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News

Whitechapel Think Tank – Future of Payments Working Group Response to the Bank of England Discussion Paper on Central Bank Digital Currencies: opportunities, challenges and design

Date 13/07/20

The Whitechapel Think Tank's Future of Payments Working Group welcomes the opportunity to participate in and respond to the Bank of England's very timely discussion on Central Bank Digital Currencies: opportunities, challenges and design. Given emergent developments in this space across multiple jurisdictions, we view the Bank of England's engagement with and initiation of these discussions with stakeholder groups as most welcome and indeed essential to ensuring consistent high standards of public engagement and adoption of common principles by central banks globally.

Background

The Whitechapel Think Tank (**WTT**) is an independent, not-for-profit body that represents and advances 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 Whitechapel Think Tank'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, WTT, alongside Innovate Finance and the City of London, is helping create a global financial services sector that is more informed, transparent, and more diverse and inclusive.

With this objective in mind, and with an eye to the developments in this space in 2020, the WTT has created the Future of Payments WG (**FPWG**). The FPWG consists of a sub-group of WTT members and external participants, including academic and other industry participants, who shall collaborate to research and develop a series of thought leadership papers around the theme of "Digital Economies and the Future of Money".

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Executive Summary

The FPWG is broadly supportive of the Bank of England's objectives in this Discussion Paper, namely in considering the question of whether or not, as the issuer of the safest and most trusted form of money in the economy, the Bank should innovate to provide the public with electronic money — or Retail Central Bank Digital Currency (CBDC) — as a complement to existing forms of money.

We appreciate the attention drawn by the Bank of England to the various considerations around design and implementation of a Retail CBDC. In our view, it is of paramount importance to consider design principles in context of the specific aims, usages and requirements associated with a CBDC, ensuring that form follows function. Furthermore, these aims, usages and requirements for a CBDC should be forward-looking and should seek to encompass support not only for greater innovation in the payments space, but also to enable wider adoption and innovation in other emerging technologies such as distributed ledger technology (DLT), artificial intelligence / machine learning (AI/ML), and the internet of things (IoT).

Our response to the discussion paper highlights that significant changes to the end-to-end UK Payment Infrastructure may be required in order to incorporate a CBDC. It is clear to the FPWG that, should the Bank of England conclude that there is merit in incorporating CBDC's into the UK's domestic and international payments architecture, the sooner it is included in the country's national payments strategic planning the better.

The FPWG includes members with considerable experience in extant payments systems and in the development of the UK's strategic plan for its payments architecture going forward. The group would be happy to meet with the Bank to discuss this in greater detail, if that was felt to be of value.

The degree of change required is likely to be dependent upon the final design and implementation of both the Bank of England's RTGS V2 programme and the New Payment Architecture currently under design with Pay.UK (both of which seek some convergence with the implementation of a Common Credit Message under ISO20022). Similarly, other Pay.UK initiatives, such as Request to Pay and Confirmation of Payee, are also likely to be factors in how a CBDC might function in a retail environment.

In order to fully opine on how CBDC might function within the wider payments infrastructure, we are therefore reliant on the full and final publication of the New Payments Architecture, and how that will deliver fully on the requirements identified by the PSF. However, in the interests of maintaining momentum with respect to CBDC, members of this group will also be willing to work with the Bank to consider how the introduction of a CBDC by the Bank may lead, either directly or by catalysis, to the earlier and assured delivery of those requirements.

In our response, we would like to highlight several areas to which our members have drawn specific attention:

1. Should there be CBDCs at all?

Our ultimate consensus was that that CBDCs are here to stay, 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 – suggests an inevitability to their introduction, which 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. There is also 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 may provide a means for central banks to preserve the sanctity of sovereign monetary policy as a tool for national economic independence and management.

Introduction of a Retail CBDC in the UK is not, however, without its challenges. We identified the following as key considerations with respect to the implementation plan associated with roll-out of a CBDC:

a. Systemic challenge - given the level of systemic impact, full adoption of a universal CBDC will take considerable time. Adoption will accelerate, as the perceived value and benefit of Retail and Wholesale CBDCs increases and becomes ever more widely apparent to different communities and stakeholder groups.

b. Infrastructure - current demands on financial system infrastructures are already heavy. Such a systemic transformation to a CBDC-based financial model will influence the path taken to reach that end state. That might include obsolescence of extant infrastructures and construction of new ones.

c. The role of banks – whilst we believe it is unlikely that the core function of banks – challenger or incumbent, as storehouses of private and public sector reserves and sources of capital – will change, we do envisage that the means by which they fulfil these functions will change.

d. Adoption timeline - it will take time for CBDCs or equivalent to subsume cash and other physical and digital forms of money. The adoption of CBDCs and / or their private sector equivalents will be gradual, running sequentially and in parallel across private and public sectors. The power of the status quo (i.e. cash and other current digital payment methodologies), and the current level of satisfaction with the status quo will influence the rate of take-up.

e. Disintermediation – whilst not a prerequisite of CBDCs, it is probable that some intermediaries will adapt or will disappear. On the disintermediation side, there was also the issue of whether retail deposits may flow over to the central bank, leaving banks with an increased liquidity risk and cost.

2. Tokens vs. Accounts

We began our deliberations on this topic by recognising that a token is a store of value, whereas an account is a means of holding a store of value. In general, we recognised that, in order to solve for many of the use cases we envisage as benefiting from the introduction of a CBDC, a token-based CBDC provides greater benefit. However, this does not preclude the creation of accounts, by Payment Interface Providers (PIPs) which can hold tokens as a store of value. A token does not have to be held in an account; it may be held in a wallet, or on a bespoke device. Tokens may also be stored in, for example, a car's wallet, to effect automated, smart payment for petrol via the internet of things.

There are also considerations around interoperability with existing forms of money. Cash displays many of the characteristics of a token, being a standalone unit of value that is also a bearer instrument. Tokens and existing forms of currency may need to co-exist for a long period of time, and quite possibly indefinitely. Interoperability is essential for those who need to convert the token into other forms of currency, not least for those who won't or can't accept a token. Interoperability will also be a key factor in achieving wider financial inclusion objectives. However, this should not be taken to imply that international cooperation is a prerequisite to the deployment of CBDC in a domestic, retail context, or that the requirements for a domestic, Retail CBDC should be short-changed in service to requirements for cross-border interoperability. Ultimately, individual nations have authority to establish their own regulatory frameworks and rules for how domestic, Retail CBDC transactions should work, and we believe that the incentives are broadly aligned for international cooperation for cross-border payments.

3. Interoperability

When discussing interoperability, we considered two different definitions. The first form of interoperability refers to the ability for CBDC to be used interchangeably with existing forms of currency and payment mechanisms. This, in our view, is essential for successful adoption of Retail CBDC and we discuss it at greater length in our responses to the Discussion Paper. 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. We considered that one might think this less applicable to Retail CBDC and more to Wholesale CBDC, assuming 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.

Our recommendation would be that, if such a group does not already exist, then the Bank of England forms a working group with other central banks, to assess the requirement for and development of standards of interoperability between CBDCs.

4. Distributed vs Centralised

We concluded, as a group, that we are comfortable with a decentralised architecture, defined as a network of independent, private actors operating ledger of transactions, provided that it possesses the following characteristics:

a. The central bank is the issuer of the tokens.

b. The operators are independent but closely regulated.

c. There is a single distributed ledger for transactions. By 'distributed ledger', we mean a ledger that requires (i) ex-ante consensus among participants to record transactions and (ii) synchronisation of the ledger entries to all participants.

d. There are strict eligibility requirements for being able to participate in ledger consensus and write to the ledger.

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

5. Privacy

Privacy, and the ability to balance privacy concerns against the capabilities afforded for fraud reduction and anti-money laundering, is 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. We recognise that privacy and data protection are very different concepts. Privacy is about the retention of a degree of anonymity when using CBDC for payments. Data protection is about the controls around retention and sharing of any personal data collected in the course of such transactions.

Although a CBDC system that allows disintermediated peer-to-peer transactions might not suit the needs of regulators, it is not the case that the only alternative is a fully traceable system wherein it is possible to identify both counterparties to every transaction. Other 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 token 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).

Discussion Paper Response
Section 7.2 – Understanding the impact of CBDC on payments

1. How could CBDC be designed to support a more resilient payments landscape in the UK?
FPWG Response:

Resiliency is not determined so much by the type of payments systems (i.e. whether it is CBDC or not), but by the back-up measures put in place to protect them. Payments systems can and do fail, so all of them have disaster recovery measures in place (e.g. RTGS is backed up by MIRS). It may also be possible to divert payments flows in a system such as CHAPS to one of the DNS schemes (albeit with potential lifting of some system rules – e.g. payment limits and liquidity requirements), particularly once a common message standard is adopted across all e-payment mediums.

One of the issues here is that unlike the GBP DNS and RTGS systems, CBDC will be based on different technology, and it is not clear at the moment that it could be used as back-up for the existing fiat schemes. Therefore, just as today, the Payment Interface Providers (PIPs) and the central bank would have to work together to determine appropriate contingency measures which would include a cloud native failover resistant hosting infrastructure for CBDC (be this DLT-based or not). The good news here is that most PIPs today are well versed in this.

We find it useful to highlight two different aspects of resilience: (i) the likelihood of an underlying payment system failing and ways in which that can be mitigated (e.g. RTGS and FPS active sites) and (ii) whether other means exist to conduct payments if that Payment System is down (interoperability).

A lot of work has been done on that in the past, and this is one of the reasons that the Bank is introducing the concept of a Common Credit Message (CCM) which will work on both RTGS Renewal and the New Payments Architecture (NPA). However, for interoperability to truly work, you need an identical membership set between each payment system AND for relevant system restrictions to be lifted that might prevent interoperability from taking place. For example, the FPS system limit of £250K would prevent many CHAPS payments from being redirected across that system. There would also be an immediate need to increase the Net Settlement Cap and the supporting Reserves Collateralisation Account.

2. How could CBDC be designed in a way that improves the efficiency and speed of payments, while also facilitating competition and innovation?
FPWG Response:

Simplification is the fundamental improvement required by the UK payments system. 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). A CBDC should definitely not use yet another network mechanism, which would complicate things still further.

Slimming this down to a single real time 24/7 payments system would be an ideal solution and that would be a great goal for a CBDC to achieve. Once that structure is in place, the PIPs are then free to provide value add overlay services. However, the Bank should be mindful that this goal is being partly achieved by both RTGS Renewal, and by the NPA (certainly in terms of rationalisation and efficiency). The challenge for the Bank is to look at these developments and decide whether the future-proofing advantage of CBDC brings any sufficient incremental benefit when set against the ultimate obsolescence of RTGS Renewal and the New Payments Architecture.

CBDC has, in the first instance, the potential to replace cheques as well as cash - both mediums on the decline in terms of usage and both costly to the economy. This will provide opportunities for PIPS to compete and innovate with ideas for replacement of both of these payment mediums, accompanied by further improvements in P2P and P2B payments. Such innovation should also be beneficial to those who currently do not have a bank account. Another opportunity for innovation is in the trading of this CBDC on the currency markets, covering private digital currencies as well as other CBDCs.

3. How could CBDC be designed to meet future payment needs? How might future innovations and evolutions in technology (e.g. the Internet of Things) change these needs?
FPWG Response:

The CBDC and supporting payments market structure should be designed in such a way that it can increase competition by facilitating greater access and innovation by new entrants. 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

Two key trends in the payments industry today are the reduction in cash transactions and the growth of digital payments. These trends suggest the move towards a totally digital world where payments are made remotely and, preferably, in real time. The recent Access to Cash Review (https://www.accesstocash.org.uk/media/1087/final-report-final-web.pdf) has shown that there remain a number of key challenges (digital inclusion, communications infrastructure) that need to be addressed to enable some people to switch from cash to digital, and the same challenges could 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, wristwatch, even new facilities such as public 'hotspots') to enable payments innovation and the internet of things (IoT).

New innovations may also impact the CBDC in areas such as integration, interoperability and capacity. IoT, for example, could create requirements for CBDC to integrate with new platforms, message types and protocols. IoT may also mean a great many more messages flowing across the CBDC platforms.

The design therefore needs to be flexible and modular in order to be able to quickly react to changing needs (i.e. as driven by IoT) and innovation in the e-commerce arena. It is therefore key to identify the core capabilities as envisaged today to include near horizon opportunities, modularise these components and build out by delivering known requirements whilst ensuring overall capabilities are not restricted. This means that during the initial development stages advances in technology will need to be constantly assessed for value and viability.

4. As usage of cash as a means of payment declines, is it important to preserve access to central bank money for households and businesses?
FPWG Response:

Central bank money currently provides the greatest financial security and from that perspective it can be argued that it is important to preserve access. It also provides finality, security and privacy (again see Access to Cash Review https://www.accesstocash.org.uk/media/1087/final-report-final-web.pdf). It is important to state that central bank money 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. It must be noted that most 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 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.

The other aspect is privacy. Cash allows broadly anonymous transactions, and as Yves Mersch of the European Central Bank has noted, any system that fundamentally alters the ability for individuals to conduct transactions privately will 'inevitably raise social, political and legal issues' [1]. The organs of society charged with protecting privacy must also contend with the possibility of criminal use. If CBDC, or its usage, can be made as anonymous as cash (AML/CTF issues not withstanding), but not more so, this may also strengthen the case for its adoption. This perhaps becomes an even stronger factor if companies such as Amazon and Google become major players in the payments arena, with their appetite for data.

[1] Yves Mersch. Speech at the Consensus 2020 virtual conference, 2020-05-11, https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200511~01209cb324.en.html See also the responses in Q.9, Q.25 & Q.29.

5. Does CBDC pose other opportunities or challenges with respect to the payments landscape that we have not discussed?
FPWG Response:

One of the key challenges is around the impact on markets and activities in other financial instruments. Although we appreciate that the Bank of England has, to date, considered Wholesale and Retail CBDC separately, there is a question to be asked around the logic in having separate implementations. Although used for different mechanisms and on different systems, the underlying CBDC structure and token could arguably be the same. If a Retail CBDC becomes a widely used instrument, then there may be an appetite for it to be used for wholesale transactions; for example, it may be used to settle products such as securities. The use of CBDC to effect cross-border transactions, whether or not such transactions take place entirely within the CBDC system itself, will be key to its future viability - whether it is traded only with other CBDC currencies or can be traded for fiat currencies or other digital currencies is a matter for future debate!

This then poses the question of how a Retail CBDC would be integrated into central securities depositaries such as CREST, or indeed Central Clearing Counterparties like LCH Clearnet. Both of these infrastructures settle via RTGS today, as do other FMIs outside of the Payment Systems. This has been discussed previously by the Bank, and engaging CREST and CLS in early-stage discussions around a CBDC implementation would be optimal.

Collateral management in general will be another item of note. Today, participants in payments systems, such as BACS and FPS, are required to pre-fund their Reserves Collateralisation Accounts (funded from their Reserve Accounts at the Bank of England) to cover their Net Sender Cap, and thought will need to be given as to how CBDC payments systems will be collateralised.

There is a potential requirement that conversion from fiat currency held in reserve accounts could be used, and vice versa, as the need arises. Licensed banks that are not direct participants in the UK Payment Systems still often hold reserve accounts within RTGS which are then used (via RTGS functionality) to provide collateral to those institutions that act on their behalf on an agency basis.

Another opportunity to bear in mind is the use of CBDC to settle overseas transactions. This again raises questions in regard to both interoperability with other CBDCs, and, in the interim, 'conversion' to existing forms of currency. In order to realise the maximum benefits associated with more efficient, cheap and immediate cross-border payments, there must be consideration given to interoperability, at a technical level, with other CBDCs. Is there an argument to be made for advocacy for and creation of a global standard? Discussions with new ventures such as RTGS. Global will prove advantageous at this point.

6. What factors would determine the level of adoption of CBDC as a means of payment in the UK?
FPWG Response:

We believe there are a number of factors that will contribute towards the level of adoption of CBDC as a means of payment in the UK:

a. Accessibility to all potential end users (both acting as payment originators and beneficiaries).

b. Individual consumers need to perceive a Retail CBDC as being useful to them and offering benefits above current payment mechanisms and cash. There are also questions to be asked around the degree of privacy and surveillance associated with CBDC transactions – whilst CBDC offers obvious benefits in terms of potential for surveillance of activity in support of AML and fraud prevention objectives, this must be implemented in such a way that it does not routinely violate the privacy of individuals.

c. Corporates and SMEs must perceive value and realise benefits through supporting payments in CBDC.

d. Direct usage of CBDC by government in pursuance of its distributive policy ends and encouragement by government of its use by citizens and businesses, for example, to make tax administration easier, more transparent, and more automated.

e. Financial institutions will need to:
    i. Understand the product.
    ii. Have a clear grasp of the benefits.
    iii. Understand the capacity of PIPs to build the infrastructure.
    iv. Understand the impact on other market infrastructure providers (e.g. CREST and CCPs such as LCH).

f. The CBDC system should be interoperable with existing payments systems (e.g. support payments where the sender wants to send via CBDC, and the beneficiary wants to receive via cash or bank account etc). The beneficiary should not be forced to receive CBDC if they prefer other forms of currency. Therefore, can CBDC be fully fungible with other forms of currency, with the payment system undertaking a swap to cash or bank money, if the beneficiary does not have an account that can allow deposits or withdrawals with CBDC?

It will be key to work with innovative payment providers who already have an audience of early adopters, to help drive the first wave of users and driving momentum in the mainstream.

7. Are the design principles described in Chapter 3.2 comprehensive? What are the most significant trade-offs between some of these design principles?
FPWG Response:

We would add the following items to this list:

a. Liquidity efficiency. In order to function effectively, the payment system needs to have a strong liquidity management feature or be fully fungible with existing GBP payment systems.

b. Universality. CBDC should be available to substantially all individuals and businesses to use.

c. Transparency for system operators. The public needs to be able to audit and verify that the system is behaving as expected.

d. Interoperability with existing processes and systems.

We also note that the text given for the “Privacy” design principle describes data protection, not privacy. The text should be changed to clearly indicate that retail users cannot be expected to trust that some third party will protect their data from profiling. (Appropriate data protection in the context of the relationship between users and their financial institutions still applies without limitation.)

8. How could CBDC be designed to complement other public and private sector initiatives to improve payments in the UK?
FPWG Response:

A Retail CBDC should be operated on a 24/7 immediate payments model. Depending on the timing of its launch, this would then complement the current Faster Payments System (FPS). The New Payments Architecture (NPA) should then accommodate both in its clearing and settlement layer.

9. Could CBDC provide unique benefits, over and above existing initiatives, to improve UK payments?
FPWG Response:

If the necessary privacy and digital inclusion issues can be addressed, it could become an alternative to cash if consumers have a method of "withdrawing" it onto a token device/wallet (accessibility to be a consideration) and to be able to spend it anonymously up to the amount that has been withdrawn. A CBDC could also potentially replace cheques as well as cash, accelerating peer-to-peer payments and bringing them into the mainstream. Importantly, this would entail that Retail CBDC users could hold value outside of accounts, as they do with cash and other real assets.

Compared to stablecoins or cryptocurrency, CBDC offers the ability for its users to exchange assets whose issuance and destruction are managed entirely by the central bank.

There is also the ability to make payment for digital assets. A Wholesale CBDC is essential in order to facilitate immediate settlement on-ledger of digital asset (e.g. security token) transactions and to enable the development of the wholesale markets in digital assets and their more widespread adoption. At the same time, a Retail CBDC can also open up investment opportunities for individuals and businesses in digital asset markets and tokenised securities, property etc. A Retail CBDC can also enable greater automation via use of smart contracts in many everyday transactions and interactions.

Additionally, many jurisdictions have accelerated their plans to introduce a CBDC in light of the issues experienced in distributing finance and aid during the Covid-19 crisis. Had a CBDC existed prior to the crisis, it could have facilitated the direct distribution of funds to individual citizens and to businesses, without the need for intermediaries such as banks (and the associated layers of costs added to fund distribution). A CBDC can also provide a cheaper, more efficient and more direct mechanism of distributing benefits, including any potential universal basic income.

10. Could the potential benefits of CBDC alternatively be achieved with policy levers to (a) influence the private sector to deliver a better payments landscape, or (b) address market failures or co-ordination problems in the private sector?
FPWG Response:

The UK is already trying to achieve this through regulation, such as the Payment Services Regulation, and initiatives, such as the New Payments Architecture. These and other initiatives (e.g. Open Banking, RTGS Renewal) are going a long way to addressing issues such as speed and efficiency, so policy levers could work to achieve some of the potential benefits of CBDC. Given that adoption of a CBDC will be a lengthy process and will entail considerable additional work by the PIPs, it is worth exploring this as a tactical solution.

11. Could the potential benefits of CBDC be alternatively achieved by enabling new innovative private sector arrangements (e.g. stablecoins) to develop?
FPWG Response:

As stated above, the current slew of payments initiatives in the UK are addressing a number of key issues and it may well make sense to allow time for these to bed down, before embarking on a widespread launch of CBDC. Private stablecoin initiatives may deliver some of the potential benefits of a CBDC and actively learning from these is critical. There are however, a number of key factors which need to be seriously considered such as liability, liquidity, risk management and governance.

The key 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 lead to greater market fragmentation, which hinders rather than helps the evolution of digital asset markets.

There are also many potentially 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 also the potential for private companies to (inadvertently or not) manipulate currency value through large movements in the currency or assets backing the stablecoins.

Section 7.3 – Understanding the impact of CBDC on monetary and financial stability –

12. What opportunities could CBDC provide to enhance monetary or financial stability?
FPWG Response:

The approach to the maintenance 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 and for it in turn to deploy its means of doing so through robust governance systems such as the Monetary Policy Committee. The advent and wider use of private digital currencies such as Libra would serve to undermine the effectiveness of that centralised approach to stability.

The extent to which these alternatives will be adopted remains to be seen, but we consider that at the very least the Bank of England should be aware of the risk of the market moving in this direction and equip itself with the means of replicating the utility of Libra and other alternative private stablecoins and non-fiat currencies, so that its central and independent role remains effective.

Beyond this basic protective aspect, we believe that further exploration of the "sovereign money" approach is required. An extreme position could be the potential complete disintermediation of the banks if all money creation and liquidity control mechanisms vest, via a CBDC, in the central bank. This could conceivably reduce the overall systems' reliance on the banks and reduce the chances of a repetition of 2008/9. As stated earlier in this response we consider there remains a role for the well-regulated commercial banks, but the creation of the ability for citizens and businesses to settle direct in central banks money as a complement to doing so in commercial money would provide an additional protective buffer against instability caused by ill-advised commercial activity by the banks.

13. How much demand would there be to hold CBDC? How would that demand vary depending on the economic design choices outlined in this paper?
FPWG Response:

If a CBDC does nothing more than allow of instant and atomic settlement of liabilities, then arguably there will be a direct correlation between the use and holding of CBDC and that of cash under current conditions. With the latter very much in decline in the UK there is a question then about the utility of a CBDC and its use, especially at the retail end.

The more intuitive correlation on usage may be with the overall utility of using a CBDC as against other methods of payment. As a business, for example, if, when making a payment via CBDC, all the consequences (audit, reconciliation, tax reporting, balance assessment) of having

undertaken a transaction can be dealt with in real time, as the transaction completes and at lower cost than that currently incurred in meeting those after-the-fact requirements, then take up of CBDC is likely to be higher in the commercial world (with knock on effects to the individual account/currency holder).

In general, we consider the issue of customer utility to be a crucial one for the Bank to consider. In line with the customer-centric mandate of the PSR and the design of the NPA, we think it is vital that the design and implementation of CBDC takes into account the needs and potential benefits for the end user: citizens, taxpayers, businesses, welfare and pension recipients, etc.

14. To what extent might CBDC lead to disintermediation of the banking system? How would the degree of disintermediation vary with different economic, functional and technological design options outlined in this paper? How would different degrees of disintermediation affect the stability of banks and the rest of the financial system?
FPWG Response:

We do not see the direct benefit of disintermediation as an end in itself. Indeed, we consider there to be some risk associated with a cliff edge switch to a CBDC that would curtail the role of banks as credit creators in the current regulated system.

Overall this question we feel is subordinate to that of the use and benefit case for the introduction of the CBDC at all. If that case is made and it is introduced, then the market will respond. Incumbents and challengers will need to consider their ongoing business and commercial models and those providing best outcomes for customers will prevail.

We broadly share the views expressed by Yves Mersch that disintermediation is problematic and untenable. Ultimately we believe that the primary value of CBDC is as a means of payment, not as a store of value. We do not read the third bullet point in the 'Key Points' for Chapter 5 to mean that households or businesses should hold CBDC for extended periods of time. If CBDC is implemented correctly, then banks would continue to provide vehicles for investment as well as medium-term and long-term storage of value, and in this sense they would not be disintermediated.

[1] Yves Mersch. Speech at the Consensus 2020 virtual conference, 2020-05-11, https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200511~01209cb324.en.html

15. How would CBDC affect the monetary transmission mechanism and policy setting under existing monetary policy frameworks? What overarching analytical frameworks could be used for modelling how CBDC would affect the macroeconomy and monetary policy?
FPWG Response:

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16. What are the most significant risks to monetary policy implementation, and how could those risks be addressed?
FPWG Response:

It may be possible to incentivise or disincentivise holders of CBDC for spending it within a certain timeframe. This could be used to implement a policy mechanism that would complement monetary policy. Although it would not be the same as imposing negative interest rates, it might be possible to use this approach to disincentivise hoarding of currency directly.

17. How could CBDC affect the portfolio of unconventional monetary policy tools available to the central bank? How effective would a remunerated CBDC be in relaxing the effective lower bound on monetary policy?
FPWG Response:

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18. How would increasing the efficiency of payment systems affect the macroeconomy and monetary policy?
FPWG Response:

Section 7.4 – Functionality and provision of CBDC

19. What are the advantages and disadvantages of this public-private payments platform approach? What alternative approaches might be considered?
FPWG Response:

Advantages:
i. The Bank does not have to offer a full suite of retail/commercial payments services.

ii. The PIPs main their relationships with their customers.

iii. The Bank could very likely duplicate certain components of the RTGS platform infrastructure for some parts of the service (e.g. accounting and settlement).

iv. With the right framework around governing and regulating PIPs and their access, this could open up opportunities for innovation and new market entrants in the payments space.

Disadvantages
i. Another scheme rulebook has to be created.

ii. Putting customer accounts on the ledger creates another layer of complication while potentially undermining some of the privacy characteristics that would be needed for its widespread adoption. In this case, a preferable option might be to create a settlement account for the PIP, as happens today, and let the PIP handle the customer accounting.

iii. If customers are required to hold CBDC in accounts, then they do not truly control it. The demand for instruments of value that retail users truly control is essential to its adoption.

iv. The range of APIs to be created will have to be very carefully thought out. How many services, what protocols, what standards? APIs may well have to be mapped back into other messages at the customer level.

20. Are there viable business models that would incentivise firms to offer CBDC-related payment services in this approach?
FPWG Response:

There should be no shortage of business models with the introduction of a CBDC, particularly one that is interoperable with other platforms and technologies. Assuming that it is interoperable, the new CBDC as legal tender in the UK, would be integrated into the various payments systems. This integration will require new technology development, both of software and hardware, that allow CBDC transfers and payments to be made and accepted in various configurations, including person-to-person (e.g. birthday gift for the grandchild), customer-to-business (e.g. buying coffee), and business-to-business (e.g. the coffee shop purchasing coffee beans from the supplier).

The software associated with these transactions would be varied and produced by numerous competitors, in much the same way that existing payment systems are operated by multiple competitors utilising their own systems. Similarly, the hardware for storing and carrying balances would be varied depending on the producer and may include devices like hardware

keys, cards with chips and new types of devices not yet conceived. As with software, we expect competition to arise with the development of various devices from both new entrants and incumbents.

While the above relates to existing business models that would be incentivised to offer products and services associated with the new form of pound sterling, the future points to several key new business models that should adopt the CBDC. In particular, trends seem to indicate that "internet of things" businesses will soon arrive and their use of a CBDC will create many new business models. Internet of things (IoT) refers to a diverse array of possibility associated with hardware devices that are connected to the internet and there can act as digital agents for their owners.

One example might be a car with an internet connection that also has wallet software allowing the car's owner to store money in the car. While the owner is driving around, they can instruct the car to make payments for fuel and other goods, rather than by use of cash or a credit/debit card. Another example might be a refrigerator with an internet connection that automatically 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 people's imagination and security considerations.

Artificial intelligence presents another emerging area of technology that can be expected to leverage a CBDC. In a simple form, 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. There is no need for separate wallets in each item, although the security of such an arrangement might be superior. But as a practical matter, the different IoT devices and digital agents could access the CBDC balance in a single wallet or account.

We can envisage CBDC, if designed properly, as providing a complete payment service to both retail and commercial customers, such that all possible requirements that flow from the making of a payment can be dealt with in real time. For example, and in line with the Bank's own proposition for an Open Banking Platform for the SME sector, transactions in a "smart" CBDC could include all the details required for tax and accounting purposes and for regulatory reporting.

In short, we expect that an interoperable CBDC will incentivise many participants in the economy to create new products and services. It is possible that these products and services could be created in the absence of a CBDC; however it is also strongly likely that they would in that case be built on privately-issued single-currency stablecoins instead, which could well lead

to greater fragmentation of services across stablecoin silos, not to mention the wider economic and monetary policy implications of large-scale stablecoins.

21. What are the respective advantages or disadvantages of (a) the pooled accounts model described in Chapter 4.2, and (b) the alternative approach described in Box 3 in Chapter 4?
FPWG Response:

The pooled accounts model would be a simpler accounting model for the Bank as it would only be handling one account for each PIP. Operationally this would make account reconciliation and cash management very much easier.

It would, however, be a more complex model for the PIPs. They would have to set up mirror accounts for each of their customers in their own books and reconcile same to the pooled balances on the main platform account. This is not an impossible task of course and indeed banks have to do this in the derivatives world where client assets on accounts at central clearing counterparties are pooled on a similar basis. Pooled accounts can mean setting up complex legal structures to ensure that client funds are officially segregated from other balances in the pool as well as from the PIP itself.

In terms of the alternative approach suggested in box 3, this certainly has some merit. It would allow for the operational infrastructure to remain as it is today thus avoiding a potentially large amount of work and investment on all sides. Indeed, it could be argued that the payments infrastructures offer that protection today. The deferred net settlement systems are fully pre-funded by central bank money and payments on CHAPS cannot be released unless there are sufficient funds on the sender account. Therefore, there is settlement finality for the beneficiary of the payment.

The question will be whether these liabilities replace existing PIP liabilities or sit alongside them. If the latter, then PIPs will have to segregate the two types of liabilities in their books for accounting purposes. Since the central bank liability would have to be fully collateralised by the PIP, we may ask the question, does that liquidity then become “dead money” (i.e. cannot be used for any other purpose)? If so, this problem would become more acute in the event that clients moved the majority of their deposits into central bank money, as more liquidity becomes frozen. Of course, PIPs can extract revenues from other sources. At present, however, net interest income is still a major part of the payments business revenue for many banks.

22. What kind of overlay services would be most useful? What functionality would a CBDC core ledger need to provide to enable these?
FPWG Response:

There are a number of overlay services that would be useful, depending on whether the customer is a consumer or a business:

i. Mobile payments. Consumers are increasingly effecting payments to each other by this channel and a similar trend is beginning to emerge in the corporate world as well. API technology will be needed to allow phones and other devices to interoperate with the accounts.

ii. Personal financial management tools for consumers. As they grow more used to CBDCs and use them more, consumers will want to have a real time view of their transactions/balances. They may also require other services such as cash forecasting, savings advice and offers/ discounts.

iii. Cash reporting and cash management services for businesses. Again, as businesses get more comfortable with CBDCs they may use them more for daily transactions. Multi-banked businesses, for example, may require centralised cash management services such as sweeping and pooling or may simply require centralised cash reporting as offered by Account Information Service Providers under PSD2.

iv. Automated invoice/payments matching. This is an increasingly important service for businesses as it enables both efficient cash management and working capital management.

v. Payments tracking. Going beyond the processing of a payment in real time, this is about being able to track its progress in real time through to its destination. This is very important, for example, for businesses when they are paying suppliers for goods.

vi. Automated reporting of financial reference and transactional data to government for either tax or welfare purposes.

In order to support these types of overlay services, the CBDC service will need to have a variety of APIs for on-ramps and off-ramps to CBDC accounts, for example to facilitate movement to other wallets, other accounts, etc. The API infrastructure should be capable not only of handling the payments process, but also be able to feed large amounts of data down to the PIPs. This will then allow them in turn to interrogate the data and offer the services mentioned above. The CBDC service would therefore need to ensure that it was able to convey large amounts of information on a message in such a way that it could be processed automatically via the PIPs to their customers.

23. How could CBDC be designed to ensure businesses are able to easily accept CBDC payments at the point of sale?
FPWG Response:

This answer really depends on the structure which the CBDC adopts. At the moment, POS payments are based on the cards framework which has a complicated ecosystem linking the client /merchant/merchant acquirer and the card issuing bank. Will the CBDC still use the cards framework, or will it use its own framework? The former would require the cards schemes to incorporate CBDC into their framework. In the latter case, the CBDC service may still need to link up at least two banks (customer's and merchant's) as well as the merchant and the client. The merchant POS will need to be updated to handle CBDC.

24. What would be needed to ensure that CBDC would be inclusive and accessible by all sectors of society in the UK?
FPWG Response:

Solving this issue must be both a key requirement for a CBDC as well as a key consideration when developing the implementation and roll-out plan. There will be a role for both hardware and software providers, to ensure inclusiveness and accessibility by all.

Hardware devices will enable almost anyone to hold and transact in the CBDC. For people with sufficiently advanced mobile phones, especially those equipped with internet access and near field communication ('NFC'), there would be no need to acquire an additional device. CBDC tokens could be moved to and from the device via either the internet, or NFC (which is likely to be more secure). Merchants will need a hardware device that can accept payments via NFC, but such devices are fast becoming ubiquitous. Payments can also occur between people with such mobile phones, using the service platform as an intermediary.

For those members of society that lack such a mobile phone, the CBDC roll-out plan could include a free device for any person providing appropriate identification, or who can otherwise be verifiably identified as an eligible person. Identity verification methodologies are beyond the scope of this answer but there are abundant existing means to accomplish the task. These hardware devices can be created and manufactured by multiple suppliers, providing yet another business model incentivized by CBDC (see response to item 20 above), with the basic specifications set by Government in consultation with appropriate experts. (To support constant access to the value held in any device it is key that some form of free 'hotspot' capability is provided).

Whether the hardware device is someone's mobile phone, a merchant's hardware, or the device provided by the Government, it will require software capable to sending and receiving the CBDC

tokens. Interoperability between CBDC and existing forms of money is also essential, as discussed elsewhere in this document, in order to facilitate as wide a reach to consumers as possible.

25. What is the appropriate privacy model for CBDC? Is it necessary, or feasible, to replicate any of the privacy aspects of cash?
FPWG Response:

The twin demands of data privacy and fraud prevention / AML will need to be managed. Individuals have a right to privacy in their transactions and so it may be best for the PIPs to hold the data on these. This is another reason why having accounts at PIP level rather than on the CBDC platform may be preferable. However, we should also consider that not all individuals who want access to and transact in CBDC will want to do so via a PIP, and indeed, part of a Retail CBDCs appeal may lie in the ability to create innovative payments solutions and products that are not themselves centralised. Bearing this in mind, the CBDC infrastructure should accommodate the ability to transact without the need for both counterparties to be associated with every transaction (following applicable KYC and AML checks on recipients of CBDC) and to accommodate the scenario in which one party to a transaction may not have, or may not be transacting via, an account with a PIP.

See also the response to Q.4 above.

26. Would offline payments functionality be required in CBDC?
FPWG Response:

Although the ability to conduct transactions natively in a CBDC system is desirable, it is not a short-term goal, as transactions with cash will remain for the foreseeable future (although they are expected to decline as CBDC becomes widely accepted). Identification of an appropriate mechanism for transacting CBDC offline is an open research question that should be addressed. At the same time, we should not allow this limitation to inhibit the development of CBDC as a payment technology.

Section 7.5 – Technology, infrastructure and further innovation

27. The paper describes a core ledger, operated by the Bank, which supports a range of Payment Interface Providers through an API layer. What are the advantages and disadvantages of this architecture? What are the alternative architectures that we should consider?
FPWG Response:

We believe that a distributed ledger architecture, subject to the requirements outlined in the answer to #29, would be more appropriate than the design proposed by the discussion paper. In particular, a distributed ledger architecture would offer a set of benefits including but not limited to the following:

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.

28. What are the main trade-offs that arise in deciding on a technology approach? What should we be prioritising in these trade-offs?
FPWG Response:

1. Speed vs. security.

2. Speed vs. the transparency of the operation of the system. The public has an interest in being assured that the system operates according to the rules; the controls, and distribution of functions among stakeholders, that will be needed to provide that assurance are likely to require performance trade-offs.

3. The trade-off among privacy, scalability, and control as characterised by Goodell, Al-Nakib, and Tasca [2]. We believe that individuals should be able to conduct transactions without fear that they will be profiled, although there might be limits to which transactions can be conducted with this degree of privacy.

4. Level of automation vs. depth of information that needs to be carried.

5. Ease of access vs. security.

[2] G. Goodell, H. Al-Nakib, and P. Tasca. 'Digital Currency and Economic Crises: Helping States Respond.' https://arxiv.org/abs/2006.03023

29. The core ledger for this model of CBDC could be centralised, or operated through a consensus-driven distributed approach. Which is the optimum approach, and why?
FPWG Response:

We concluded as a group that we are comfortable with a decentralised architecture, defined as a network of independent, private actors operating a ledger of transactions, provided that it possesses the following characteristics:

1. The central bank is the issuer of the tokens. 2. The operators are independent but closely regulated.

3. There is a single distributed ledger for transactions. By 'distributed ledger', we mean a ledger that requires (a) ex-ante consensus among participants to record transactions and (b) 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.

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

A 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, but 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 unsurmountable - the R3 Corda platform, for example, have 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 for the Bank to explore the on-going developments in the Digital Identity world, in order to ascertain whether any thinking might inform and apply to the work here.

30. What are the merits, or challenges, of either 'token-based' or 'account-based' approaches to a CBDC ledger? Are there particular use cases that are better supported by either approach? Are there alternative approaches?
FPWG Response:

A token is a store of value, whereas an account is a means of holding a store of value. In general, we recognised that, in order to solve for many of the use cases we envisage as benefiting from the introduction of a CBDC, a token-based CBDC provides greater benefit. However, this does not preclude the creation of accounts, by Payment Interface Providers (PIPs) which can hold tokens as a store of value. A token does not have to be held in an account; it may be held in a wallet, or on a bespoke device. Tokens may also be stored in, for example, a car's wallet, to effect automated, smart payment for petrol via the internet of things.

Most importantly, tokens allow individual users of CBDC to verify for themselves that their money is as good as anyone else's. This is an important feature of cash that cannot be achieved with accounts-based systems, since the bank intermediates such judgements and determination.

There are also considerations around interoperability with existing forms of money. Cash possesses many of the characteristics of a token, being a standalone unit of value that is also a bearer instrument. Tokens and existing forms of currency may need to co-exist for a lengthy period of time. Interoperability is essential for those who need to convert the token into other forms of currency, not least for those who won't or can't accept a token. Interoperability will also be a key factor in achieving wider financial inclusion objectives.

The token system is effectively a new part of the financial instrument ecosystem, which effectively future-proofs money. Fiat currency is backed by its host government; tokens are not unless mandated at law (and we expect that CBDC will be mandated as such by law). The utility of the token system suggests that sovereign CBDCs will have to be introduced to compete with or run alongside other private payment coins (e.g. Libra).

31. What are the key use-cases for programmable money?
FPWG Response:

• Repeat payments across the trade life-cycle of a financial instrument (e.g. dividends, subscriptions, coupon payments).

• Conditional payments (e.g. on completion of certain contracts conditions, escrow payments).

• Trade Finance (payment on successful presentation of shipping documents).

• Taxation (taking tax in flight rather than later. Especially useful for customs payments).

• Benefit payments.

• Enabling the Internet of Things (IoT).

• Smart contract execution.

• Facilitating payments in financial derivatives.

• Facilitating payment factoring.

• Please also refer to responses to items [20, 22 and 24] above.

32. What architecture choices would best support programmable money functionality in a CBDC? Would it be preferable to build this functionality into the core ledger, via a separate module, or to enable the functionality to be provided by third parties? Are there alternative approaches?

FPWG Response:

The choices made in any CBDC implementation related to this question are quite important because they determine much of how the system will function.

We strongly favour a platform with a more open and flexible architecture in order to allow interoperability of the CBDC across multiple platforms and systems as well as the ability for others to innovate with the technology. It is this type of platform that has the potential to unleash the creative power of UK citizens that will drive new and better uses of the CBDC. While there are many policies that can encourage creativity, we believe that an open and flexible platform will allow for builders of all types to experiment, resulting in useful impacts and new business models.

The programmability architecture would be best and simplest if it sat at PIP level, where it could be accessed and programmed by a third party. This would keep the core ledger simple and more secure. In this way, the PIP-level activity that results in movements from smart contracts and other types of programming would feed transaction data to the core ledger without impacting the codebase of the core ledger. The less ability people have to program the core ledger codebase, the more secure that codebase remains.

Please note the discussion in Q.30 concerning token-based versus account-based architectures for the core ledger. We note that it is possible to maintain both architectures for the same CBDC by, for example, having separate core ledgers for each and reconciling those two ledgers at a definitive ledger layer. While that would introduce somewhat more complexity, it would also introduce somewhat more flexibility, for example by allowing wholesale payments to occur in an account-based ledger and retail payments using a token-based ledger (either directly with retail accounts maintained there or, more preferably, through the PIP architecture).

33. How could CBDC support offline functionality? Are there technology solutions that can enable this without exposing any party to credit risk?
FPWG Response:

Please see responses to Q.26. With the token-based model described above, there should be no credit risk to any party because the tokens exist only on a single device at any given time. Implementing offline use of CBDC is no trivial task, bearing in mind that the complexity in the design of a ledger system, distributed or centralised, is largely to protect against double-spending in its various forms. This is an important area for future research.

34. What dependencies would CBDC have on other innovations, such as digital identity solutions?
FPWG Response:

Please see responses to Q.19 and Qs. 22-24, concerning how the CBDC would be made available to all sectors of society. We believe that an effective, inclusive and efficient CBDC could be accomplished with existing technologies. While innovations such as digital identity, improved hardware devices, improvements in security, and improvements in private key management might be desirable and enable additional functionality or flexibility, we do not view them as mandatory.

35. What other future technology and digital economy innovations should we be factoring into the potential design of CBDC? How might these impact the future demands placed on CBDC, and potential approaches to designing a CBDC?
FPWG Response:

We should consider the possibility that, strategically, both retail and institutional users might have an interest to leverage the CBDC system to transact using cash-like assets other than CBDC, for example Treasury securities or commercial paper, that are not issued by the central bank. The CBDC architecture could be designed with this future interoperability in mind. The system could also be architected to support future derivatives or factoring schemes that explicitly make use of the programmability intrinsic to the design of the CBDC system.

Finally, we consider that there will be many forms of digital asset custodians, including those who might hold digital assets without the ability to transact them arbitrarily. Such systems can be implemented in various ways, ranging from encrypted cloud storage to stewards that can facilitate transactions or changes of ownership subject to certain restrictions.