participation in a new BIS group, alongside the Bank of Canada, Bank of Japan, European Central Bank, Sveriges Riksbank and the Swiss National Bank, is encouraging in this context, given that the group's mandate also includes discussion of cross-border interoperability²¹.

As demonstrated, the UK currently has a plethora of payments systems. Slimming this down to a single, real-time 24/7 payments system would be an ideal target end-state, and one that could ultimately be enabled via the introduction of a CBDC. Prior to the consideration of CBDC, this goal was being partially addressed through the RTGS Renewal and New Payments Architecture (NPA) programmes, at least in terms of rationalisation and efficiency. Implementation of a retail CBDC will take time. However, it would be prudent for the Bank of England to look at the two existing programmes in the context of such an introduction and ensure that the current objectives and the reengineering required to deliver those programmes objectives still stand or require moderation in the light of the capabilities CBDC will bring.

²¹ BIS Innovation Hub, <https://www.bis.org/topic/fintech/hub.htm> (accessed 12th October 2020)

Slimming this down to a single, real-time 24/7 payments system would be an ideal target end-state...

4. SETTLEMENT FINALITY – THE STATUS QUO

Settlement finality is a concept originally introduced in order to ensure that payment between two parties is irrevocable at the point of exchange or delivery.

The intention of settlement finality is to protect both parties from an attempt to unwind the transaction, should one become insolvent during the course of the day. In the absence of settlement finality, such an “unwinding” could otherwise take place irrespective of whether the payment has already settled (either in commercial bank money or central bank money). This risk particularly applies where one of the parties to the transaction is based in a jurisdiction that itself operates an insolvency “zero-hour rule”, whereby the insolvency is wound back to

the first hour of the day in which the insolvency is declared. The risks arising from such an event become more pronounced for cross-currency transactions across time zones, as highlighted by the failure of Herstatt Bank in 1974 (which, in turn, gave rise to the term “Herstatt Risk”). Whilst such events are rare, their impact is profound and also likely to have a systemic contagion effect. For this reason, all major payment systems today operate under settlement finality protection.

Settlement finality is normally achieved via legislation in the relevant jurisdiction. Payment systems that are designated under relevant local laws may apply for protection against the operation of insolvency law, for instructions entered into their system. By virtue of the application of these local laws, payments then effectively become final and irrevocable at the point in the payment system’s processes where settlement is deemed to have taken effect. For countries within the EU, settlement finality is defined and governed by the 1998 EU Settlement Finality Directive. With respect to the UK, this EU directive was locally transposed into the Financial Markets and Insolvency (Settlement Finality) Regulations 1999 (and thus now forms part of the UK’s local body of law).

In the UK, the operator of a payment or settlement system seeking designation must apply to the Bank of England for designation and demonstrate that they are able to meet the criteria set out in the Settlement Finality Regulations. Once designated, the system operator undertakes to meet certain obligations on an on-going basis, including the continual safekeeping and monitoring of sufficient funds from participating financial institutions, to support settlement (whether via RTGS or DNS).

For DNS schemes, such funds are “set-aside” in a cash collateral account for the particular scheme; this means that the designated system must have both funds in the reserve account to cover the settlement itself, plus the set-aside funds in their cash collateral account. This is a considerable overhead for operators of designated systems, as the cash collateral accounts are, in all but name, frozen assets.

5. SETTLEMENT FINALITY IN THE CONTEXT OF CBDC

The introduction of a CBDC, particularly one based on a form of DLT, will fundamentally change (and even eliminate) the complexities of settlement finality. The immutable nature of DLT gives rise to embedded settlement finality at the point of exchange – with no further oversight or set-aside of funds in cash collateral accounts required.

In other words, the use of DLT in a retail CBDC system offers “atomic settlement”: irrevocable, final and real-time settlement of retail transactions, using central bank-backed digital fiat currency, and eliminating credit risk between the instigator and the beneficiary of the relevant payment. The existing tripartite process of payment, clearing and settlement would be collapsed into one simple, trustable and assured digital process. When taken in conjunction with the enhanced data capabilities afforded by, and the overall efficiency cost reduction and policy delivery associated with, a CBDC, the benefits become

significant. And furthermore, when overlaid with the additional benefits of programmability, other functions that any payer may want to discharge at the point of payment, (including but not limited to reporting, reconciliation, payee assurance, tax deduction and regulatory compliance), can all be supported - not only automatically and in real-time - but on the basis of a reliable and tamper-proof record.

Built-in settlement finality, at the point of transaction, would have the potential to release considerable liquidity into the market, allowing financial institutions and businesses to become far more inventive and flexible in how they manage their assets whilst still preserving market integrity. This could also incentivise financial institutions and other PIPs to move away from existing payment methods and to develop new payment products and offerings based on CBDC. New entrants to the market would benefit from no longer needing to fund cash collateral accounts, lowering their barriers to entry and promoting greater competition and innovation in the payments space.

6. THE IMPACT OF CBDC ON PAYMENTS INFRASTRUCTURE PROVIDERS AND MARKET PARTICIPANTS

Introduction of a CBDC will infer the creation of a new payments infrastructure, which in turn will require the necessary processes and rules associated with such an undertaking to be implemented by all participants in the new payments system. In order to do so effectively, existing and potential future PIPs will need to be engaged early in supporting the Bank of England during the design, pilot and roll-out phases of the new CBDC. If the infrastructure is to be operated solely by the Bank of England as a centralised system, then the payments infrastructure may be assumed, once live, to be fully compliant with applicable regulation. If it is operated on a private basis (as per FPS and other current systems) or via a decentralised infrastructure, then it will require formal regulatory oversight and supervision by the Bank of England. Additionally, the PIPs themselves will require regulatory authorisation and supervision from the FCA (and potentially the PRA).

The PIPs will need to assess the impact of the CBDC on their own internal front-to-back payment and accounting systems, applications and platforms, in order to ascertain changes required to support holding of and access to CBDC wallets and / or accounts, and processing of CBDC payments. A key challenge will be around the support of real-time settlement of payments, and the impacts this will have not only on technology and operations, but also on those business models that are dependent on the interest accrued on funds held before being released for settlement. Liquidity management practices may need to be reviewed. In the short term, traditional securities could be utilised, with more innovative solutions, such as CBDC-settled bonds, being adopted at a later stage. New liquidity options will require both system and process changes to accommodate both traditional and digital securities and cash settlement.

Interoperability and communications standards between the PIPs and the CBDC infrastructure will need to be defined. As noted previously, it would be reasonable to assume that any messaging infrastructure will use ISO20022 as the basic message schema. However, a domestic retail CBDC may also require its own

additional, bespoke message fields, which would need to be reflected throughout the front-to-back systems and application stacks of all direct participants in the CBDC scheme. It is also possible that the architects of the CBDC infrastructure may decide to introduce a wholly new standard for interfacing to the CBDC. If so, then new mappings will need to be created by participants. Again, it is key that all aspects of interoperability are considered when designing the supporting infrastructures for a CBDC.





G. The Road to Adoption of a CBDC

Introduction of a retail CBDC in the UK is a significant undertaking, and one that is not without its challenges, particularly given the impact on every aspect of payments and settlements for financial institutions, as well as corporate and individual end-users.

These must be recognised and addressed in order for implementation and roll-out of the CBDC to be successful. Notwithstanding these, a well-designed CBDC also creates numerous opportunities for genuine innovation and change, not only in terms of retail payments but also in enabling more effective distribution of finances between governments and citizens.

The FPWG has identified the following as key considerations to be taken into account when developing the wider adoption plan associated with roll-out of a retail CBDC:

- a. Systemic challenge** - Given the level of systemic impact, full adoption of a universal retail CBDC will take considerable time. This means that banks and other payment providers will need to support both extant and new systems in parallel, perhaps for an indefinite period. Initially, take-up of CBDC may be limited to early adopters and specific user groups and ecosystems. As the value and benefit of the CBDC becomes apparent to different communities and stakeholder groups, and a critical mass is reached, the process of adoption would be anticipated to gain momentum and to accelerate.
- b. Infrastructure** – As has been noted, the current payment infrastructure is undergoing significant change and transformation via a number of in-flight strategic programmes (such

as New Payments Architecture and RTGS2), none of which was designed or initiated with the future introduction of a CBDC in mind. The introduction of a CBDC will need to be factored into these plans and, eventually, could lead to the obsolescence of some of these infrastructures. Whilst on the one hand, this is the nature of progress, it also creates challenges in understanding the path to the new target state and any intermediate stages.

- c. The role of banks and intermediaries** – Whilst it is unlikely that the core function of commercial banks, as both deposit takers and creators of commercial bank money via their lending activities, will change, it is envisaged that the means by which they fulfil these functions may evolve with the introduction of a CBDC. A degree of intermediation is likely to be built into a UK CBDC via the PIPs; nevertheless, it is probable that some current models of intermediation will discontinue, as existing intermediaries either adapt or face their business models becoming extinct.
- d. Adoption timeline** - It will take time for a CBDC to gain enough uptake that they divert significant usage from cash and other physical and digital forms of currency. The adoption of a CBDC will be gradual, across both private and public sectors. The power of, and current level of satisfaction with, the status quo, in terms of cash, other current digital payment mechanisms, and non-fiat forms of digital currency (including cryptocurrencies and stablecoins), will influence the rate of take-up.

These considerations carry a level of potential risk. As suggested by Alwazir et al²², any central bank seeking to implement a CBDC will need to understand and manage three types of risk:

1. Strategy and policy risks - Ensuring integrity and stability of payments infrastructure, consumer protection, price stability, financial stability, financial integrity, financial inclusion and economic growth.

2. Operational risks - Fraud, legal, IT infrastructure, culture and behaviour, governance and decision making as well as project management risks.

3. Financial risks - Liquidity, market and credit risks. If not effectively managed, these combine to adversely affect the reputation of the central bank, which is vital to the stability of the national monetary system.

1. FACTORS INFLUENCING THE SUCCESSFUL ADOPTION OF CBDC

There are a several factors that will support early adoption of CBDC as a means of payment in the UK:

- i. Accessibility to all potential end users (both acting as payment originators and beneficiaries). In the initial stages, this will be heavily influenced by the level of interoperability afforded with existing forms of fiat currency.
- ii. End users – including both individuals and businesses - need to perceive a retail CBDC as being useful to them, providing added value to their transactions, and offering benefits over and above those use cases enabled by current payment mechanisms and cash.
- iii. Culturally and historically, the UK is a jurisdiction with a high regard for individual rights to privacy, and therefore take-up of a CBDC will be influenced by the extent to which it is seen as preserving those rights. Whilst CBDC offers obvious benefits in terms of potential for surveillance of activity in support of AML and fraud prevention objectives, this should be implemented in such a way that it does not routinely violate the privacy of individuals.

²² "A Survey of Research on Central Bank Digital Currency", Jihad Alwazir et al, <https://www.imf.org/en/Publications/WP/Issues/2020/06/26/A-Survey-of-Research-on-Retail-Central-Bank-Digital-Currency-49517> (accessed 12th October 2020)

a. Introducing new change during a time of great change

First and foremost, any central bank seeking to implement a CBDC must also recognise that the financial services industry is undergoing a period of significant transformation even prior to the introduction of a CBDC. In the UK and EU, there is major infrastructural change taking place, driven by central banks and regulators, such as the New Payments Architecture, RTGS Renewal, merger of Target 2 and Target 2 Securities, and the 5th Anti-Money Laundering Directive (5AMLD). Banks and payments providers are also currently responding to the regulatory push for roll-out of open banking standards, which in the main are made easier by the adoption of the ISO20022 message standard. ISO20022 itself is the mainstay for the reengineering programmes mentioned previously and therefore is central to the internal change programmes each institution is undertaking.

Indeed, the level of change already planned for the next five years has led to delays in the Target2/Target2 Securities and SWIFT ISO20022 programmes, and delays are probable in other large programmes of work. However, such delays do provide opportunity to incorporate, where appropriate, some changes to accommodate planning for incorporation of, and interoperability with, CBDC at an early stage. Also due consideration should be given to whether there is an opportunity to pilot CBDC as an independent verification of the RTGS2 programme (as it is possible that the exchange of e-money for CBDC could take place through RTGS2 as it does for cash distribution today).

Therefore, the Bank of England will need to consider the timing, and phasing, of a CBDC's implementation very carefully. In order to clarify this point it is worth summarising some of the key challenges that banks and other payments providers will face:

- A CBDC will be akin to a new means of payment, and therefore financial institutions will need to assess the impact on all of their front-to-back technology, operational infrastructure and processes.
- Impact is not limited to payments and settlements systems; the introduction of a CBDC can potentially impact the systems of every function in a financial institution (e.g. sales and trading, trade finance, treasury and lending).
- The customers of banks and payments institutions, such as corporates and buy-side financial institutions (such as asset managers), will be impacted too, in particular where they have direct interfaces to the bank.

- Technology vendors will need time to assess the impact of a CBDC on their technologies.
- All market participants will need to assess the CBDC technological and operational impacts against other industry developments, in order to determine whether synergies can be achieved, or if the CBDC requires totally new investment.
- Potential PIPs will need to understand the extent to which the CBDC will be interoperable with other payment mechanisms, as well as the extent to which it will be interoperable with other CBDCs, when assessing the impact to their business models.

In short, every financial institution and corporate will be significantly impacted by the introduction of a retail CBDC. In order for implementation and roll-out to be successful, the Bank of England will require intensive cross-industry engagement and collaboration, and a detailed implementation roadmap that will cover the impact on, and risks posed to, every part of the financial markets ecosystem.

In order for implementation and roll-out to be successful, the Bank of England will require intensive cross-industry engagement and collaboration...

b. Degree of Backwards Compatibility with Existing Payments Infrastructure

A standalone CBDC that lacks integration with existing payments infrastructure, and that cannot be used interchangeably with other forms of fiat currency via interfaces between their respective supporting infrastructures, will face higher barriers to adoption. As noted previously, mass adoption – the ultimate goal – requires effective and efficient interoperability enabling flexible and fungible use of CBDC and other forms of fiat currency. This includes the means by which payment may be initiated by the payer in CBDC but received by the beneficiary in their non-CBDC bank account – or vice versa.

Should this degree of backwards compatibility be lacking, then the CBDC will be reliant on reaching a critical mass of early and enthusiastic adopters in order for any benefits to be realised. It may be possible, at a minimum, to have a standalone CBDC infrastructure that interacts with current payments systems through simple web-based services or via an API supporting interchange and

reconciliation. This would lessen the disruption to existing platforms and systems and, more importantly, provide a less expensive approach to trialling the CBDC proposition.

c. The Role of Financial Institutions, and Fears of Disintermediation

Some payments and banking providers may view the introduction of a CBDC as a potential means for their ultimate disintermediation. Indeed, at one extreme of CBDC design, a pure tokenised CBDC might be perceived as disintermediating banks, given that tokens could be held in user-controlled wallets, or as disintermediating payments providers, given that payments could be made peer-to-peer from one wallet to another directly. This scenario is highly unlikely in the UK or any other jurisdiction.

Firstly, the role of banks as creators of commercial bank money, through their fractional reserve banking activities, is fundamental in any economy. When designing a CBDC, central banks will need to take into account the extent to which retail end-users will need to be incentivised to continue holding money – in either CBDC or other form – in bank accounts, as this is currently the method of supporting lending activity in the economy and hence the creation of money.

Secondly, the potential for disintermediation is mitigated through the treatment of the CBDC as an indirect or intermediated claim on the central bank. The Bank of England's own proposed model of using PIPs as intermediaries, between the core CBDC infrastructure and the general public, would mitigate this risk. The FPWG broadly shares the views expressed by Yves Mersch²³ that disintermediation is problematic and untenable. Ultimately, the primary benefit introduced by a CBDC arises from its function as a means of payment, not as a store of value. In this context, banks would continue to provide vehicles for investment, as well as medium-term and long-term storage of value, and in this scenario, they would not be disintermediated.

d. The Case for Cash

Cash plays an important, albeit steadily diminishing, role in the payment ecosystem. Usage is particularly concentrated in certain sectors of society – the elderly, the unbanked and those who are financially excluded, those who are technologically excluded, and those on lower incomes who use cash as a means of managing their budgets and avoiding debt. For these groups, abstract cash management using cards, online banking or an app, can prove challenging – and indeed is currently a barrier to uptake of existing forms of digital money, online banking and mobile payments.

²³ "An ECB digital currency – a flight of fancy?" Speech by Yves Mersch at the Consensus 2020 virtual conference, <https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200511~01209cb324.en.html>

For individuals who struggle with technology, an enforced shift to digital payment mechanisms could mean handing over control of their finances to someone else. Those who are less familiar with the digital world may also be more vulnerable to scams; giving someone online access to a bank account or card can have

devastating consequences. A malicious user can empty an entire account online in a few clicks, any time of the day or night, and this is often impossible to remedy or rectify afterwards. Cash is still viewed by many as an accessible and practical solution in certain everyday situations. An individual with limited physical mobility may require a friend or carer to do their grocery shopping. Paying in cash, instead of via a card, limits the risk and makes it easier to check how much was spent. It is therefore necessary to be mindful of the risks and challenges that CBDC could create for more vulnerable individuals whilst ensuring that the opportunities to support this section of society through innovation is not ignored.

It is anticipated that cash and other existing forms of fiat currency will continue to co-exist with CBDC for some time. The FPWG does not envisage CBDC as replacing cash in the UK in the near future; currently it should be viewed as another component of the fiat currency available to citizens and businesses. Not only would the social and political implications of an enforced transition away from cash be extremely far-reaching, but it is simply not practicable to force such a move whilst maintaining trust and stability in the monetary system. Such a transition must be gradual and should be voluntary.

e. Technology Inclusion and Access

Accessibility of CBDC and digital payments systems is also highly dependent on the quality and widespread availability of technology infrastructure, particularly in terms of broadband speed and mobile phone network coverage. Individuals and businesses located in rural areas, where investment in such infrastructure is lacking, may be at risk of being left behind in the digital economy. The adoption roadmap for a CBDC must therefore take into account the local and regional infrastructure required to support it.

Technology inclusion and access must also be both a core requirement for a CBDC as well as a key consideration when developing the implementation and roll-out plan. Inclusiveness and accessibility of the CBDC will require both hardware and software solutions. Access to CBDC must not be restricted to mobile device apps; where necessary, it may require the creation of dedicated hardware wallet devices. This is an important consideration as well when considering the design choices around accounts versus tokens.



2. OPPORTUNITIES ARISING FROM IMPLEMENTATION OF A WELL-DESIGNED CBDC

a. Financial inclusion

The number of financially disadvantaged UK citizens remains high; some 1 million people are still considered 'unbanked', around 8 million have unmanageable debt and 9 million have no access to mainstream credit. There have been many improvements in these areas but there is more that can be done. The potential benefits to financial inclusion that can be achieved by a well-designed and widely-adopted CBDC have been discussed elsewhere in this paper.

b. Improving Government Distribution Mechanisms

Currently, distributions from the Department of Work and Pensions (DWP) are paid into the bank accounts of beneficiaries via the existing UK payments infrastructure. The need to, and cost of doing that, could disappear with a well-designed CBDC. For example, a proposed design could see entitlements to government money as being a direct claim against a government CBDC account held at the Bank of England. That credit can be held in the account (and offset against the national debt), until such time as it is drawn down via the retail CBDC infrastructure, by the individual holder of the entitlement. The individual payee could in turn potentially offset their CBDC credit against any debt they might owe to the state (e.g. tax). This dynamic, real-time netting of entitlements and debts between the state and individuals (and businesses) reduces friction, risk and cost between all parties.

A similar model could be developed for HMRC, whereby CBDC tax payment accounts could be opened by any taxpayer, and amounts deposited on a regular or irregular basis reflecting the individual or business's cycle of income. Incentives could be offered in exchange for early or upfront payments.

Software or apps linked to the taxpayer's business account could calculate the amount of corporation tax, VAT, national insurance and other tax payable, and initiate payments or schedule automatic transfer to the HMRC account. The taxpayer can budget more easily, with a clear and holistic view of their revenues and taxes owed on these, and HMRC improves the accuracy and timeliness of its revenue collection.

What is in prospect here, and this is of particular importance in the post-Covid recovery situation, is a much more flexible and nuanced financial relationship between citizens, businesses and the state. The binary relationship of creditor (DWP claimant) or debtor (taxpayer) to the state, becomes more calibrated. Emergency funds could be paid out to recipients directly and efficiently via a CBDC infrastructure, during future pandemic-related or economic crises.

HMRC has paid out tens of billions of pounds in support to employees and to the SME sector, while the DWP, via the Universal Credit (UC) framework, has similarly assisted in supporting those unable to earn during lockdown. However, systems for claiming these funds have sometimes been complex with long lead times, and significant sectors, such as the self-employed and those not in conventional employment, excluded from assistance due to the complexity of assessing the circumstances and needs. The FPWG considers that a well-designed CBDC, if it existed now, would be an effective policy delivery tool not only in managing support during future crises, but also in encouraging the economic recovery that will be of such vital importance as the UK emerges from the Covid-19 pandemic.





H. Conclusions and Recommendations for a Well-Designed Digital Pound

The FPWG concludes that, for a number of reasons more fully articulated in Section C, the Bank of England and the UK Government should proceed to plan for adoption of a UK retail CBDC, or digital Pound.

At its core, a digital Pound must reflect the fundamental British values of democracy, rule of law, individual liberty and mutual respect, in keeping with the integral role played by sovereign currency in the relationship between the state, businesses and individual citizens. Building on this notion and translating it to the context of a digital currency, the FPWG has identified a set of principles that will be fundamental to a well-designed digital Pound. These principles, whilst yet to be fully defined, should not only comport with British values, but also aim to promote good behaviours in all actors, and to ensure the success of a UK retail CBDC for all sectors of society and the economy.

- 1. Fiat Currency:** As extensively discussed in this paper, the CBDC must be a new form of the UK's fiat currency, equivalent in all respects to existing forms of money including physical cash and electronic money.
- 2. Legal Certainty and Trustworthiness:** In a democratic society governed by the rule of law, it is vital that a digital Pound is designed with legal certainty and trust built into its very design and architecture. In particular, fundamental issues must be addressed around the capabilities afforded to the Bank of England and other state actors, in terms of direct application of monetary or other government policy, and their potential impact on the constitutional and legal rights of individual citizens.
- 3. Privacy:** It will be imperative to consider the impact of a digital Pound on the legal rights to privacy of individual citizens, and the various considerations around designs that might infringe upon these rights in the course of user activity and transactions.
- 4. Transparency:** There are many open questions around the architecture of the digital Pound and its supporting infrastructure, the extent to which these are expected to achieve certain trust characteristics, specifically including transparency and accountability of infrastructure

operators and institutional stakeholders, as well as public disclosure and review of the design and architecture, the implementation of the digital currency as it is deployed, and the powers and capabilities afforded to other actors and stakeholders.

- 5. Interoperability:** In order to realise its full potential as a globally important digital currency, the digital Pound would need to be designed for interoperability with existing forms of domestic fiat currency (including cash and electronic money), existing and emerging global payments infrastructures, and other CBDCs and digital currencies.
- 6. Programmability:** Interoperability across multiple platforms has the potential to spur innovation and to maximise the functionality, availability and usage of a digital Pound for all sectors of society.
- 7. Inclusivity:** Whilst it is clearly not realistic to expect that the digital Pound will exactly replicate the accessibility and usability of cash, nevertheless it should be designed with financial and technology inclusivity in mind. In particular, this could be borne out by the interfaces, on-ramps and off-ramps that the architecture supports for a diverse set of infrastructure and application providers that are able to ensure wider reach and inclusivity of the digital Pound throughout society.

The adoption of a token-based model would allow CBDC to function in the same way as physical money with the privacy that physical money affords yet still be fungible and exchangeable within the existing payments infrastructure. Tokens and accounts are not mutually exclusive, and indeed could co-exist, with peer-to-peer token payments being supported below certain thresholds, and accounts held at PIPs being mandated for larger payments.

As per the Bank of England's Discussion Paper²⁴, an indirect model of access to the Bank of England should be adopted, with PIPs holding accounts directly on the CBDC infrastructure and then offering access to and services around the CBDC to all other businesses and consumers. Given the FPWG's recommendation that the CBDC infrastructure should be designed such that it is interoperable with existing and planned payment infrastructure within the UK and globally, with respect to some in-flight upgrades to existing payment infrastructure (such as the UK's New Payments Architecture), it will be worth exploring the potential to build in CBDC support to the planned work.

Engagement with both industry and the public will be a vital component of any roadmap for successful adoption of a CBDC. The roll-out and adoption strategy should be phased in order to minimise disruption and to maximise successful take-up by all user groups, as well as ensuring that the full benefits associated with the digital Pound can be realised. As with all large-scale roll-outs of new technology infrastructure, there will be a need for testing, sandbox rollouts and targeted roll-outs to specific, discrete user groups, before wider adoption is attempted. Interoperability with existing systems and with other CBDC payment systems globally will also require testing.

Finally, the CBDC must be introduced alongside existing forms of fiat currency (physical cash and bank deposits, with no immediate plans to supplant it, but rather a recognition of the role all forms of fiat currency play in the payments and finance ecosystem as the UK transitions to a digital economy.

²⁴ Bank of England, "Central Bank Digital Currency: opportunities, challenges and design", (accessed 12th October 2020)



Appendix

- Selected Resources

The following resources, whilst not all directly cited in this paper, nevertheless formed an important body of input to the thinking of the FPWG, and we would recommend them as reading materials for anyone interested in exploring further the topics raised in this paper:

1. Arner, Buckley, Zetzsche, and Didenko, "After Libra, Digital Yuan and COVID-19: Central Bank Digital Currencies and the New World of Money and Payment Systems", June 2020, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3622311
2. Bank of England, "Central Bank Digital Currency: opportunities, challenges and design", March 2020, <https://www.bankofengland.co.uk/paper/2020/central-bank-digital-currency-opportunities-challenges-and-design-discussion-paper>
3. Bank for International Settlements, "Committee on Payments and Markets Infrastructures: Central bank digital currencies", March 2018, <https://www.bis.org/cpmi/publ/d174.pdf>
4. Bank for International Settlements, "BIS Quarterly Review: International banking and financial market developments", March 2020, https://www.bis.org/publ/qtrpdf/r_qt2003.pdf
5. Bank for International Settlements, "G7 Working Group on Stablecoins: Investigating the impact of global stablecoins", October 2019, <https://www.bis.org/cpmi/publ/d187.pdf>
6. Bank for International Settlements, "BIS Papers No 107: Impending arrival – a sequel to the survey on central bank digital currency", August 2020, <https://www.bis.org/publ/bppdf/bispap107.pdf>
7. Bank for International Settlements, "Rise of the central bank digital currencies: drivers, approaches and technologies", August 2020, <https://www.bis.org/publ/work880.htm>
8. Banque de France, "Central Bank Digital Currency Experiments with the Banque de France", March 2020, <https://www.banque-france.fr/sites/default/files/media/2020/03/27/200327-call-for-applications.pdf>
9. The Block Research, "A Global Look at Central Bank Digital Currencies", August 2020, <https://www.theblockcrypto.com/post/75022/a-global-look-at-central-bank-digital-currencies-full-research-report>
10. Codruta Boar, Henry Holden and Amber Wadsworth, "BIS Papers No 107: Impending arrival – a sequel to the survey on central bank digital currency", January 2020, <https://www.bis.org/publ/bppdf/bispap107.pdf>
11. David Birch, "The Digital Currency Revolution", April 2020, https://static1.squarespace.com/static/54d620fce4b049bf4cd5be9b/t/5e872664179d333a496d7b3b/1585915502002/Birch_02-20_v8+%281%29.pdf
12. Digital Dollar Project website, <https://www.digitaldollarproject.org>
13. Dutch Central Bank, "DNBulletin: Digital currency issued by central banks can protect public interests in payment systems", April 2020, <https://www.dnb.nl/en/news/news-and-archive/dnbulletin-2020/dnb388309.jsp>
14. European Parliament, "Crypto-assets: Key developments, regulatory concerns and responses", April 2020, [https://www.europarl.europa.eu/RegData/etudes/STUD/2020/648779/IPOL_STU\(2020\)648779_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2020/648779/IPOL_STU(2020)648779_EN.pdf)
15. European Parliament, "Public or Private? The Future of Money", December 2019, <https://www.europarl.europa.eu/cmsdata/207653/13.%20PE%20642.356%20DIW%20final%20publication-original.pdf>
16. Federal Reserve, Speech by Governor Lael Brainard on "Digital Currencies, Stablecoins, and the Evolving Payments Landscape", February 2020, <https://www.federalreserve.gov/newsevents/speech/brainard20191016a.htm>

17. Financial Stability Board, "Consultative document on Addressing the regulatory, supervisory and oversight challenges raised by "global stablecoin" arrangements", April 2020, <https://www.fsb.org/wp-content/uploads/P140420-1.pdf>
18. FINRA, "3 Things to Know About Stablecoins", April 2020, <https://www.finra.org/investors/insights/3-things-stablecoins>
19. Geoff Goodell and Tomaso Aste, "Can Cryptocurrencies Preserve Privacy and Comply with Regulations?", May 2019, <https://arxiv.org/pdf/1811.12240.pdf>
20. Geoffrey Goodell, Hazem Danny Al-Nakib, Paolo Tasca, "Digital Currency and Economic Crises: Helping States Respond", June 2020, <https://arxiv.org/pdf/2006.03023.pdf>
21. IOSCO, "Public Report on Global Stablecoin Initiatives", March 2020, <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD650.pdf>
22. Kenneth Rogoff, "A Chinese digital currency is the real threat, not Facebook's Libra", November 2019, <https://www.theguardian.com/business/2019/nov/11/chinese-digital-currency-facebook-libra>
23. Noriyuki Yanagawa, Hiromi Yamaoka, "Bank of Japan Working Paper Series: Digital Innovation, Data Revolution and Central Bank Digital Currency", February 2019, https://www.boj.or.jp/en/research/wps_rev/wps_2019/data/wp19e02.pdf
24. Patrick Murck and Linda Jeng, "INSIGHT: Say Hello to Your New Local Bank—The Fed", April 2020, <https://news.bloomberglaw.com/banking-law/insight-say-hello-to-your-new-local-bank-the-fed>
25. Positive Money, "Money We Trust: Designing Cash's Digital Counterpart", June 2020, <http://positivemoney.org/wp-content/uploads/2020/04/Positive-Money-Money-We-Trust.pdf>
26. Steven Guinness, "CBDC: The Overarching Goal Behind the Digitisation of Money", April 2020, <https://www.zerohedge.com/crypto/cbdc-overarching-goal-behind-digitisation-money>
27. Ulrich Bindseil, "European Central Bank Working Paper Series: Tiered CBDC and the financial system", January 2020, <https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2351~c8c18bbd60.en.pdf>
28. World Economic Forum, "Insight Report: Central Bank Digital Currency Policy Maker Toolkit", January 2020, http://www3.weforum.org/docs/WEF_CBDC_Policymaker_Toolkit.pdf
29. Young Sik Kim, Ohik Kwon, "BOK Working Paper: Central Bank Digital Currency and Financial Stability", February 2019, <https://www.iaisweb.org/page/consultations/current-consultations/application-paper-on-the-supervision-of-climate-related-risks-in-the-insurance-sector/>



For more information, please contact:

Jeremy J O'B Wilson

jjob.wilson@gmail.com

Jannah Patchay

jannah.patchay@marketsevolution.com
