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**AFTER LIBRA, DIGITAL YUAN AND COVID-19:  
CENTRAL BANK DIGITAL CURRENCIES  
AND THE NEW WORLD OF  
MONEY AND PAYMENT SYSTEMS**

**ANTON N. DIDENKO, DIRK A. ZETZSCHE,  
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**After Libra, Digital Yuan and COVID-19: Central Bank Digital Currencies and the New World of Money and Payment Systems**

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## **EBI Working Paper Series**

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**Anton N. Didenko/Dirk A. Zetsche**

**Douglas W. Arner/Ross P. Buckley**

**After Libra, Digital Yuan and COVID-19: Central Bank Digital  
Currencies and the New World of Money and Payment Systems**

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# After Libra, Digital Yuan and COVID-19: Central Bank Digital Currencies and the New World of Money and Payment Systems

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## ABSTRACT

Technology, money and payment systems have been interlinked from the earliest days of human civilization. But over the past two decades technology has reshaped money and payment systems to an extent and speed never before seen. Milestones include the establishment of M-Pesa in Kenya in 2007 (creating mobile money systems), Bitcoin in 2009 (triggering in time the explosive growth in distributed ledger technology and blockchain), the announcement of Libra in 2019 (triggering a fundamental rethinking of the potential impact of technology on global monetary affairs), and the announcement of China's central bank digital currency – the Digital Currency / Electronic Payment (DCEP) here referred to as the Digital Yuan (marking what is likely to be the first major economy sovereign digital currency).

The COVID-19 pandemic and crisis of 2020 has spurred electronic payments in ways never before seen. In this paper, we ask the question: In the context of the crisis and beyond, what role can technology play in improving the effectiveness of money and payment systems around the world?

This paper analyses the impact of distributed ledger technologies and blockchain on monetary and payment systems. It particularly considers the policy issues and choices associated with cryptocurrencies, stablecoins and sovereign (central bank) digital currencies. We examine how the catalysts reshaping monetary and payment systems around the world – Bitcoin,

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Libra, China’s DCEP, COVID-19 – challenge regulators and give rise to different levels of disruption. While the thousands of Bitcoin progenies could be ignored, safely, by regulators, Facebook’s proposal for Libra, a global stablecoin, brought an immediate and potent response from regulators globally. This proposal by the private sector to move into the traditional preserve of sovereigns – the creation of currency – was always likely to provoke a roll-out of sovereign digital currencies by central banks. China has moved first, among major economies, with its Digital Yuan – the initiative that may well trigger a chain reaction of central bank digital currency projects across the globe.

COVID-19 is driving digitalization to new heights, particularly in payments. In this context, we argue most central banks should focus not on rolling out novel new forms of blockchain-based money but rather on transforming their payment systems: this is where the real benefits will lie both in the crisis and beyond. Looking forward, neither the extreme private nor public model is likely to prevail. Rather, we expect the reshaping of domestic money and payment systems to involve public central banks cooperating with (new and old) private entities which together will provide the potential to build better monetary and payment systems at the domestic and international level. Under this model, for the first time in history, technology will enable the merger of the monetary and payment systems.

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## INTRODUCTION

In an article published in early 2019, two of us envisioned an upcoming battle royale among sovereign digital currencies (SDC),<sup>1</sup> with major economies launching them.<sup>2</sup> That paper concluded by predicting: “This future is very real and may be *very near*”.<sup>3</sup> At the time, there was not enough evidence to confirm our speculation. Despite a range of pilot projects and theoretical studies in a number of jurisdictions, the need for wider adoption of SDCs internationally remained questionable at best. We now re-examine this thesis in light of the dramatic challenges resulting from three major new catalysts: (i) Facebook’s Libra project,<sup>4</sup> (ii) China’s SDC and (iii) the COVID-19 global pandemic.<sup>5</sup>

These three catalysts are causing a fundamental reorientation of domestic and international monetary and payment technologies, policies and regulatory frameworks governing payment systems – in stark contrast to *any* previous disruption. Earlier innovations like e-money, Bitcoin and other cryptocurrencies, stablecoins and even early forms of SDC all failed to trigger a rethinking of the fundamental characteristics of the payment system based on the duality of central bank and commercial bank money. The three catalysts examined in this paper are different in three ways. First, and crucially, each of them has, or is likely to have, a *systemic* effect on domestic and international payment systems – and for this reason we here refer to them as “systemic catalysts”. Second, all three systemic catalysts now coexist and are not spaced over time. Third, all three are mutually reinforcing – developments and regulatory changes affecting one of them often directly impact the others.<sup>6</sup>

We analyse why these new catalysts have systemic implications and, in relation to Libra and China’s Digital Yuan, compare them against their non-systemic counterparts such as other stablecoins and other SDCs. We contextualize this analysis by situating the systemic catalysts relative to the recurring challenges in payment system design. Finally, we consider how the challenges posed by these systemic catalysts are likely to affect the design of future digital monetary and payment systems – by looking beyond Libra, the Digital Yuan and COVID-19.

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<sup>1</sup> In contrast to the prevailing lexicon characterized by the widespread use of the term “central bank digital currency” (or “CBDC”), we take a broader view of the possible design choices of new state-run currency types. In this article, “sovereign digital currency” (or “SDC”) refers to any digital form of official currency issued by or on behalf of the state that is different from traditional central bank accounts. We treat CBDC merely as a subcategory of SDC that is issued by a central bank.

<sup>2</sup> Anton Didenko & Ross Buckley, “The Evolution of Currency: Cash to Cryptos to Sovereign Digital Currencies” (2019) 42:4 Fordham Int’l LJ 1041 at 1093.

<sup>3</sup> *Ibid* at 1094 (emphasis added).

<sup>4</sup> Cf Dirk Zetsche, Ross Buckley & Douglas Arner, “Regulating Libra” (2020 forthcoming) Oxford J Legal Stud. For a detailed review of Libra’s catalyst function see *infra*, at III.

<sup>5</sup> Cf Douglas W Arner, Janos Nathan Barberis, Julia Walker, Ross P Buckley, Andrew M Dahdal & Dirk Andreas Zetsche, *Digital Finance & The COVID-19 Crisis* (University of Hong Kong Faculty of Law Research Paper No. 2020/017, 16 April 2020) online SSRN: <<http://dx.doi.org/10.2139/ssrn.>>.

<sup>6</sup> The announcement of Libra in June 2019 accelerated CBDC-related research at the People’s Bank of China. See Chen Jia, “Central Bank Unveils Plan on Digital Currency”, *China Daily* (9 July 2019) online: China Daily <<http://www.chinadaily.com.cn/a/201907/09/WS5d239217a3105895c2e7c56f.html>>. In turn, the impending launch of China’s SDC was used by Facebook to justify Libra to “extend America’s financial leadership around the world”. See Kiran Stacey & Hannah Murphy, “Zuckerberg Warns Blocking Libra Will Be Boon to China Tech”, *Financial Times* (24 October 2019) online: Financial Times <<https://www.ft.com/content/28c600de-f5a1-11e9-9ef3-eca8fc8f2d65>>.



In the future, we envisage three emerging design choices for such systems, reflected in centralized, decentralized and hybrid models, which will combine in various ways money and payment via technology and regulation.

Looking forward, neither fully private alternative payment systems (APS) nor strictly public SDCs are likely to dominate. Rather, as with existing payment systems, we expect hybrid models involving partnerships between the public and private sectors most likely to emerge in the wake of the three systemic catalysts. In these structures, monetary arrangements will remain dominated by central banks – particularly major economy central banks – with the private sector involved in various payments configurations. This hybrid SDC model will merge the monetary and the payment system in many cases, with the greatest potential benefits arising from both addressing the challenges of the COVID-19 crisis and supporting financial inclusion and sustainable development going forward. Such a framework combines opportunities to support globalization through creation of a common technological framework for money and payments at the international level with the potential to fragment the global monetary and financial system into competing major currency blocks. Unfortunately, the latter appears more likely in the current environment with the potential emergence of a Digital Yuan, a Digital Dollar and perhaps other major SDCs, with a Digital Euro being the logical third major currency SDC.

This paper proceeds as follows. Following this introduction, Part I outlines the role of the state in modern money and payment systems and highlights the recurring challenges faced by financial regulators in addressing the central role such systems play in economic and financial systems, both domestic and international. Part II examines the effects of four non-systemic technological innovations as catalysts in the payment systems and explains why these catalysts were not systemically disruptive. Part III focuses on the impact of Libra on the rollout and design of SDCs, particularly central bank digital currencies (CBDCs), and highlights possible regulatory approaches to global stablecoins. Part IV considers the key design features of SDCs in the context of the Digital Yuan project of the People’s Bank of China and explains why it will lead to a proliferation of SDC projects globally. Part V situates the previous discussion in the context of the COVID-19 pandemic and argues that monetary and payment systems are undergoing fundamental changes as a result of new technologies and of competition between nations. The highest profile example relates to the potential for a Digital Dollar. Part VI analyses the implications of all of these developments for the future of monetary and payments systems. We argue that for most governments, the greatest domestic benefits will be offered through fast payment systems, but that internationally the advent of national monetary competition through major economy SDCs will be the defining development of the next decade, with these factors driving discussions relating to a new Digital Dollar. We conclude by suggesting that the technology is now there to develop better international payment arrangements and even better international monetary arrangements – but that the former is far more likely than the latter.

## I. THE STATE AND THE MONETARY AND PAYMENT SYSTEM

Today, the state plays a central role in monetary and payment arrangements. This section highlights the main aspects of the role of the state in the design and oversight of modern

monetary and payment systems,<sup>7</sup> considers the major underlying challenges which such systems have evolved to address, and analyses how various technologies can serve to address these challenges.

### A. *The Role of the State in Monetary and Payment Systems*

At the core of all modern economic and financial systems are monetary and payment systems, with a central bank generally responsible for maintaining monetary stability and financial stability in order to underpin wider economic objectives.<sup>8</sup> Monetary stability is based on a chosen currency – the legally mandated form of money. Money and the state designated currency in turn are designed to provide three central functions: means of payment, store of value and medium of exchange.

Historically the state has played the key role of authorizing certain media of exchange to have the official status of national currency and promoting demand for such media of exchange by requiring that certain payment obligations (eg. taxes, duties and levies) be satisfied exclusively through their use. In chartalist monetary systems,<sup>9</sup> the state is the ultimate trusted party that handles the management of the money supply in its territory.

Payment systems – standing at the core of monetary and financial systems – form the key linkage between economic and financial systems. Central banks thus generally play a central role in supporting, regulating and supervising payment systems. Today, those systems are primarily electronic (with cash playing an important, albeit very minor, role in most systems), generally intermediated via the banking system, and commonly facilitated by settlement using central bank accounts in order to ensure finality.

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<sup>7</sup> According to the BIS, a payment system is “a set of instruments, procedures, and rules for the transfer of funds between or among participants” that “includes the participants and the entity operating the arrangement”. See Bank for International Settlements & International Organization of Securities Commissions, *Principles for Financial Market Infrastructures* (BIS & IOSCO, 2012) online: <<https://www.bis.org/cpmi/publ/d101a.pdf>> at 8. For different approaches to the design of payment systems and the role of the central entity see *ibid* at 148. For the history of payment systems and the law governing them, see, Benjamin Geva, *The Payment Order of Antiquity and the Middle Ages: A Legal History* (Oxford: Hart, 2011), *idem.*, “Cryptocurrencies and the Evolution of Banking, Money and Payments”, in Chris Brummer, ed., *Cryptoassets Legal, Regulatory and Monetary Perspectives* (Oxford University Press, 2019) 11.

<sup>8</sup> See Anton Didenko & Ross Buckley, “The Evolution of Currency: Cash to Cryptos to Sovereign Digital Currencies” (2019) 42:4 *Fordham Int’l LJ* 1041 at 1072; Michael W Taylor, Douglas W Arner & Evan C Gibson, “Central Banks’ New Macroprudential Consensus” in David G Mayes, Pierre L Siklos & Jan-Egbert Sturm, eds, *The Oxford Handbook of the Economics of Central Banking* (Oxford Handbooks Online, 2019).

<sup>9</sup> The concept of a chartalist monetary system can be generally summarized by reference to Abba Lerner:

“[W]hatever may have been the history of gold, at the present time, in a normally well-working economy, money is a creature of the state. Its general acceptability, which is its all-important attribute, stands or falls by its acceptability by the state.” Abba P Lerner, “Money as a Creature of the State” (1947) 37 *Am Econ Rev* 312 at 313.

## B. Contemporary Monetary and Payment Systems

In contemporary economic and financial systems, the state sets out the framework of the national payment system and oversees its implementation. Public entities (eg. central banks) are frequently directly involved in setting up, or operating, retail and large value payment systems. Legal rules determining payment and settlement finality (ie. when payments become irrevocable) provide additional certainty and protection for payment system participants and the economy at large. Additional protections may include licensing and supervision requirements and prohibitions on rollback of past payment transactions after initiation of bankruptcy proceedings.<sup>10</sup>

### 1. Intermediary-based Payments

In a typical payment transaction today, the payment (a book entry across accounts in one or more currencies) is transferred from a payer to a recipient through two intermediaries, the payer's and the recipient's payment service providers (PSPs).<sup>11</sup>

Figure 1: Payment Process

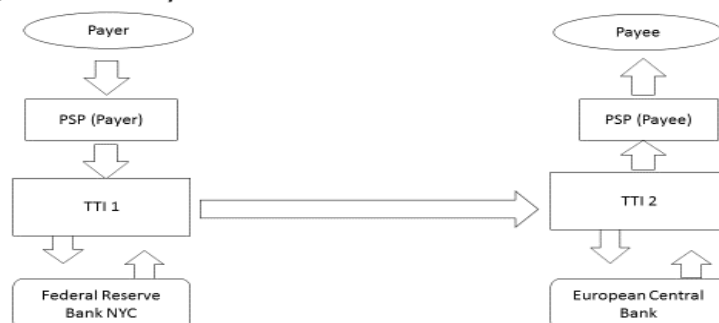


In practice, however, the PSPs are rarely linked to each other directly. Instead, the PSPs rely on a chain of intermediary PSPs that manage links to other PSPs. As the case may be, and depending on who the recipient's PSP is, those other PSPs may be a different type of bank (for instance, a savings bank rather than commercial bank), or of a different country or payment region. For reasons explained in the next section, some of these PSPs have an account at their respective central bank. Assuming a chain of intermediaries ranging from the central bank to the recipient, we refer to those intermediaries connected to the central bank as Top Tier Intermediaries (TTIs).

<sup>10</sup> Bankruptcy laws occasionally permit rollback of transactions entered into during the day on which an entity goes into external administration (or bankruptcy proceedings otherwise commence). Known as a “zero hour rule”, such rollback allows invalidation of payments made between midnight that day and the time the insolvency order is made. To promote legal certainty, the application of zero hour rules has been restricted in the context of payment systems. For example, Article 7 of the *EU Directive 98/26/EC of 19 May 1998 On Settlement Finality in Payment and Securities Settlement Systems*, and section 6(1) of the *Australian Payment Systems and Netting Act 1998*.

<sup>11</sup> The term “payment service provider” is used in EU law – see *Directive (EU) 2015/2366*, Article 1(1) – and in Australia – see *Payment Systems (Regulation) Act 1998 Standard No 3 of 2016* s 2.3. However, laws across the world use different terminology, including “money transmitters” in the US (see 18 USC § 1960(b)(2)), “money transfer operators” in Russia (Federal Law “On the National Payment System” No 161-FZ of 27 June 2011, s 3(2)).

Figure 2: Payment with TT intermediaries



## 2. DNS and RTGS Systems

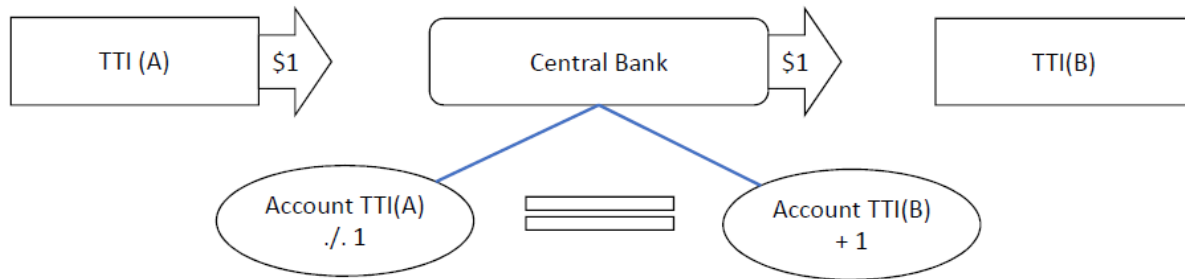
Prior to the 1970s, payment systems were structured as deferred net settlement (DNS) systems. The deferral referred to the time difference between payment instruction and execution: in DNS the respective transfers are netted and the balance transferred at a predetermined later time, such as close of business day. Given multiple transactions, credit risk, ie. the risk that one PSP defaults on an obligation, increases with the time lag between a payment instruction and its execution. In order to reduce the risks that materialized in the collapse of Herstatt Bank in 1974, most countries have moved towards wholesale real-time gross settlement (RTGS) systems where each payment is settled intra-day in real-time, foregoing netting altogether. RTGS systems became possible as a result of high speed centralized processing systems for large transaction volumes. While the Federal Reserve's FedWire and the EU's Target2 are among the largest in terms of institutions connected and volumes processed, by 2012, some 85 per cent of 150 countries surveyed by the World Bank had RTGS systems in place.<sup>12</sup>

For lack of a common settlement time, netting is impossible in an RTGS. Since each payer in an RTGS system needs to have the full amount of each payment available to it at the moment of payment, the system requires a substantially larger liquidity pool to operate efficiently. Since central banks are particularly good at providing short-term liquidity, RTGS systems generally have access to central bank liquidity. Moreover, in order to ensure payment finality, transactions have to take place across the books of the central bank (by electronic rebalancing of the respective TTIs' accounts), or a designated payment system, respectively.<sup>13</sup> That means the respective central bank often assumes the function of a de facto central counter party to all TTIs. This is beneficial to the extent that monitoring of, and participating in, RTGS also provides core data for the central bank's monetary policy and mechanisms.

<sup>12</sup> See *Global Payment Systems Survey (GPSS) Section II: Large-Value Payment Systems*, online: The World Bank <<http://www.worldbank.org/en/topic/financialinclusion/brief/gpss>>.

<sup>13</sup> BIS & IOSCO, *supra* note 7 at 67-9.

Figure 3: RGTS with Central Bank



In order to avoid perverse incentives, RTGS systems are not widely available to end users.<sup>14</sup> Only certain (strictly regulated and supervised) TTIs have accounts with the central bank. Those without a central bank account must rely on TTIs who do have (and would typically charge for) such access.<sup>15</sup> In particular, in cross-border transactions access to the domestic payment systems is limited to domestically licensed, regulated and supervised TTIs.

### 3. Fast or “Instant” Payment Systems

RTGS typically do not deal with retail and non-TTI-based payments, resulting in increased costs and risks for these groups. This is where “fast payment systems” (FPS) come into play. In terms of speed, FPS stand in between RTGS and digital financial services (DFS): The BIS defines “fast payments” as “payments in which the transmission of the payment message and the availability of ‘final’ funds to the payee occur in real time or near-real time on as near to a 24-hour and seven-day (24/7) basis as possible”.<sup>16</sup> Using the same links among intermediaries as DFS, in most FPS while the client’s accounts are rebalanced immediately, settlement between the relevant PSPs of payee and payer is in fact deferred.<sup>17</sup> In the meantime the payee’s PSP essentially extends credit to the payer’s PSP. In some rare cases,

<sup>14</sup> See section I(C)(1)(a).

<sup>15</sup> In the EU’s TARGET2 RTGS payment system, direct access is restricted to credit institutions, central banks and certain public entities admitted by Member States’ central banks as direct participants (e.g. government treasury departments). Cf. Art. 4(1)-(2) of Annex II to the Guideline of The European Central Bank of 5 December 2012 on a Trans-European Automated Real-time Gross Settlement Express Transfer system (TARGET2) (recast) (ECB/2012/27). Other access types (indirect participation, multi-addressee access and Addressable BIC holders) settle payments via accounts of direct participants.

<sup>16</sup> See Bank for International Settlements, “Fast Payments – Enhancing the Speed and Availability of Retail Payments” (Committee on Payments and Market Infrastructures, November 2016) online: <<https://www.bis.org/cpmi/publ/d154.pdf>> at 6 [BIS, *Fast Payments*]. FPS is also referred to as “instant payment systems”, see e.g., the close to real time retail settlement service launched by the European Central Bank in November 2018 dubbed TIPS – TARGET *Instant* Payment Settlement. See *What is TARGET Instant Payment Settlement (TIPS)?*, online: European Central Bank <<https://www.ecb.europa.eu/paym/target/tips/html/index.en.html>>. Another retail payment scheme set up by the European Payments Council (a not-for-profit association of payment service providers and their associations) is known as SEPA (Single Euro Payments Area) *Instant* Credit Transfer. See *SEPA Instant Credit Transfer*, online: European Payments Council <<https://www.europeanpaymentscouncil.eu/what-we-do/sepa-instant-credit-transfer>>.

<sup>17</sup> See BIS, *Fast Payments*, supra note 16 at 16, Table 3.

however, FPS offer immediate settlement.<sup>18</sup> This second type of FPS has overcome economic barriers such as cost of implementation, existence of sufficient demand and coordination among participants,<sup>19</sup> either through assistance and incentives set by regulators or participation of central banks in the set-up and operations of the FSP similar to the central bank's role in RTGS. The second option is one, inter alia, the Reserve Bank of Australia has implemented,<sup>20</sup> and is being considered as one element in the context of proposals for a “Digital Dollar” in the United States (discussed further below).

### C. Recurring Challenges of Payment Systems Design and Regulation

Two broad policy objectives dominate payment system design: (i) safety (incorporating stability, integrity,<sup>21</sup> customer and data protection concerns) and (ii) efficiency (including cost efficiency, competition and innovation).<sup>22</sup>

#### 1. Safety

Service interruptions of systemically important payment systems have the potential to trigger a temporary breakdown of payment operations in the economy, a potential source of systemic risk.<sup>23</sup> In turn, the stability of the payment system is a key task of regulators.<sup>24</sup> Service interruptions may result from the breakdown of the settlement process, failure by intermediaries to perform their respective functions or as a result of disruptive technological innovation.

##### a. Settlement disruption

All payment systems suffer from settlement or payment risk, ie. the risk that a counterparty (such as another PSP) fails to deliver payment for technical or financial reasons. Settlement risk increases the longer the time window between the payee's access to funds and when the

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<sup>18</sup> *Ibid* at 77, Table D.

<sup>19</sup> *Ibid* at 25-28.

<sup>20</sup> In Australia, the operation of the FPS (known as the “New Payments Platform” or “NPP”) is facilitated by the Fast Settlement Service – a settlement system built by the Reserve Bank of Australia (RBA). The FSS was developed and is operated by the RBA: settlement occurs across the exchange settlement accounts held at the central bank by NPP participants. At the time of writing, around 74 per cent of NPP payments were settled via the FSS, the rest being payments between the clients of the same NPP participant. See Emilie Fitzgerald & Alexandra Rush, “Two Years of Fast Payments in Australia” *RBA Bulletin* (March 2020) online: <<https://www.rba.gov.au/publications/bulletin/2020/mar/two-years-of-fast-payments-in-australia.html>>.

<sup>21</sup> Being the domain of integrity related regulation such as the FATF's AML/CTF standards, we do not consider in detail integrity as a separate objective in this article, but understand integrity as inherent to the safety objective.

<sup>22</sup> BIS & IOSCO, *supra* note 7 at 10-11.

<sup>23</sup> Systemically important payment systems are payment systems that have “the potential to trigger or transmit systemic disruptions”. See BIS & IOSCO, *supra* note 7 at 12.

<sup>24</sup> See Douglas Arner, *Financial Stability, Economic Growth and the Role of Law* (New York: Cambridge University Press, 2007). The payment system is critical for the operation of the money market, whereas the latter is the key vehicle through which monetary policy measures are transmitted into the wider economy. See European Central Bank, *Eurosystem Oversight Policy Framework*, (ECB Eurosystem, July 2016) online: <<https://www.ecb.europa.eu/pub/pdf/other/eurosystemoversightpolicyframework201607.en.pdf>> at 3.

wholesale settlement infrastructure settles the balance. Settlement risk prevails in DNS systems (due to the deferred settlement) or in FPS due to intraday credit among the PSPs (which frequently settle without a central bank account in between).<sup>25</sup>

In RTGS systems central bank access is typically limited to TTIs while most system users and non-TTI PSPs lack direct access. These excluded users have to rely on indirect access to RTGS services, such as: (i) direct access to a settlement account but not to central bank credit, (ii) authorization to an agent to order transfers on accounts owned by others, and (iii) indirect access through a customer relationship with a direct RTGS system account holder.<sup>26</sup> Through all these three means, the excluded enter into a functional credit relationship with the TTIs: either money is deposited with the TTI (ie. the user or excluded PSP gives credit to the TTI) or the TTI grants credit to the excluded. In this non-central bank relationship, settlement, credit and market risks exist. Settlement risk in DFS and FPS is generally mitigated by customer transaction limits, net debit caps, loss-sharing agreements, collateral requirements or pre-funding arrangements,<sup>27</sup> while for RTGS, PSP operational set up and technical abilities are central.<sup>28</sup>

#### b. Reliance on intermediaries

Where most payment system users are excluded from central bank access, designing adequate and proportionate prudential requirements for TTIs and promotion of public trust in them (eg. via capital requirements, deposit insurance or stability mechanism arrangements, ring-fencing of payment infrastructure, and bail-out legislation) remains an ongoing challenge.<sup>29</sup> Licensing requirements, regulation and supervision, as well as restricting access to RTGS systems to large regulated institutions, are all instrumental for systemic stability.

Where mobile and other non-financial electronic payment services – such as M-Pesa, Alipay, Mastercard, and PayPal – account for large shares of a given payment system, in an increasing range of jurisdictions, they are being brought directly into the payment and settlement regulatory and supervisory framework, while in others such entities are subjected to tailor-made PSP regulation.

#### c. Disruptive innovation

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<sup>25</sup> See BIS & IOSCO, *supra* note 7 at 38-39.

<sup>26</sup> See Peter Allsopp, Bruce Summers & John Veale, *The Evolution of Real-Time Gross Settlement: Access, Liquidity and Credit, and Pricing* (The World Bank, 2009) online: <<http://siteresources.worldbank.org/EXTPAYMENTREMITTANCE/Resources/TheEvolutionofRTGS.pdf>> at 10.

<sup>27</sup> For specific country examples see BIS, *Fast Payments*, *supra* note 16 at 78, Table E.

<sup>28</sup> See on tech risk, as new category of systemic risk, Ross P Buckley, Douglas W Arner, Dirk A Zetsche & Eriks Selga, “The Dark Side of Digital Financial Transformation: The New Risks of FinTech and the Rise of TechRisk” (2019) online: SSRN <<https://ssrn.com/abstract=3478640>>.

<sup>29</sup> The requirements are noticeably lower for entities that do not hold customer funds (such as payment initiation service providers or account information service providers) and, consequently, pose lesser risks. See, e.g., paragraph 35 of the Preamble and Articles 7 and 8 of the Directive (EU) 2015/2366 of 25 November 2015 On Payment Services in the Internal Market.



Innovation holds the potential to disrupt the payment system<sup>30</sup> and create safety and integrity issues. Innovation may relate to:

- new channels, such as payments made using mobile devices, wearable tech or performed by connected devices known as the “internet of things” (IoT),
- new technologies, such as distributed ledger technology (DLT),<sup>31</sup> cloud computing<sup>32</sup> or artificial intelligence,<sup>33</sup> and/or
- new participants, such as digital-only banks, new data service providers or technology companies utilizing their customer data to provide payment services, sometimes referred to as “TechFins”.<sup>34</sup>

Integrity is another concern related to innovation. For instance, alternative digital currencies raise challenges with regard to consumer and investor protection, anti-money laundering and combating the financing of terrorism (AML/CFT), enforcement of tax laws and international sanctions, as well as circumvention of capital controls and securities laws, to name a few.<sup>35</sup>

## 2. Efficiency

The second perennial task of payments regulators is increasing efficiency. Transaction costs reduce the use of payment systems. Of the 131 countries that were reforming their national payment systems according to a World Bank survey in 2012, 113 (86 per cent) cited the need to increase overall efficiency as the factor that triggered reform.<sup>36</sup> Since payment is the

<sup>30</sup> According to a recent survey, an overwhelming majority of financial institutions believe that payment services are (and will continue over the next five years to be) the subsector (by far) most affected by technological developments. See Kathryn Petralia, Thomas Philippon, Tara Rice & Nicolas Véron, *Banking Disrupted? Financial Intermediation in an Era of Transformational Technology* (International Center for Monetary and Banking Studies, 2019) online: <[https://www.cimb.ch/uploads/1/1/5/4/115414161/banking\\_disrupted\\_geneva22-1.pdf](https://www.cimb.ch/uploads/1/1/5/4/115414161/banking_disrupted_geneva22-1.pdf)>.

<sup>31</sup> DLT refers to a database structure in which all records are stored and updated simultaneously across all data storage points (nodes), jointly constituting a common ledger that is distributed among nodes and operates on the basis of algorithms ensuring that each node holds the accurate version of the database. The key advantage of a distributed database is its ability to solve the storage trust issue by replacing multiple competing sets of data with a single source of information accepted by all nodes. For a more technical description see Dirk Zetsche, Ross Buckley & Douglas Arner, “The Distributed Liability of Distributed Ledgers: Legal Risks of Blockchain” (2018) 4 U Ill L Rev 1361 at 1370-1374.

<sup>32</sup> Cloud computing refers to a computing model that “enables on-demand network access to a shared pool of configurable computing resources”. See Juan Carlos Crisanto, Conor Donaldson, Denise Garcia Ocampo & Jermy Prenio, “Regulating and Supervising the Clouds: Emerging Prudential Approaches for Insurance Companies” (Bank for International Settlements, 2018) online: <<https://www.bis.org/fsi/publ/insights13.pdf>> at 5-6.

<sup>33</sup> There are many different approaches to defining “artificial intelligence”. In the broad sense, it refers to “application of computational tools to address tasks traditionally requiring human sophistication”. See, in the financial services context, Financial Stability Board, *Artificial Intelligence and Machine Learning in Financial Services: Market Developments and Financial Stability Implications* (FSB, 1 November 2017) online: <<https://www.fsb.org/wp-content/uploads/P011117.pdf>> at 3-4.

<sup>34</sup> For a detailed discussion about the concept of “TechFin” see Dirk Zetsche, Ross Buckley, Douglas Arner & Janos Barberis, “From FinTech to TechFin: The Regulatory Challenges of Data-Driven Finance” (2018) 14:2 NYU J L & Bus 393 at 405-408.

<sup>35</sup> See Dirk Zetsche, Ross Buckley, Douglas Arner & Linus Föhr, “The ICO Gold Rush: It’s a Scam, It’s a Bubble, It’s a Super Challenge for Regulators” (2019) 60:2 Harv Int’l LJ 267.

<sup>36</sup> See *Global Payment Systems Survey (GPSS) 2012; Section VIII: Reforming the National Payments System*, online: The World Bank <<http://www.worldbank.org/en/topic/financialinclusion/brief/gpss>>.

dominant form of performance in most commercial contracts, higher than necessary payment costs mean fewer commercial transactions, translating into lower economic growth.<sup>37</sup>

a. Costs, speed and accessibility

Greater efficiency is achievable through: (i) lower processing costs,<sup>38</sup> (ii) higher processing speed,<sup>39</sup> and (iii) broadening access to the payment system (in particular to digital payment channels, seen as a key element of financial inclusion<sup>40</sup>). The latter two objectives are generally the main rationales behind the introduction of FPS.<sup>41</sup> FinTech and TechFin firms also target payments by capitalizing on their higher efficiency, lower cost, and increased accessibility stemming from non-legacy design.

b. Liquidity and cash management

RTGS systems require TTIs and other PSPs to hold sufficient liquidity to function properly. In addition, the PSPs must be prepared to manage liquidity outside the normal business hours of the RTGS platform or the central bank.<sup>42</sup> The liquidity management techniques may include, for instance, transfers of supplementary funds prior to any service interruptions of the “core” RTGS system (eg. before the evening or weekend) or introducing a settlement agent (such as the central bank).<sup>43</sup> The excess provision of highly-rated liquidity as a precondition for running a RTGS is in itself costly for TTIs.

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<sup>37</sup> For a discussion about interrelation between transaction costs and economic growth more generally, see, e.g., David Bywaters & Pawel Mlodkowski, “The Role of Transactions Costs in Economic Growth” (2012) 7 Intl J Econ Pol’y Studies 53.

<sup>38</sup> A number of studies provide various estimates of costs associated with the operation of retail payment systems. In Europe, these can range between 0.42% and 1.35% of GDP. See Heiko Schmiedel, Gergana Kostova & Wiebe Ruttenberg, *The Social and Private Costs of Retail Payment Instruments; A European Perspective* (European Central Bank Eurosystem Occasional Paper Series No 137, September 2012) online: <<https://www.ecb.europa.eu/pub/pdf/scpops/ecbocp137.pdf>> at 25. See also Björn Segendorf & Thomas Jansson, *The Cost of Consumer Payments in Sweden* (Riksbank Research Paper Series No 93, 2012) online: <<https://ssrn.com/abstract=2092577>>. In Australia, the cost fell from 0.8% of GDP in 2006 to 0.54% of GDP in 2013. See Chris Stewart, Iris Chan, Crystal Ossolinski, David Halperin & Paul Ryan, *The Evolution of Payment Costs in Australia* (Reserve Bank of Australia RDP 2014-14, December 2014) online: <<https://www.rba.gov.au/publications/rdp/2014/pdf/rdp2014-14.pdf>>. For an analytical framework for calculating retail payment costs see e.g. World Bank Group, *Retail Payments: A Practical Guide for Measuring Retail Payment Costs* (Financial Infrastructure Series Payments Systems Policy and Research, November 2016) online: <<http://documents.worldbank.org/curated/en/255851482286959215/pdf/111216-WP-P155382-PUBLIC-ABSTRACT-SENT.pdf>>.

<sup>39</sup> Costs and speed are also the motives for the modernization of legacy payment systems which are often programmed in obsolete languages or use outdated database designs. Morten Bech & Rodney Garratt, “Central Bank Cryptocurrencies”, *BIS Quarterly Review* (September 2017) online: <[https://www.bis.org/publ/qtrpdf/r\\_qt1709f.pdf](https://www.bis.org/publ/qtrpdf/r_qt1709f.pdf)> at 66.

<sup>40</sup> Douglas W Arner, Ross P Buckley & Dirk A Zetzsche, *FinTech for Financial Inclusion: A Framework for Digital Financial Transformation* (Alliance for Financial Inclusion & G-24 Special Report, September 2018) online: <<https://www.afi-global.org/publications/2844/FinTech-for-Financial-Inclusion-A-Framework-for-Digital-Financial-Transformation>> [AFI, *FinTech for Financial Inclusion*].

<sup>41</sup> See section I(A)(3).

<sup>42</sup> See BIS, *Fast Payments*, *supra* note 16 at 44.

<sup>43</sup> Different challenges may come up where cash is involved. These challenges may include excessive costs for replacing banknotes and coins where the amount of cash in circulation has been decreasing rapidly. See on the

### c. Cross-border retail payments

A field where greater efficiency is sorely needed is cross-border payments: “[C]ross-border retail payments remain slow, costly and opaque, with heightened risks to manage”.<sup>44</sup> At the time of writing, the global average cost of sending remittances remained close to 7 per cent, with transfers to Sub-Saharan Africa being the most expensive, with an average cost of 9 per cent.<sup>45</sup> Traditional PSPs may not see cross-border retail payments as a sufficiently attractive business to justify investment.<sup>46</sup>

A highly successful cross-border system is the European Single Euro Payment Area (SEPA) which was implemented through the first Payment Services Directives (PSD I) and a multilateral agreement among all PSPs.<sup>47</sup> More than 500 million consumers now pay the same transaction costs, with transactions settled in the same timeframe, among 36 countries including all EU/EEA countries plus Switzerland and a number of smaller European countries. Designed as an open standard, in principle SEPA is open for other countries to join. However, the preconditions – a strong central regulator working on this project for more than a decade and demanding enormous infrastructure investments from European PSPs – may not be easy to mimic in other cross-border settings.

SEPA is an outstanding example of what is achievable when central banks work with incumbents to integrate new technologies in payment systems. Other outstanding examples of cooperation with central banks include M-Pesa and Alipay, the tech platforms that have shaped the Kenyan and Chinese payments revolutions.<sup>48</sup>

The many challenges listed above provide the context for the development of modern money and payment arrangements. To date this has been a long-term evolutionary process. As will be seen next, in Part II, new technologies like DLT and blockchain, while attracting the attention of most regulators, have not so far substantially disrupted the money and payments landscape.

## II. NON-SYSTEMIC CATALYSTS: E-MONEY, BITCOIN, STABLECOINS AND EARLY SDCs

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relevant challenges for central banks Sveriges Riksbank, *The Riksbank's E-krona Project: Report I* (2017) online: <[https://www.riksbank.se/globalassets/media/rapporter/e-krona/2017/rapport\\_ekrona\\_uppdaterad\\_170920\\_eng.pdf](https://www.riksbank.se/globalassets/media/rapporter/e-krona/2017/rapport_ekrona_uppdaterad_170920_eng.pdf)>.

<sup>44</sup> See Committee on Payments and Market Infrastructures, *Cross-Border Retail Payments* (Bank for International Settlements, February 2018) online: <<https://www.bis.org/cpmi/publ/d173.pdf>> at 3 [CPMI, *Cross-Border Retail Payments*].

<sup>45</sup> See The World Bank, *Remittance Prices Worldwide* (Issue 31, September 2019) online: <[https://remittanceprices.worldbank.org/sites/default/files/rpw\\_report\\_sept\\_2019.pdf](https://remittanceprices.worldbank.org/sites/default/files/rpw_report_sept_2019.pdf)> at 1.

<sup>46</sup> See CPMI, *Cross-Border Retail Payments*, *supra* note 44 at 2.

<sup>47</sup> See *Payment Services Directive 2007/64/EC*.

<sup>48</sup> These initiatives, along with mobile money's electronic progeny such as Alipay, have been largely brought into the existing system, albeit at the same time importantly expanding its availability and efficiency.

Underlying all the non-systemic catalysts discussed in this Part is the proposition that new technology-facilitated forms of non-bank liabilities should be widely used for making payments to third parties.

### A. *The Limited Reach of Electronic Money*

Electronic money (e-money, mobile money) platforms were some of the earliest disruptors of the modern payment systems before cryptocurrencies.<sup>49</sup> E-money allowed non-banks (such as telecom operators) to offer their own liabilities to clients in order to facilitate payments, even though such liabilities needed to be linked to fiat currency (known as the float) deposited with authorized financial institutions. Despite some notable successes in developing countries,<sup>50</sup> electronic money platforms have never been important in major economies. They struggled in jurisdictions with a developed banking sector due to competition from incumbents. For example, in South Africa, where M-Pesa launched twice, it eventually had to be abandoned as a result of insufficient demand.<sup>51</sup> Overall, the disruptive effects of electronic money were thus limited, since at its core it was never designed to challenge the duality of central bank and commercial bank-issued money. If anything, this is reinforced by the massive success of Alipay and WeChatPay in China, both of which relied for their initial growth on funding from underlying bank accounts.

### B. *Bitcoin and its Progeny*

The first real challenger to incumbent bank-linked payment systems was Bitcoin.<sup>52</sup> When launched, in 2009, Bitcoin was barely noticed by financial regulators. Today, the situation has changed, although less dramatically than many of Bitcoin's more ardent enthusiasts would have hoped. Over 2,600 Bitcoin spinoffs<sup>53</sup> globally have provided regulators a good

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<sup>49</sup> The concept of e-money was introduced into the legal framework of the European Union in 2000 by means of the *Directive 2000/46/EC (L 275/39)* of 18 September 2000 On the Taking up, Pursuit of and Prudential Supervision of the Business of Electronic Money Institutions. M-Pesa began operation in Kenya in 2007. See Anton Didenko, "Regulating FinTech: Lessons from Africa" (2018) 19:2 San Diego Intl LJ 311 at 361.

<sup>50</sup> *Ibid.* At the time of writing, M-Pesa continued its domination of the Kenyan e-money market, with a market share of 98.8% (28,627,861 out of 28,976,406 e-money subscriptions across the country). See Communications Authority of Kenya, *Second Quarter Sector Statistics Report for the Financial Year 2019/2020* (October-December 2019) online: <<https://ca.go.ke/wp-content/uploads/2020/03/Sector-Statistics-Report-Q2-2019-2020-1.pdf>>. E-money remains the key instrument of financial inclusion in Tanzania, with a more diversified and competitive market and a total of 26,383,998 (as of March 2020). See Tanzania Communications Regulatory Authority, *Quarterly Communications Statistics: January – March 2020 Operators' Submissions* (2020) online: <[https://tcra.go.tz/statistic\\_document/8/march](https://tcra.go.tz/statistic_document/8/march)>.

<sup>51</sup> Didenko, *supra* note 49.

<sup>52</sup> Bitcoin is the first digital currency issued without a single administrator and repository. For a more detailed explanation, see, e.g., Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller & Steven Goldfeder, *Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction* (Princeton University Press, 2016); Rainer Böhme, 'Bitcoin: Economics, Technology, and Governance' (2015) 29(2) J Econ Perspect 213; Dirk Baur, KiHoon Hong & Adian Lee, "Bitcoin: Medium of Exchange or Speculative Assets?" (2018) 54 J Int Financial Mark, 177.

<sup>53</sup> See *All Cryptocurrencies* (CoinMarketCap) online: <<https://coinmarketcap.com/all/views/all/>>.

reason to search for opportunities to improve monetary and payment systems, by looking to the potential of the underlying technology, such as DLT.<sup>54</sup>

First, DLT may reduce the *disruption risks* that challenge the *integrity* of payment systems by disintermediating the data storage function currently monopolized by TTIs in RTGS. DLT could provide a distributed database of critical payment system information updated by authorized parties in almost real time. Such distributed databases could generate a “golden record” of critical data for the transactions of all PSPs (with or without central bank access). Both wholesale and small value RTGS systems could then offer truly *instant settlement and finality of payments* for all payment system end users, resulting in groundbreaking FPS. Examples include Project Jasper in Canada, Project Ubin in Singapore and Project Inthanon in Thailand.<sup>55</sup>

Second, DLT could improve the *efficiency* of the payment system:

- DLT can provide the technical means to keep a secure and tamper-resistant transaction history reflecting every historic payment operation.<sup>56</sup> Many benefits follow. For example, resilient transaction records can ensure transparent money transfers and help counter money laundering and terrorism financing, curb corruption

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<sup>54</sup> See Dirk Zetsche, Ross Buckley & Douglas Arner, *supra* note 31.

<sup>55</sup> Phases 1 and 2 of Project Jasper of Bank of Canada involved building and testing a proof of concept distributed ledger wholesale interbank payment system. Within this system, the Bank of Canada issues digital depository receipts (DDR) that are “backed one for one by cash pledged...by the participants”. In other words, DDRs act as a new digital type of currency that represents central bank deposits. Different design choices were analyzed in phases 1 and 2: the former involved an Ethereum platform using proof-of-work consensus algorithms, while the latter implemented a Corda platform in which the proof-of-work mechanism was replaced with the notary function performed by the central bank. See James Chapman, Rodney Garratt, Scott Hendry, Andrew McCormack & Wade McMahon, *Project Jasper: Are Distributed Wholesale Payment Systems Feasible Yet?* (Bank of Canada Financial System Review, June 2017) online: <<https://www.bankofcanada.ca/wp-content/uploads/2017/05/fsr-june-2017-chapman.pdf> 4-5>. The Monetary Authority of Singapore has experimented with Ethereum-based central bank-issued digital currency (Singapore dollar equivalent) for interbank payments, as well as with setting up real time gross settlement (RTGS) systems on different distributed ledger platforms (Corda, Hyperledger Fabric and Quorum). See Monetary Authority of Singapore, The Association of Banks in Singapore & Accenture, *Project Ubin Phase 2: Re-imagining Interbank Real-Time Gross Settlement System Using Distributed Ledger Technologies*, November 2017) online: <<http://www.mas.gov.sg/~media/ProjectUbin/Project%20Ubin%20Phase%202%20Reimagining%20RTGS.pdf>>. Both regulators subsequently switched to experimentation involving settlement of securities against tokens representing official currency (namely, digital depository receipts in Phase 3 of Project Jasper and cash depository receipts in Project Ubin DvP) on distributed ledger platforms. See Bank of Canada, TMX Group, Payments Canada, Accenture & R3, *Jasper Phase III: Securities Settlement Using Distributed Ledger Technology* (October 2018) online: <[https://www.payments.ca/sites/default/files/jasper\\_phase\\_iii\\_whitepaper\\_final\\_0.pdf](https://www.payments.ca/sites/default/files/jasper_phase_iii_whitepaper_final_0.pdf)> [*Project Jasper Phase III White Paper*]; Monetary Authority of Singapore, Singapore Exchange & Deloitte, *Delivery Versus Payment on Distributed Ledger Technologies: Project Ubin* (2018) online: <<http://www.mas.gov.sg/~media/ProjectUbin/Project%20Ubin%20DvP%20on%20Distributed%20Ledger%20Technologies.pdf>>. See also the recently announced Project Inthanon in Thailand, Bank of Thailand, *Announcement of Project Inthanon Collaborative Partnership* (BOT Press Release No 54/2018, 21 August 2018) online: <<https://www.bot.or.th/Thai/PressandSpeeches/Press/News2561/n5461e.pdf>>.

<sup>56</sup> This enhanced recordkeeping functionality can have a range of other applications, e.g. by providing greater visibility of a counterparty’s exposure, open positions and accounts. For regulatory challenges in monitoring derivative trading portfolios see, e.g., *Keynote Address of CFTC Commissioner J. Christopher Giancarlo Before the Cato Institute, Cryptocurrency: The Policy Challenges of a Decentralized Revolution* (12 April 2016) online: Commodity Futures Trading Commission <<https://www.cftc.gov/PressRoom/SpeechesTestimony/opagiancarlo-14>>.

and uphold taxation. In addition, individuals and businesses can find it much easier to prove ownership of their funds.

- A state-backed digital currency could find wide-spread acceptance among end users and provide deep liquidity, replacing thousands of alternative digital currencies.<sup>57</sup>
- Replacement of cash with a cash-like<sup>58</sup> digital currency authorized by the state can lower the cost of maintaining the supply of physical currency and protecting it against counterfeiting.<sup>59</sup>
- A baseline DLT, creating (only) one data set acceptable to all nodes (in contrast to an operating system), can underpin the development of all PSP systems (including international cooperation among central banks), making the backbone of the payment system future-friendly *and* open to innovation at the same time.

Besides potentially reducing systemic risk and improving operational efficiency, DLT may offer a number of opportunities:

- DLT has the potential to dramatically alter the financial inclusion landscape if the necessary infrastructure<sup>60</sup> is put in place. If the profit motive that drives the private sector leads banks to underserve various segments of the population, the government can fill this gap by issuing a competing payment and deposit option.<sup>61</sup>
- States using another country's official currency as legal tender could use the platform to launch an independent national currency.
- Newly authorized forms of currency could be used to raise money from the public in addition to, or in place of, issuing interest-bearing government bonds.<sup>62</sup>

Bitcoin was designed to be a technological alternative, independent of governments and their central banks, to replace the fiat currencies which lie at the heart of financial systems globally. It was conceived and launched as an active competitor to existing state-centred

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<sup>57</sup> See Gabriele Camera, "A Perspective on Electronic Alternatives to Traditional Currencies" (2017) 1 Sveriges Riksbank Econ Rev 126 at 139. The obvious issue in this case is that this authorized system may not be the most efficient one.

<sup>58</sup> In this context, "cash-like" refers mainly to fungibility and anonymity of cash, as well as to the fact that it does not bear interest (whether positive, or negative).

<sup>59</sup> See JP Koning, *Fedcoin* (19 October 2014) online: Moneyness <<http://jpkoning.blogspot.com/2014/10/fedcoin.html>>.

<sup>60</sup> On the relevance of financial infrastructure in the context of financial inclusion, see AFI, *FinTech for Financial Inclusion*, *supra* note 40 at 16-18.

<sup>61</sup> JP Koning, *Fedcoin: A Central Bank-Issued Cryptocurrency* (R3 Reports, 15 November 2016) online: <<https://static1.squarespace.com/static/55f73743e4b051cfcc0b02cf/t/58c7f80c2e69cf24220d335e/1489500174018/R3+Report+-+Fedcoin.pdf>> at 13.

<sup>62</sup> Venezuela used a DLT platform to launch the "Petro" (a new type of digital currency). The whitepaper contemplated the sale of up to 82,400,000 units of "Petro". See Petro White Paper, version 1.0, 30 January 2018, on file with the authors. Although some sources state the ICO raised USD 5 billion, the exact numbers are difficult to confirm. See Aaron Stanley, *Analyst: Don't Write Off Venezuelan Petro Implications* (24 April 2018) online: Forbes <<https://www.forbes.com/sites/astanley/2018/04/24/analyst-dont-write-off-venezuelan-petro-implications/#16b28fe7204a>>. The Republic of Marshall Islands has passed legislation to underpin an ICO of "Sovereign" units issued on a DLT platform by the Ministry of Finance. See sections 303(a) and 305(3) of the *Declaration and Issuance of the Sovereign Currency Act 2018*, online: <[https://rmiparliament.org/cms/images/LEGISLATION/PRINCIPAL/2018/2018-0053/DeclarationandIssuanceoftheSovereignCurrencyAct2018\\_1.pdf](https://rmiparliament.org/cms/images/LEGISLATION/PRINCIPAL/2018/2018-0053/DeclarationandIssuanceoftheSovereignCurrencyAct2018_1.pdf)>.

money and payment systems. In over 10 years since launch, Bitcoin has operated in a stable manner using its underlying DLT and blockchain database.<sup>63</sup>

Thousands of Bitcoin copycats have modified and refined the Bitcoin model – by implementing different consensus protocols, user authorization mechanisms and smart contracts (with mixed success).<sup>64</sup> While many of these have decentralization as an ideal – the idea of “decentralized finance” (DeFi)<sup>65</sup> – Bitcoin remains largely unique in respect of full decentralization and independence, with Ethereum probably next closest in this respect and arguably the most successful of the thousands of Bitcoin-inspired DLT systems to date. But even Ethereum remains small compared to major RTGS and new payment systems such as Alipay (with more than billion users<sup>66</sup>). This helps to explain the Financial Stability Board’s largely optimistic attitude towards the risks generated by alternative payment systems (APS)<sup>67</sup> created to facilitate the circulation of cryptocurrencies.<sup>68</sup>

### C. *The Plight of Stablecoins*

Very few DLT-based cryptocurrencies<sup>69</sup> developed privately have so far lived up to expectations. Concerns endure about consumer and investor protection, in terms of a perceived lack of transparency and uncertainty around *underlying value*. Stablecoins have been developed to tackle the latter problem by linking their value to various assets, such as fiat currencies or precious metals. However, the underlying stabilization mechanisms come in many forms, with some likely to recreate the currency risks discussed in the previous section.

A telling example is Tether, the world’s leading stablecoin by market capitalization at the time of writing.<sup>70</sup> Tether’s online disclosure contains no promise to ensure that the stablecoin

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<sup>63</sup> In this article, in line with our previous publications, we draw a clear distinction between DLT and blockchain. Note, however, that terminology in this area of technology remains unsettled. For more detail, see, e.g., Angela Walch, “The Path of the Blockchain Lexicon (and the Law)” (2017) 36 Rev. Banking & Fin. L. 718.

<sup>64</sup> See Zetzsche, Buckley, Arner & Föhr, *supra* note 35.

<sup>65</sup> Dirk A Zetzsche, Douglas W Arner & Ross P Buckley, *Decentralized Finance* (Institute of International Economic Law Issue Brief 02/2020, March 2020) online: <[https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=3539194](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3539194)> [Decentralized Finance Brief].

<sup>66</sup> Shi Yinglun, “Alipay Reports 1.2 Bln Users”, *Xinhua* (1 October 2019) online: Xinhuanet <[http://www.xinhuanet.com/english/2019-10/01/c\\_138440413.htm](http://www.xinhuanet.com/english/2019-10/01/c_138440413.htm)>.

<sup>67</sup> For a discussion on interplay between alternative and formal national payment systems see Didenko & Buckley, *supra* note 8.

<sup>68</sup> Financial Stability Board, *Crypto-Asset Markets: Potential Channels for Future Financial Stability Implications* (10 October 2018) online: <<http://www.fsb.org/wp-content/uploads/P101018.pdf>> at 1, 14 (stating that “crypto-assets do not pose a material risk to global financial stability”).

<sup>69</sup> Cryptocurrencies may be sovereign or non-sovereign and are generally based on blockchain and rely upon cryptography. However, this does not mean all alternative currencies utilizing cryptography will be cryptocurrencies. For instance, while cryptography underpins the “gold” used in many computer games, these are generally not treated as cryptocurrencies. In this paper “cryptocurrencies” will be interpreted narrowly, and used to refer to alternative currencies that are (i) digital, (ii) cryptographically protected, (iii) based on DLT and (iv) convertible into fiat currency.

<sup>70</sup> *Top 100 Cryptocurrencies by Market Capitalization*, online: CoinMarketCap <<https://coinmarketcap.com/>>, accessed 20 May 2020.



is fully backed by fiat currency. Instead, each unit of the stablecoin is “1-to-1 pegged to the [US] dollar” and is “always valued by Tether at 1 USD”.<sup>71</sup> Thus, the “stability” of this stablecoin is based (if this description is to be trusted) on the “reserves” – assets that include “cash equivalents” and may include “other assets and receivables from loans made by Tether to third parties”.<sup>72</sup> It does not help that the transparency update on the official website was more than two years old at the time of writing.<sup>73</sup>

Stablecoins raise a number of regulatory issues – particularly in the context of securities regulation – but none has so far been systemic in significance or real in its challenge to state currencies. We expect the underlying issues regarding the majority of stablecoins can largely be addressed by existing regulatory arrangements around market integrity, custody, settlement, and cross-border cooperation though as we will discuss in the following section, a particular type – “global stablecoins” – require particular attention.

#### D. Early Sovereign Digital Currencies

Governments and regulators have not been complacent about attempts to disrupt the duality of central bank and commercial bank issued money – in particular by cryptocurrencies discussed in sections II(B)-(C). Since direct regulation of cryptocurrencies built on a permissionless blockchain can be impractical, if not impossible (especially in the absence of a coordinated international response), a number of countries are rethinking their approach to cryptocurrencies. Instead of attempting to regulate elusive cryptocurrencies with no issuer or centre of operation, driven by international organizations such as the Bank for International Settlements,<sup>74</sup> the IMF<sup>75</sup> and the World Bank,<sup>76</sup> the paradigm shift of offering government-

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<sup>71</sup> *Digital Money for a Digital Age*, online: Tether <<https://tether.to/>>, accessed 20 May 2020 (emphasis added).

<sup>72</sup> *Ibid.*

<sup>73</sup> *Attorney-Client Communication / Work Product* (1 June 2018) online: Tether <<https://tether.to/wp-content/uploads/2018/06/FSS1JUN18-Account-Snapshot-Statement-final-15JUN18.pdf>>, accessed 20 May 2020.

<sup>74</sup> Eg. Bank for International Settlements, *Central Bank Digital Currencies. Technical report*, Basel Committee on Payments and Market Infrastructures (2018); M. L. Bech and R. Garratt, R., *Central Bank Cryptocurrencies*, BIS Quarterly Review (2017); Christian Barontini and Henry Holden, *Proceeding with Caution - a Survey on Central Bank Digital Currency*, BIS Papers 101 (2019); Raphael Auer, Giulio Cornelli and Jon Frost, *Taking Stock: Ongoing Retail CBDC Projects* BIS Quarterly Review (1 March 2020) online: <[https://www.bis.org/publ/qrpdf/r\\_qt2003z.htm](https://www.bis.org/publ/qrpdf/r_qt2003z.htm)> .

<sup>75</sup> Eg. Itai Agur, Anil Ari and Giovanni Dell’Ariccia, *Designing Central Bank Digital Currencies*, IMF Working Paper (November 2019) online: <<https://www.imf.org/en/Publications/WP/Issues/2019/11/18/Designing-Central-Bank-Digital-Currencies-48739>>; Tobias Adrian and Tommaso Mancini-Griffoli, *The Rise of Digital Money*, FinTech Notes 19/01, International Monetary Fund July 2019) online: <<https://www.imf.org/en/Publications/fintech-notes/Issues/2019/07/12/The-Rise-of-Digital-Money-47097>>; Tommaso Mancini-Griffoli, M. S. Martinez Peria, I. Agur, A. Ari, J. Kiff, A. Popescu, and C. Rochon, *Casting Light on Central Bank Digital Currencies*, IMF Staff Discussion Notes 18/08, International Monetary Fund (2018) online: <<https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2018/11/13/Casting-Light-on-Central-Bank-Digital-Currencies-46233>>

<sup>76</sup> Eg. Rodrigo Mejia-Ricart, Camilo Tellez, Marco Nicoli, *Paying across borders - Can distributed ledgers bring us closer together?* (26 March 2019) online: <<https://blogs.worldbank.org/psd/paying-across-borders-can-distributed-ledgers-bring-us-closer-together>>.

issued or government-backed digital currencies has been closely studied.<sup>77</sup> Most notably, the Bank of Canada and the Monetary Authority of Singapore have run pilots of sovereign digital currency with those of the Swedish Riksbank probably the closest to launch,<sup>78</sup> while the Bank of England has developed an entire research agenda on CBDCs.<sup>79</sup>

Nevertheless, prior to the announcement of Libra in mid-2019, despite apparent interest in the concept of SDC, central banks and governments generally remained reluctant to engage too deeply with the relevant projects for a variety of reasons, such as limitations imposed by existing legal frameworks,<sup>80</sup> disappointing experience with earlier attempts<sup>81</sup> or the uncertain benefits of new currency types.<sup>82</sup> Such activities remained, for the most part, investigative in

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<sup>77</sup> In 2018, the Bank for International Settlements (BIS) conducted a survey among 63 central banks from countries representing circa “80% of the world’s population and over 90% of its economic output” to measure the current state of development of so-called “central bank digital currencies” (CBDC). Some 70% of respondents were working on CBDCs or were planning to do so soon. See Christian Barontini & Henry Holden, *Proceeding with Caution – A Survey on Central Bank Digital Currency* (BIS Papers No 101, January 2019) online: <<https://www.bis.org/publ/bppdf/bispap101.pdf>>. A similar survey conducted one year later showed this percentage had grown to 80%. See Codruta Boar, Henry Holden & Amber Wadsworth, *Impending Arrival – A Sequel to the Survey on Central Bank Digital Currency* (BIS Papers No 107, January 2020) online: <<https://www.bis.org/publ/bppdf/bispap107.pdf>> at 3.

<sup>78</sup> See *supra* note 55. Sweden probably is the closest developed economy to actual launch: its e-krona project was launched in March 2017 and began pilot testing in February 2020, ahead of China. See <https://www.riksbank.se/en-gb/payments--cash/e-krona/>. The first and second reports were published in 2017 and 2018 respectively: Sveriges Riksbank, *The Riksbank’s e-Krona Project – Report 1* (September 2017), online: <<https://www.riksbank.se/en-gb/payments--cash/e-krona/e-krona-reports/e-krona-project-report-1/>> and E-Krona Project, *Report 2* (October 2018), online: <<https://www.riksbank.se/en-gb/payments--cash/e-krona/e-krona-reports/e-krona-project-report-2/>>

<sup>79</sup> The BoE has also produced its own theoretical research in the form of staff working papers and eventually published a corresponding discussion paper in 2020. See Bank of England, *Central Bank Digital Currency: Opportunities, Challenges and Design* (Discussion Paper, March 2020) online: <<https://www.bankofengland.co.uk/-/media/boe/files/paper/2020/central-bank-digital-currency-opportunities-challenges-and-design.pdf?la=en&hash=DFAD18646A77C00772AF1C5B18E63E71F68E4593>> at 6 [*BoE CBDC Discussion Paper*].

<sup>80</sup> The proposal to develop a new digital currency in Estonia, known as “Estcoin”, was first voiced in August 2017 as part of the country’s e-Residency program and involved issuing digital tokens as part of a “government-supported ICO”, i.e. a state-run crowdfunding project. See Kaspar Korjus, “Estonia Could Offer ‘Estcoins’ to E-Residents” (E-Residency Blog, 22 August 2017) online: Medium <<https://medium.com/e-residency-blog/estonia-could-offer-estcoins-to-e-residents-a3a5a5d3c894>>. However, attempts to design a national “cryptocurrency” were scrapped following criticism from the President of the European Central Bank, who stressed that “no member state can introduce its own currency”. See Francesco Canepa, “EBC’s Draghi Rejects Estonia’s Virtual Currency Idea”, *Reuters* (8 September 2017) online: Reuters <<https://www.reuters.com/article/us-ecb-bitcoin-estonia/ecbs-draghi-rejects-estonias-virtual-currency-idea-idUSKCN1BI2BI>>.

<sup>81</sup> Ecuador announced the launch of a central-bank operated e-money platform (dinero electrónico) in 2014, but due to a lack of demand the project was wound down in 2018. See Banco Central del Ecuador, *Sobre los Saldos de las Cuentas de Dinero Electrónico* (1 April 2018) online: <<https://www.bce.fin.ec/index.php/boletines-de-prensa-archivo/item/1081-sobre-los-saldos-de-las-cuentas-de-dinero-electronico>>. See also Lawrence H White, “The World’s First Central Bank Electronic Money Has Come – And Gone: Ecuador, 2014-2018” *Cato at Liberty* (2 April 2018), online: Cato Institute online: <<https://www.cato.org/blog/worlds-first-central-bank-electronic-money-has-come-gone-ecuador-2014-2018>>.

<sup>82</sup> The report of Phase 3 of Project Jasper concluded that, despite the conducted pilot, the “project scope was not sufficiently broad to determine whether DLT would yield significant cost savings or efficiency gains”. See *Project Jasper Phase III White Paper*, *supra* note 55. The second phase of project ‘Stella’ developed by the Bank of Japan and the European Central Bank noted that the discussions concerning the application of distributed ledger technologies to delivery versus payment arrangements were “still at an early stage” and “further analysis on the

nature.<sup>83</sup> According to the BIS, over 85 per cent of the central banks surveyed in the second half of 2018 were either “somewhat unlikely” or “very unlikely” to issue any type of new central bank digital currency in the short term.<sup>84</sup>

In the decade following the launch of Bitcoin, many central banks considered the potential role of new technology and new competitors but – despite the immense hype around cryptocurrencies – never saw them as serious competitors to existing systems, with the technology of technical interest rather than a source of fundamental disruption. This changed with the announcement of Libra in 2019, as discussed in Part III.

### III. LIBRA AS A SYSTEMIC CATALYST

In June 2019 Facebook proposed “Libra”, the first “global stablecoin”.<sup>85</sup> Libra was the first catalyst of sufficient scale and potential to lead central banks to rethink their previous approach to SDCs. This previous approach was characterized by three common features.

First, pre-Libra SDC initiatives rarely went beyond pilots to determine the feasibility of implementing DLT for interbank settlements, securities settlements or cross-border payments.<sup>86</sup>

Second, the few SDC projects that were implemented were outliers and not representative of the potential of SDCs generally. For example, failure of the Ecuador initiative may be attributed to the sovereign’s reputation as a serial defaulter,<sup>87</sup> whereas the Petro in Venezuela was launched amidst hyperinflation and seen as an instrument to circumvent US sanctions.<sup>88</sup>

Third, there was, and is, a surprising dearth of economic impact studies of SDC initiatives critically assessing and comparing the expected costs and benefits of such projects, suggesting perhaps that SDCs remained, prior to mid-2019, a solution looking for a problem to solve. A speech by Yves Mersch, a member of the Executive and Supervisory Board of the European Central Bank (ECB), makes clear that the ECB was engaged in CBDC initiatives “[n]ot because [they] want to keep up with fashionable trends, but because [they] have to be ready”.<sup>89</sup> In the light of significant demand for cash in the European economy,<sup>90</sup> the regulator

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safety and efficiency of individual approaches” was warranted. See Bank of Japan & European Central Bank, *BOJ/ECB Joint Research Project on Distributed Ledger Technology*’ (27 March 2018) online: <[https://www.boj.or.jp/en/announcements/release\\_2018/data/rel180327a2.pdf](https://www.boj.or.jp/en/announcements/release_2018/data/rel180327a2.pdf)>.

<sup>83</sup> See Barontini & Holden, *supra* note 77 at 8.

<sup>84</sup> *Ibid* at 11.

<sup>85</sup> See Zetzsche, Buckley & Arner, *supra* note 4 at 3.

<sup>86</sup> See Projects Inthanon, Jasper, Khokha, Stella, Ubin in Figure 5, under Section IV(B) below.

<sup>87</sup> See *supra* note n 81 above.

<sup>88</sup> See Patrick Gillespie, “Venezuela Tries a Cryptocurrency to Solve its Economic Crisis” *CNN* (20 February 2018) online: CNN Business <<https://money.cnn.com/2018/02/20/news/economy/venezuela-petro/index.html>>.

<sup>89</sup> Yves Mersch, *An ECB Digital Currency - A Flight of Fancy?* (Speech, 11 May 2020) online: BIS <<https://www.bis.org/review/r200511a.htm>>.

<sup>90</sup> In the euro area, almost 79% of consumer payments are made using cash, so demand for a new digital currency is not apparent. See Henk Esselink & Lola Hernández, *The Use of Cash by Households in the Euro Area* (ECB

was only “preparing to be ready *should things change*”.<sup>91</sup> Until that happens, the ECB is waiting – waiting for a catalyst.

The lack of progress on the rollout of SDC platforms prior to mid-2019 was hardly surprising in the absence of a more disruptive catalyst than the cryptocurrencies discussed in sections II(B)-(C). That catalyst was provided by the announcement of Libra, a global digital monetary instrument – a “global stablecoin”<sup>92</sup> combined with a global electronic payment system and digital identification framework capable of effectively competing against state-issued money and existing payment systems: domestic and international. Libra is thus the first example of a digital currency with the potential to become systemic – a characteristic Bitcoin and its progeny always lacked.

### A. Libra at a Glance

In June 2019 Facebook revealed plans to roll out in 2020 its own cryptocurrency – combined with a global digital payment system and digital identification system via Facebook / WhatsApp / Instagram Pay. Libra’s ambitious objective to “enable a simple global currency and financial infrastructure that empowers billions of people”<sup>93</sup> immediately drew the attention of policymakers, central bankers and regulators worldwide.<sup>94</sup> This announcement was highly disruptive – not because of the size of Libra’s promise (many have promised to revolutionize the payment system) – but from its perceived ability to deliver on the promise, given Facebook’s global reach and the combined resources of organisations backing the project.<sup>95</sup>

### B. Libra’s Impact on the Future of Monetary and Payment Systems

Libra is expected to integrate a whole range of innovative technologies, from new DLT consensus algorithms to new open identity standards.<sup>96</sup> Comprehensive analysis is outside the scope of this paper. Instead, we focus on the design features which have the potential to be

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Occasional Paper Series No 201, November 2017) online: <<https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op201.en.pdf>> at 26.

<sup>91</sup> Mersch, *supra* note 89 (emphasis added).

<sup>92</sup> See Financial Stability Board, *Addressing the Regulatory, Supervisory and Oversight Challenges Raised by “Global Stablecoin” Arrangements: Consultative Document* (14 Apr 2020), online: Financial Security Board <<https://www.fsb.org/2020/04/addressing-the-regulatory-supervisory-and-oversight-challenges-raised-by-global-stablecoin-arrangements-consultative-document/>> [FSB report].

<sup>93</sup> Libra Association, *An Introduction to Libra* (White Paper) online: <[https://libra.org/en-US/wp-content/uploads/sites/23/2019/06/LibraWhitePaper\\_en\\_US.pdf](https://libra.org/en-US/wp-content/uploads/sites/23/2019/06/LibraWhitePaper_en_US.pdf)> [*Libra White Paper v1.0*].

<sup>94</sup> Zetzsche, Buckley & Arner, *supra* note 4 at 3.

<sup>95</sup> At the moment of Libra’s announcement in June 2019, the project was supported by a group of 28 major businesses (including companies like Ebay, Mastercard, PayPal, Visa and Uber), which became the founding members of the Libra Association – a not-for-profit membership organization headquartered in Geneva tasked with governing the Libra platform. Subsequently, following regulatory backlash, several members (including PayPal, Visa, Mastercard, eBay, Stripe, and Mercado Pago) left the Association.

<sup>96</sup> Libra Association, *Libra White Paper v2.0* (April 2020) online: Libra <<https://libra.org/en-US/white-paper/>> [*Libra White Paper v2.0*].

particularly disruptive for the payment system and may impact the development of SDC projects.

First, as an APS linked to private entities with massive resources and scale (including, but not limited to Facebook with more than 2 billion users), a “wait and see” regulatory strategy was never likely, since Libra has the potential to be systemic virtually upon launch. The impact of Libra could move from too-small-to-care to too-large-to-ignore to potentially too-big-to-fail within weeks or months.<sup>97</sup> Before the project could be launched, regulators felt they had to act, and they did, with responses from the G7<sup>98</sup>, G20<sup>99</sup>, an entire framework from the FSB<sup>100</sup>, the International Organization of Securities Commissions (IOSCO)<sup>101</sup> and separate responses from most major national financial regulators.<sup>102</sup>

Second, Libra gives rise to a broad spectrum of risks for consumers and payment systems that demand a regulatory response. At core are four: Libra could (i) weaken the effect of monetary policy transmission mechanisms, (ii) increase global demand for assets within the Libra Reserve, (iii) jeopardize financial stability (as disruption of Libra could affect many economies at once) and (iv) undermine competition in the payment services market (if the platform is non-interoperable).<sup>103</sup>

Libra also raises a number of other risks, including, among others: <sup>104</sup>

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<sup>97</sup> See Douglas W Arner, János Barberis & Ross P Buckley, “The Evolution of FinTech: A New Post-Crisis Paradigm” (2016) 47:4 *Geo J Int'l L* 1271 at 1310-1311.

<sup>98</sup> See Caroline Binham, Chris Giles & David Keohane, “Facebook’s Libra Currency Draws Instant Response from Regulators”, *Financial Times* (19 June 2019) online: *Financial Times* <<https://www.ft.com/content/5535fb3a-91ea-11e9-b7ea-60e35ef678d2>>.

<sup>99</sup> Huw Jones & Tom Wilson, “G20 Sets Ground Rules Ahead of Facebook's Libra Stablecoin”, *Reuters* (14 April 2020) online: *Reuters* <<https://www.reuters.com/article/us-g20-regulator-stablecoins/g20-sets-ground-rules-ahead-of-facebooks-libra-stablecoin-idUSKCN21W0TU>>.

<sup>100</sup> *FSB report, supra* note 92.

<sup>101</sup> IOSCO, *Global Stablecoin Initiatives Public Report* (22 March 2020) online: <<https://www.iosco.org/library/pubdocs/pdf/IOSCOPD650.pdf>>.

<sup>102</sup> See Jesse Hamilton, “Fed’s Jerome Powell Has ‘Serious Concerns’ With Facebook Libra Proposal” *Bloomberg* (11 July 2019) online: <<https://www.bloomberg.com/news/articles/2019-07-10/fed-s-powell-has-serious-concerns-with-facebook-libra-proposal>>; US House of Representatives, Committee on Financial Services, *Letter to Mark Zuckerberg, CEO of Facebook, Sheryl Sandberg, COO of Facebook, and David Marcus, CEO of Calibra* (2 July 2019); Mark Carney, *Enable, Empower, Ensure: A New Finance for the New Economy* (Speech given by Mark Carney, Governor of the Bank of England, 20 June 2019) online: <<https://www.bankofengland.co.uk/-/media/boe/files/speech/2019/enable-empower-ensure-a-new-finance-for-the-new-economy-speech-by-mark-carney>>; Claude Soula & Sophie Fay, *Libra Sous l’Œil des Banques Centrales* (interview with François Villeroy de Galhau, Governor of the Bank of France, 25 June 2019) online: <<https://www.banque-france.fr/intervention/libra-sous-loeil-des-banques-centrales>>; Detlef Fechtner and Mark Schrörs, *Supervisors Must Keep an Eye on Libra* (interview with Burkhard Balz, Member of the Executive Board of the Deutsche Bundesbank, 12 July 2019) online: <<https://www.bundesbank.de/en/press/interviews/-supervisors-must-keep-an-eye-on-libra—802132>>.

<sup>103</sup> See G7 Working Group on Stablecoins, *Investigating the Impact of Global Stablecoins* (October 2019) online: <<https://www.bis.org/cpmi/publ/d187.pdf>> at 11-16.

<sup>104</sup> *Ibid* 5-11; Zetzsche, Buckley and Arner, *supra* note 4 at 17-26.

- insufficient legal certainty, due to unclear legal status of Libra under national laws, which may involve its characterization as electronic money, virtual currency, or securities;
- lack of sound governance, as Libra’s own value is based on the value of underlying assets (which form the Libra Reserve) and depends on the efficiency of the corresponding stability mechanism;
- failure to ensure operational resilience of a large-scale currency platform;
- non-compliance with personal data protection and AML/CFT obligations; and
- inadequate consumer protection mechanisms.

Furthermore, many of the risks are exacerbated by Libra’s broad – and potentially global – scope. Given Libra’s massive scale, most of the above issues can only be adequately addressed through a coordinated global regulatory response. However, Libra’s developers did not appear to be interested in waiting for the regulators to develop a joint response and seemed focused on simply launching the project upon securing a minimum level of support to begin operation.<sup>105</sup> Absent a global consensus, individual countries and their regulators would be left to their own devices. This would be an example of Facebook founder Mark Zuckerberg’s motto: “Move fast and break things.” As noted below, this initial approach led to a global regulatory backlash, resulting in a very different approach from Libra 1.0 in June 2019 to Libra 2.0 in April 2020.

Third, Libra’s design represents an evolution of the ideas underlying Bitcoin and can be used by governments as a litmus test of new technologies. Libra’s developers rejected the established “proof of work” consensus algorithm underlying the most successful alternative digital currencies (including Bitcoin and Ether) “due to their poor performance and high energy (and environmental) costs”<sup>106</sup> and developed their own model (known as “LibraBFT”) promising “high transaction throughput, low latency, and a more energy-efficient approach to consensus”.<sup>107</sup> Other notable innovations include a new custom programming language<sup>108</sup> and a revised blockchain structure.<sup>109</sup>

What really matters, however, is not the seemingly endless search for a “perfect” blockchain – thousands of blockchains have been designed to date. Libra’s design can be used by regulators to gauge what the market views, at the time, as the most advanced technology – a valuable opportunity for addressing the two groups of recurring challenges identified in section I(C). While SDC is not a static concept (the underlying technologies will continue to evolve over time, in the light of market-driven innovation), Libra’s role as a technological

<sup>105</sup> The recent assurances voiced by Facebook’s CEO are illustrative here: since Facebook does not technically control Libra, the new currency could launch regardless of the fact that, according to Zuckerberg, “Facebook will not be a part of launching the Libra ... anywhere in the world ... until the U.S. regulators approve”. See Jason Abbruzzese & Jo Ling Kent, “Facebook’s Zuckerberg Says Libra Won’t Launch without U.S. Approval”, *NBC News* (24 October 2019) online: <<https://www.nbcnews.com/tech/tech-news/facebook-s-zuckerberg-says-libra-won-t-launch-without-u-n1070561>>.

<sup>106</sup> Zachary Amsden et al, *The Libra Blockchain* (updated 1 May 2020) online: <<https://developers.libra.org/docs/assets/papers/the-libra-blockchain/2020-05-26.pdf>> at 18.

<sup>107</sup> *Libra White Paper v2.0*, *supra* note 96.

<sup>108</sup> *Ibid.*

<sup>109</sup> *Ibid.*

snapshot and catalyst is particularly important for early-stage SDC projects that are currently in development. For example, although in the first iteration of Libra's whitepaper the developers aspired, in the long run, "to move toward increasing decentralization over time"<sup>110</sup>, the initial design remained only partly decentralized, highlighting practical challenges of full decentralization.<sup>111</sup> The regulatory backlash that followed the original Libra 1.0 whitepaper eventually made the developers forgo the future transition to a permissionless system in favour of simply "maintaining its key economic properties".<sup>112</sup>

Fourth, Libra's design may be at odds with certain SDC projects, in particular with respect to the increased (and potentially explosive) demand for government securities from both central banks (which require sufficient assets to issue new liabilities in the form of SDC) and from the Libra Association (which intends to use such securities to back the value of Libra).<sup>113</sup>

Fifth, despite the potential risks and challenges discussed above, Libra's original underlying philosophy in the Libra 1.0 whitepaper to promote "global, open, instant, and low-cost movement of money"<sup>114</sup> (and, in the Libra 2.0 version of the whitepaper, "global, open, instant, and low-cost *payment networks*")<sup>115</sup> remains highly attractive, given that the major challenges of payment systems, such as high costs and lack of access to payment infrastructure have not been resolved. This philosophy *challenges* governments to provide a constructive response that helps resolve existing issues. So far, the short-term response to Libra has been largely emotional, including promises to prohibit development of Libra in France<sup>116</sup> and even draft legislation preventing large platform utilities (like Facebook or Amazon) from entering the financial markets and issuing their own digital currencies in the US.<sup>117</sup> However, this strategy is not sustainable in the long term and the launch of an alternative central bank-issued digital currency is going to be a much more plausible response – particularly in major economies – than an outright ban.

Sixth, the global concept of Libra forces governments to rethink their cooperation arrangements. Ad-hoc working groups and coordination through the G7/G20, FSB and BIS will not suffice for day-to-day-supervision of a global monetary and payment system, and supervisory colleges do not exist for all types of financial services provided by Libra and other global stablecoins.

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<sup>110</sup> *Libra White Paper v1.0*, *supra* note 93 at 9.

<sup>111</sup> Having said that, we acknowledge that central banks are unlikely to transition to a fully decentralized SDC platform, regardless of the level of maturity of decentralized platforms, to maintain overall control over money supply.

<sup>112</sup> *Libra White Paper v2.0*, *supra* note 96.

<sup>113</sup> *Ibid.*

<sup>114</sup> *Libra White Paper v1.0*, *supra* note 93 at 2.

<sup>115</sup> *Libra White Paper v2.0*, *supra* note 96 (emphasis added).

<sup>116</sup> Reuters Staff, "France: We Can't Allow Facebook's Libra in Europe" (12 September 2019) online: Reuters <<https://fr.reuters.com/article/bankingfinancial-SP/idUKP6N23P00H>>.

<sup>117</sup> Pete Schroeder & Ismail Shakil, "U.S. Proposes Barring Big Tech Companies from Offering Financial Services, Digital Currencies" *Reuters* (15 July 2019) online: <<https://www.reuters.com/article/us-usa-cryptocurrency-bill/u-s-proposes-barring-big-tech-companies-from-offering-financial-services-digital-currencies-idUSKCN1U90NL>>.



Finally, and most importantly from our standpoint, Libra propelled central banks to reconsider their own monetary offerings in order to better meet the needs of the economy and financial system, and see off potential competitors, whether private, public-private, or state, domestic or national, of which Libra is the standout example to date.

### C. Libra as a Global Stablecoin

In previous work, we have considered the specific regulatory challenges of Libra and possible responses.<sup>118</sup> Later, much of what we had said was confirmed in an FSB consultation report – released “coincidentally” on the same day as the Libra 2.0 whitepaper – and addressed in ten, albeit very high level, proposed principles that should guide supervisory practice.<sup>119</sup>

Libra transformed attitudes, and galvanized action, among policymakers, central bankers and regulators, in a way that Bitcoin and others did not. Libra is not the first stablecoin (section II(C) above) – but it is the first global stablecoin, and almost certainly not the last. The impact of Libra arises because of its potential for near-instantaneous scale, reach and impact.

Thus, what is a “global” stablecoin? Like most forms of systemically important financial market infrastructure (FMI) or systemically important financial institution (SIFI), definition can be difficult.<sup>120</sup> The elements of a global stablecoin however include size, scale and interconnectiveness: basically economies of scope and scale combined with network effects suggest systemic significance in financial systems.

The first stage in dealing with global stablecoins is to identify them. This can be difficult in practice due to the potential to scale quickly of offerings by non-traditional participants in finance, the so-called BigTechs. Their existing size and scale can be leveraged very rapidly in the new context of finance. From a financial stability standpoint, in addition to the traditional risks of “too big to fail” and “too connected to fail”, a non-state competitor currency poses major monetary policy risks to financial stability as it may well limit the effectiveness of the liquidity provider of last resort function of central banks. Because technology is central to stablecoins, TechRisk<sup>121</sup> and operational risks can potentially impact the entire global economy. Because of their potential scale, other issues can also impact financial stability, including market integrity (the risk of a global stablecoin being widely used for criminal activities), consumer protection (the risk that a collapse destroys a huge portion of individuals’ financial resources) and risks to competition and innovation (due to market dominance).

Identification of global stablecoins could come as they grow and evolve, as has traditionally occurred with G-SIFIs; or in the context of a specific proposal such as Libra.

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<sup>118</sup> Zetzsche, Buckley and Arner, *supra* note 4.

<sup>119</sup> FSB report, *supra* note 92, at 24-32. Although we have somewhat less confidence than the BIS in disclosure as an adequate response in the retail context.

<sup>120</sup> *Global Systemically Important Banks: Assessment Methodology and the Additional Loss Absorbency Requirement* (3 April 2020) online: BIS <<https://www.bis.org/bcbs/gsib/>>.

<sup>121</sup> For a consideration of TechRisk, see Buckley, Arner, Zetzsche & Selga, *supra* note 28.

The second matter that global stablecoins (GSCs) demand is the development of appropriate regulatory and supervisory tools in advance – tools that can be activated when a GSC or GSC project is identified. These could come in a range of forms. One example is the supervisory college approach now applied to G20/FSB identified global SIFIs (G-SIFIs). Another arises from FMIs: these are in some cases supervised via supervisory colleges, and in others are established under specific legal and regulatory systems as part of a cooperative design approach between private and public participants (such as SWIFT, CLS and Euroclear). In some cases, this could involve regulation as a utility or operation by the central bank itself.<sup>122</sup>

Third, there could be a variety of approaches which could be activity, institutional, or infrastructure based depending on the nature of the specific GSC. Activity based approaches would vary depending on the nature of the products and services being offered, whether monetary, payment, securities, etc. Cooperation and coordination on licensing, market access, supervision, resolution etc. would all be required.

The key point is that the Libra experience should be used as an opportunity to develop global systems via the FSB to identify GSCs, to put in place appropriate supervisory arrangements, and to monitor their activities and impact. In some cases, private processes could develop. We would expect – similar to the history of payment systems over the past 200 years – that often these would be public-private processes, and some would be state led.

#### *D. Global Stablecoins Constrained: The FSB and Libra 2.0*

Reacting to the remarkably strong pushback from regulators, the parameters of Libra 2.0 were announced in a new whitepaper in April 2020,<sup>123</sup> and Libra formally applied for supervision by the Swiss financial regulator, FINMA.<sup>124</sup> These events coincided with the launch of the FSB's consultation on regulatory and supervisory approaches to global stablecoins.<sup>125</sup>

Libra 2.0 dramatically scales back the original ambition of Libra 1.0 to create a global digital currency. Instead Libra opts for a series of domestic currency stablecoins, linked in a global basket, not dissimilar in some respects from another project focused on linking, if not merging, fiat currencies and DLT environments, FNALITY's Utility Settlement Coin.<sup>126</sup>

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<sup>122</sup> Dirk A Zetzsche, William A Birdthistle, Douglas W Arner, & Ross P Buckley, *Financial Operating Systems* (European Banking Institute Working Paper Series No. 58/20201, March 2020) online: SSRN <<https://ssrn.com/abstract=3532975>>.

<sup>123</sup> *Libra White Paper v2.0*, *supra* note 96.

<sup>124</sup> *Libra Association: FINMA Licensing Process Initiated* (16 April 2020) online: FINMA <<https://finma.ch/en/news/2020/04/20200416-mm-libra/>>.

<sup>125</sup> *FSB Consults on Regulatory, Supervisory and Oversight Recommendations for "Global Stablecoin" Arrangements* (14 April 2020) online: FSB <<https://www.fsb.org/2020/04/fsb-consults-on-regulatory-supervisory-and-oversight-recommendations-for-global-stablecoin-arrangements/>> [*FSB Consultation*].

<sup>126</sup> Fnality Press Office, *Utility Settlement Coin (USC) Continues to Evolve* (3 June 2019) online: FNALITY <<https://www.fnality.org/news-views/usc-continues-to-evolve>>.

Libra 2.0 (supported by Swiss financial supervisor FINMA) aims at being regulated by a lead regulator and international supervisory cooperative approaches (with supervisory colleges) – and finds general support for this approach in the work of the FSB on GSCs (with many details remaining uncertain).

Libra highlighted how, for the first time, the technology, capital and scale now exist to potentially challenge the dominant paradigm that central banks issue and control currencies. In the world of money, payment and technology, there is the world before, and after, Libra – notwithstanding that as of the time of writing, Libra is yet to be issued. Libra also prompted central banks to consider how they might use technology to build better monetary and payment systems as the foundation of economic and financial activities.

The announcement of Libra was followed by a dramatic scaling up, around the world, of work on SDCs – both ongoing and new. A follow-up BIS survey in 2019 revealed 80 per cent of central banks were now investigating CBDCs, with 10 per cent (twice the 2018 number) “likely to issue a general purpose CBDC in the short term” and another 20 per cent likely to do so “in the medium term”, even though some 70 per cent still saw themselves as “unlikely to issue any type of CBDC in the foreseeable future”.<sup>127</sup>

Perhaps the highest profile announcement came from China’s central bank, the People’s Bank of China, in late 2019, taking the lead by announcing its intention to launch its own central bank digital currency.<sup>128</sup>

#### IV. THE DIGITAL YUAN AS A SYSTEMIC CATALYST

In October 2019, after some years of work, China announced it would launch its “Digital Currency / Electronic Payment” (DCEP) project to create a “Digital Yuan” – and at the time of writing, by mid-2020, trials are ongoing, making it the first major economy to do so, though without as yet a formal announcement as to timing for the system to roll-out across the country.<sup>129</sup>

Following the 2008 Global Financial Crisis, China initiated a policy of “RMB internationalization” to promote the yuan as one of a range of viable alternative global reserve currencies to the US dollar; and thereby claim for itself some of the “exorbitant privilege” the US economy gains from minting the world’s global reserve currency and to reduce its risks from perceived over-dependence on the US dollar.<sup>130</sup> So the proposed

<sup>127</sup> Boar, Holden & Wadsworth, *supra* note 77 at 7.

<sup>128</sup> See Hannah Murphy & Yuan Yang, “Patents Reveal Extent of China’s Digital Currency Plans”, *Financial Times* (13 February 2020) online: Financial Times <<https://www.ft.com/content/f10e94cc-4d74-11ea-95a0-43d18ec715f5>>. In 2019, 80% of central banks surveyed by BIS were involved with CBDCs, an increase from 70% in 2018, see *supra* note 77.

<sup>129</sup> Helen Davidson, “China Starts Major Trial of State-run Digital Currency”, *The Guardian* (28 April 2020) online: The Guardian <<https://www.theguardian.com/world/2020/apr/28/china-starts-major-trial-of-state-run-digital-currency>>. Sweden however was the first developed country to test its system, commencing in February 2020 and running until February 2021: Colin Fulton, “Sweden Starts Testing World’s First Central Bank Digital Currency”, Reuters (20 February 2020) online: <<https://www.reuters.com/article/us-cenbank-digital-sweden/sweden-starts-testing-worlds-first-central-bank-digital-currency-idUSKBN20E26G>>.

<sup>130</sup> Barry Eichengreen, *Exorbitant Privilege: The Rise and Fall of the Dollar and the Future of the International*

creation of a private “global stablecoin” such as Libra by a US firm was always likely to trigger the precise response we have seen from China.<sup>131</sup>

However, China’s domestic context does not display the full range of impacts of the Digital Yuan. In this section we examine the Digital Yuan in the context of our SDC taxonomy and discuss the opportunities and challenges that come with SDCs more generally. We argue that China’s Digital Yuan will prove to be *the* powerful disruption that kickstarts the move from SDC-related research and piloting to multiple SDC *issuance*, particularly by major economies but also more widely.

### A. SDC Taxonomy

SDC projects typically differ across four major design parameters: (1) users, (2) scope, (3) architecture, and (4) technology.

#### 1. Users

The range of potential users is very broad. Some SDC projects include TTIs only, some include all intermediaries (TTIs and non-TTI PSPs), while others seek to include all wholesale or even all retail transactions.

At first sight, opening SDCs for all (retail and wholesale) users seems a major leap. But central banks have a long history of opening direct accounts for non-financial institutions and individuals.<sup>132</sup> For example, the Bank of England allowed members of the public to open accounts from its founding until well into the 20<sup>th</sup> century, and continued this for employees up to 2016, as did the Banque de France.<sup>133</sup> In addition, some central banks offer direct accounts for governmental agencies.<sup>134</sup>

As with any settlement system, however, the efficiency of central bank access for non-banks and individuals depends on demand: disintermediation is only achievable when both parties to a payment transaction have an account with the central bank. This is ensured where *all* transactions are settled with the central bank. At the same time, partial central bank access could be less efficient than the current TTI oligopoly, which leads us to the second question: the choice of architecture.

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*Monetary System*, Reprint Edition (Oxford: Oxford University Press, 2012).

<sup>131</sup> We predicted this response in an article posted online on 11 July 2019: see Zetsche, Buckley & Arner, *supra* note 4.

<sup>132</sup> For the experience of the Bank of England, see Koning, *supra* note 61 at 19.

<sup>133</sup> See Gwyn Topham, “Bank of England to Close Personal Banking Service for Employees”, *The Guardian* (18 July 2016) online: The Guardian <<https://www.theguardian.com/business/2016/jul/17/bank-of-england-closing-personal-banking-service-employees>>; See also Jon Frost, Hyun Song Shin & Peter Wierts, *An Early Stablecoin? The Bank of Amsterdam and the Governance of Money* (BIS Working Papers, forthcoming).

<sup>134</sup> See, e.g., <https://www.treasurydirect.gov>. The website is “the first and only financial services website that lets [users] buy and redeem securities directly from the U.S. Department of the Treasury in paperless electronic form”.

## 2. Architecture

As to architecture we distinguish between three different kinds of SDCs: (a) centralized, (b) fully decentralized, and (c) hybrid, in the context of account- and token-based structures<sup>135</sup>

### a. Centralized SDCs

A *centralized SDC* is characterized by direct access to the central bank. In essence, each user has an account with the central bank where their units of value are stored and available for all transactions. Such a design is necessarily account-based, which means verification is required to access and spend the currency based on the identity of the currency owner, similar to identification of bank account holders.<sup>136</sup> It essentially resembles so-called “electronic money” systems that are based on exchange of official currency for a matching balance (generally at par value) with the issuer (such as a telecoms operator).<sup>137</sup> By design,<sup>138</sup> centralized SDCs are permissioned systems. They lack cash-like qualities, in particular anonymous exchange.<sup>139</sup>

The idea of making central bank accounts accessible for all PSPs or even all payment system users is not new. In 1987, Nobel laureate James Tobin – drawing on an idea raised already in the 1960s and 1970s – suggested making available to the public so-called “deposited currency” to minimize reliance on deposit insurance schemes.<sup>140</sup> The new type of currency, according to Tobin, could be provided by Federal Reserve Banks themselves or by commercial banks, provided that the funds so deposited are isolated from the rest of their own liabilities. At the time, direct central bank accounts appeared a distant possibility.<sup>141</sup> Thirty

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<sup>135</sup> Our taxonomy is equivalent to that proposed by Raphael Auer & Rainer Böhme, “The Technology of Retail Central Bank Digital Currency” (2020) March BIS Quarterly Review 85, but understands the design choice “account” or “token” as inherent to the degree of centralization or decentralization: full decentralization requires some kind of token, while full centralization some kind of account.

<sup>136</sup> This is in contrast to token-based verification that is based on the validity of the actual units of currency (similar to the operation of cash, but in a digital format). For more detail, see Committee on Payments and Market Infrastructures, *Central Bank Digital Currencies* (BIS, March 2018) online: <<https://www.bis.org/cpmi/publ/d174.pdf>> at 4.

<sup>137</sup> See section II(A) above. Due to coexistence of conflicting terms, there is a need for a more neutral term for “electronic money”, such as “surrogates of official currency”. See Didenko & Buckley, *supra* note 8 at 1061-1070.

<sup>138</sup> In theory, it is of course conceivable that the state may try to label a centralized SDC as “anonymous” or “cash-like”, but such an attempt would raise major credibility concerns: “In theory, a government could itself offer debit accounts that were guaranteed to be private. Unfortunately, that promise would not be worth the paper it was written on, so to speak. Given governments’ past behaviour, who could take such a promise seriously?” See Kenneth S Rogoff, *The Curse of Cash* (Princeton: Princeton University Press, 2016) at 102.

<sup>139</sup> In its second report on the E-krona project, Swedish Riksbank concludes that the “focus of this programme should be on developing an e-krona that constitutes a *prepaid value* (electronic money) without interest and with *traceable transactions*.” See Sveriges Riksbank, E-krona Project, Report 2 (26 October 2018) online: Sveriges Riksbank <<https://www.riksbank.se/en-gb/payments--cash/e-krona/e-krona-reports/e-krona-project-report-2/>>. See also Dave Birch, *Bitcoin or Brit-PESA?* (4 January 2016) online: Consult Hyperion <<https://www.chyp.com/bitcoin-or-brit-pesa/>>.

<sup>140</sup> See James Tobin, “A Case for Preserving Regulatory Distinctions” (1987) 30:5 Challenge at 10, 13 (stating that “the government should make available to the public a medium with the convenience of deposits and the safety of currency, essentially currency on deposit, transferable in any amount by check or other order”).

<sup>141</sup> Tobin expected Federal Reserve Banks to act via “conveniently located agencies in private banks or post

years of rapid technological advancement later, it is now possible.<sup>142</sup> In the words of Barrdear and Kumhof:

By CBDC, we refer to a central bank granting universal, electronic, 24x7, national-currency-denominated and interest-bearing access to its balance sheet. ... In short, we imagine a world that implements Tobin's (1987) proposal for "deposited currency accounts".<sup>143</sup>

As noted previously, we do not define a CBDC in such a prescriptive manner but rather simply as an SDC issued by a central bank.

#### b. Decentralized SDC

A *decentralized SDC* bears the closest resemblance to Bitcoin and other decentralized digital APS. One such concept, Fedcoin,<sup>144</sup> is, at its core, a variation of the Bitcoin protocol that nonetheless enjoys a guaranteed exchange rate into the official currency (USD). In this system, mining is still required to produce a record of transactions, but alternative consensus algorithms can be implemented. Crucially, a truly decentralized SDC offers cash-like features (in particular, acceptance by all systems participants regardless of the payer's person) and does not necessarily require identification and KYC checks for each user. Technically, full decentralization is achievable through tokenization.

A less radical step towards wider retail access to central banks is the Hybrid SDC model.

#### c. Hybrid SDC

A *hybrid SDC* is a blend of a centralized and decentralized SDC. While it may use central bank accounts not all users need to have such an account: intermediaries link the users to the central bank, while each of the intermediaries runs its own DLT-based system. Within each of the DLTs tokenization may lead to cash-like characteristics such as anonymity. If each of the DLTs is an enclosed system, AML/KYC checks can be performed at the initial stage. The risk of intermediary default can be mitigated by legal means, for instance by appointing the intermediary as the central bank's agent, turning all tokens substantively into drawing rights on the funds stored in the central bank accounts.

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offices". Nevertheless, Tobin expected fundamental changes in the future, *ibid* (holding that "[c]omputer capabilities should soon make it possible to withdraw conventional currency at any office or agency, and even to order payments to third parties by card or telephone.")

<sup>142</sup> See e.g. Nicholas Gruen, *Why Central Banks Should Offer Bank Accounts to Everyone* (16 December 2016) online: Evonomics <<http://evonomics.com/central-banks-for-everyone-nicholas-gruen/>>; George Hatjioullis, "Allow Deposit Accounts With Central Banks", *Financial Times* (24 September 2017) online: Financial Times <<https://www.ft.com/content/00f796cc-9f99-11e7-8cd4-932067fbf946>>; JP Koning, *Central Banks Deposits for You and Me* (10 August 2016) online: Moneyness <<http://jpkoning.blogspot.com.au/2016/08/central-banks-deposits-for-you-and-me.html>>; Ben Dyson and Graham Hodgson, *Digital Cash: Why Central Banks Should Start Issuing Electronic Money* (Positive Money, 2016) online: <[http://positivemoney.org/wp-content/uploads/2016/01/Digital\\_Cash\\_WebPrintReady\\_20160113.pdf](http://positivemoney.org/wp-content/uploads/2016/01/Digital_Cash_WebPrintReady_20160113.pdf)>.

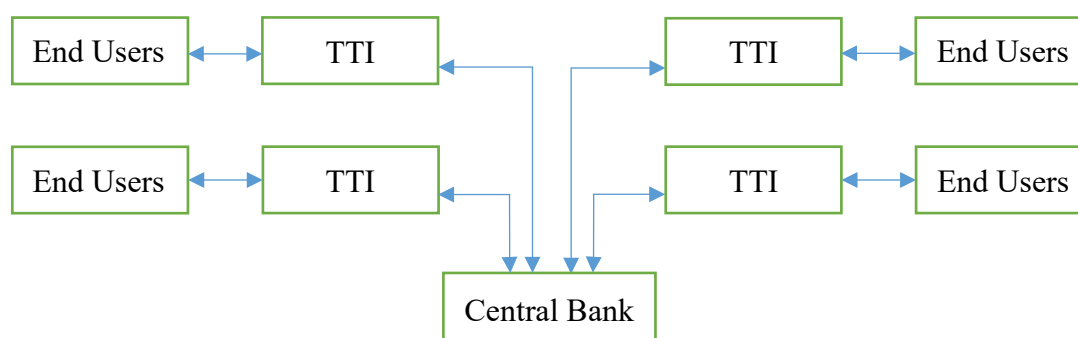
<sup>143</sup> John Barrdear & Michael Kumhof, *The Macroeconomics of Central Bank Issued Digital Currencies* (Bank of England Working Paper No 605, 2016) online: Bank of England <<https://www.bankofengland.co.uk/working-paper/2016/the-macroeconomics-of-central-bank-issued-digital-currencies>> at 7.

<sup>144</sup> See Koning, *supra* note 61.

Many recent SDC proposals suggest an intermediated approach where central banks through qualified counterparties provide access to central bank accounts.<sup>145</sup> These operators would be prohibited from lending or taking on any new risks on client funds. In addition, a multiplicity of operators would create competition and reduce the administrative burden and operational risks on central banks and avoid their needing to deal with millions (and perhaps even a billion) accounts simultaneously.<sup>146</sup> Alternatively, in Ketterer and Andrade’s model, private firms “provide all the transactional and customer [sic] services related to CBM [central bank money] accounts”, while maintaining a 100 per cent reserve for each deposit at all times.<sup>147</sup>

Intermediation of central bank accounts can take various forms, from new types of commercial bank accounts, to accounts with (non-bank) trusted intermediaries fully guaranteed by the central bank. In each case, however, users of the new currency should have direct recourse to central bank accounts. This would require introducing the technology while preserving the current TTIs’ oligopoly of central bank deposits and at the same time ensuring the corresponding benefits to end-users (in particular, insolvency remoteness).

Figure 4: Indirect End Users’ CB-access



The theoretical model dubbed RSCoin<sup>148</sup> is instructive. Circulation of RSCoin would be ensured by: (i) the central bank that controls the overall supply of RSCoins (and thus a centralized SDC and a CBDC) and (ii) “mintettes” – authorized payment system operators that are responsible for maintaining the blockchain-based register of transactions. Unlike Bitcoin miners, mintettes do not need to solve resource-intensive mathematical problems – instead, they are empowered by the regulator to compile transaction data in their own, lower level, blockchains. The central bank receives and cross-references the lower level blockchains and produces its own, definitive blockchain that contains the authoritative record of transactions. To address conflicts of interest and prevent unscrupulous behaviour,

<sup>145</sup> Dyson & Hodgson, *supra* note 142 at 2.

<sup>146</sup> *Ibid.*

<sup>147</sup> Juan Antonio Ketterer & Gabriela Andrade, *Digital Central Bank Money and the Unbundling of the Banking Function* (Inter-American Development Bank Discussion Paper No IDB-DP-449, 2016) online: IDB <<https://publications.iadb.org/bitstream/handle/11319/7587/Digital-Central-Bank-Money-and-the-Unbundling-of-the-Banking-Function.pdf?sequence=1>> at 7.

<sup>148</sup> See George Danezis & Sarah Meiklejohn, *Centrally Banked Cryptocurrencies* online: <<https://eprint.iacr.org/2015/502.pdf>>.



operators of the payment system produce publicly accessible logs and mintettes provide electronic evidence of any transaction approved for end-users. The combination of these factors is expected to give end-users enough comfort to treat payments processed by a mintette as final, without waiting for the same to appear on the central bank’s “main” blockchain (as in Bitcoin’s permissionless blockchain whereby end-users treat a transaction as reasonably “safe” only after a certain number (eg. 6 or 10) subsequent blocks appear on the blockchain).<sup>149</sup>

### 3. Scope

The system may extend only to monetary arrangements or to payment arrangements or it may include elements of both. We return to this issue in section V below.

### 4. Technology

Technology remains an evolving choice, with some systems centralized using traditional payments processing technologies (eg. RTGS) and others based on DLT / blockchain, an issue we return to below.

## *B. SDC Projects around the World*

While many governments and central banks have engaged in SDC-related research, only a small number of these projects have progressed to piloting or implementing stages.<sup>150</sup> Before analysing the reasons for this, it is helpful to categorize some of the different SDC projects, using our taxonomy to illuminate how SDC projects differ.

**Figure 5: Main Sovereign Digital Currency projects<sup>151</sup>**

Country/region	Project or Currency	Status	Architecture	Users
Bahamas	Project Sand Dollar	Pilot	Unspecified	Retail and wholesale
Canada	Project Jasper	Pilot	Hybrid	Wholesale
China	Digital Currency Electronic Payment (DCEP)	Live testing	Hybrid	Retail and wholesale
Denmark	Unspecified	Theoretical research	Unspecified	Unspecified

<sup>149</sup> *Ibid.*

<sup>150</sup> See Raphael Auer, Giulio Cornelli & Jon Frost, *Taking Stock: Ongoing Retail CBDC Projects* (1 March 2020), online: March BIS Quarterly Review < [https://www.bis.org/publ/qtrpdf/r\\_qt2003z.htm](https://www.bis.org/publ/qtrpdf/r_qt2003z.htm)> (providing an overview of CBDC projects and detailing 17 more prominent projects; five of these projects have reached the pilot stage, two are “ongoing work” (China, Sweden) with a positive outlook, while one working group currently thinks over the design for future implementation (Norway)).

<sup>151</sup> This list is based on our analysis of original policy documents and communications published by regulators as well as rules and regulations adopted in the relevant jurisdictions. It does not include projects that have not been officially confirmed by the relevant authorities (including proposals discussed by central bank researchers acting solely in personal capacity).

East Caribbean	ECCB Digital EC Currency (DXCD)	Pilot	Hybrid	Retail
Ecuador	Dinero Electronico	Decommissioned	Centralised	Retail
EU and Japan	Project Stella	Pilot	Hybrid	Wholesale
France	Digital euro	Pilot	Hybrid	Wholesale
Iceland	Rafkrona	Theoretical research	Multiple options considered	Retail
Marshall Islands	Sovereign (SOV)	Legislation passed	Hybrid	Retail
Norway	Unspecified	Theoretical research	Multiple options considered	Multiple options considered
Singapore	Project Ubin	Pilot	Hybrid	Wholesale
South Africa	Project Khokha; CBDC Feasibility Project	Pilot	Hybrid	Multiple options considered
Sweden	E-krona	Live testing	Hybrid	Retail
Switzerland	E-franc	Theoretical research	Multiple options considered	Multiple options considered
Thailand	Project Inthanon	Pilot	Hybrid	Wholesale
Ukraine	E-Hryvnia	Pilot	Hybrid	Retail
Uruguay	E-peso	Pilot	Centralied	Retail
Venezuela	Petro	In circulation	Hybrid	Retail

A number of jurisdictions have expressly rejected, for the time being, the introduction of an SDC. For example, in July 2018, the German Federal Ministry of Finance announced there were “no convincing reasons for issuing digital central bank money for a wide range of users in Germany and the Eurozone”.<sup>152</sup> At the time, the ECB stressed the risk of power outages for SDCs.

### C. *Benefits, Opportunities and Risks*

There are a number of opportunities and challenges of SDCs.

#### 1. Benefits and Opportunities

An SDC is often an attempt to marry the benefits of APS and central bank money. The dream is to ensure universal acceptance within the formal payment system while eliminating costly middlemen.<sup>153</sup> Such a design would bring a number of benefits:

First, central banks could act as the ultimate trusted, bankruptcy-proof intermediary, replacing commercial banks.

<sup>152</sup> Markus Kasanmascheff, *Germany's Finance Ministry: State-Issued Digital Currency Has 'Not Well Understood' Risks* online: Cointelegraph <<https://cointelegraph.com/news/germany-s-finance-ministry-state-issued-digital-currency-has-not-well-understood-risks>>.

<sup>153</sup> Mojmír Hampl, *Central Banks, Digital Currencies and Monetary Policy in Times of Elastic Money* (Speech at OMFIF Roundtable, 11 July 2017) online: BIS <<https://www.bis.org/review/r170720b.pdf>> at 2.

Second, integration of blockchain into the SDC offers enhanced recordkeeping. Tracing functionality would enhance the quality of data on the national economy compiled by central banks. They thus offer a potential solution to issues surrounding market integrity such as AML/CFT consideration (in that potentially all transactions in a closed electronic system whether account or token based could be traced). Ironically, this enticing benefit for regulators may be seen as unnecessarily intrusive by end-users and could promote the use of “real” cash instead.

Third, SDCs could be used as a vehicle for critical national expenditure (public procurement, government subsidies) to bypass commercial banks completely. This could substantially reduce systemic risks associated with commercial banks, lower the impact of collapse of any given financial institution and, consequently, diminish incentives to bail out failed banks. This has particular appeal in the context of COVID-19 lockdowns.

Fourth, central banks and governments could modernize their ageing wholesale payment systems with advanced functionality including support for smart contracts.<sup>154</sup>

Fifth, SDCs have the potential to dramatically alter the financial inclusion landscape, provided the necessary infrastructure is in place, including providing enhanced control for regulators over distribution of benefits.

Sixth, SDCs can also be used for raising money by the state – a feature of Venezuela’s Petro.<sup>155</sup> Petro was launched by the government of Venezuela in 2018. It is an asset-backed cryptocurrency, backed by raw materials such as oil and gold. The Petro was designed to supplement Venezuela’s ailing economy, raise capital and attract investment by circumventing US sanctions. It is generally seen as unsuccessful, but not because of its design.

For reasons identified in section V(B) below, the current SDC *status quo* will change significantly when China launches its Digital Yuan, and more so if the Digital Yuan is usable offshore.<sup>156</sup> The disruptive effect of a large-scale sovereign digital currency is likely to be far greater than privately issued stablecoins, as SDCs are likely to be more resilient to international regulatory harmonization (which can be observed in relation to Libra)<sup>157</sup> – as the objectives of central banks with SDCs are likely to conflict with those of central banks without one.

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<sup>154</sup> Morten Bech & Rodney Garratt “Central Bank Cryptocurrencies” (2017) September BIS Quarterly Review 55 online: BIS <[https://www.bis.org/publ/qtrpdf/r\\_qt1709f.pdf](https://www.bis.org/publ/qtrpdf/r_qt1709f.pdf)> at 66-67.

<sup>155</sup> Gobierno Bolivariano de Venezuela (Government of Venezuela), *Petro: Towards the Economic Digital Revolution* (2018) online: <[https://www.petro.gov.ve/descargas/Petro-whitepaper\\_eng.pdf](https://www.petro.gov.ve/descargas/Petro-whitepaper_eng.pdf)> at 14.

<sup>156</sup> The initial announcements regarding the Digital Yuan stress it will only be usable within China, but we expect this to change over time – and perhaps relatively early in the process. See *The Governor of the People's Bank of China, Yi Gang, was interviewed by reporters from the "Financial Times" and "China Finance" during the "Two Sessions"* (26 May 2020) online: The People’s Bank of China <<http://www.pbc.gov.cn/goutongjiaoliu/113456/113469/4028235/index.html>>; Roger Huang, *China Will Use Its Digital Currency To Compete With The USD* (25 May 2020) online: Forbes <<https://www.forbes.com/sites/rogerhuang/2020/05/25/china-will-use-its-digital-currency-to-compete-with-the-usd/#428bedd31e8f>>.

<sup>157</sup> See G7 Working Group on Stablecoins, *supra* note 103 at 20-21.

## 2. Challenges

The small number of countries heading towards piloting and implementation indicate regulatory concerns and challenges. Regulatory challenges relating to SDCs can be grouped into four categories.

The first covers technical issues involved in setting up a SDC, particularly in the absence of accepted international standards on DLT and blockchain. Regulators are faced with a multitude of possible design choices, yet may have inadequate resources or limited access to the required expertise to answer the many technical questions required. Should the system utilize DLT and, if so, using what consensus algorithm? Will the database be a blockchain and, if so, how will the blocks be linked together? What cybersecurity protections should be put in place? Can each unit of sovereign digital currency be traced back to its source and, if so, how would the system scale over time? How can mistakes/erroneous payments be rectified? Which algorithm or regulator/authority/group of entities will control issuance? What information about users and their transactions will be public and what only available to the regulator? How will end users access their balances: via biometric/multifactor identification or otherwise? We will discuss some of these design choices *infra*, in Part V.

The second group of challenges concerns the impact of a SDC on the payment system, financial markets and economy. Regulators should perform a comprehensive *ex ante* analysis of the system, identifying entities that may end up in direct competition with the state once it implements an SDC (eg. commercial banks, electronic money issuers). State-backed competition may force some of these to rethink their business model, relocate or cease operations altogether. Uncontrolled implementation of SDCs may lead to commercial bank runs and upset the duality of central bank and commercial bank money which underpins most payment systems. Alternately, regulators may seek to level the playing field by artificially making SDCs less attractive by placing limits on interest or other features (at least initially). Regulators must also consider any implications for money supply and whether the new currency will be issued via an ICO (“initial coin offering”) or in exchange for other forms of sovereign money (eg. cash) or commercial bank money (or both) and design corresponding conversion mechanisms.

Third, establishing trustworthiness will be vital for acceptance and stability of the SDC. Unless the state bans all alternative forms of official currency and forces the transition to a centralized CBDC, market forces will determine its usage. Although sovereigns have a broader arsenal of tools at their disposal (such as the prerogative to designate a SDC as the official currency on par with cash and funds in bank accounts), the need to generate sufficient trust in, and demand for, a SDC remains. While Libra primarily seeks to engender trust among end-users through the Libra Reserve, the resilience of the underlying blockchain and the composition of the governing entity, for users of a SDC, the legal status and reputation of the central bank will often be sufficient. However, where a state or central bank has failed to meet its obligation in the past, as with Ecuador,<sup>158</sup> state backing may mean little; and when

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<sup>158</sup> Unfortunately, the inevitable lack of demand led to the demise of the Ecuadorian programme: the Ecuadorian government had already defaulted on sovereign bonds in the past, and thus “it was reasonable for an informed citizen in 2014-17 to think that dollars on deposit at a private commercial bank in Ecuador were *less* risky than dollars on deposit at the central bank”. See Lawrence White, *The World’s First Central Bank Electronic Money Has Come – And Gone: Ecuador, 2014-2018* (2 April 2018) online: Cato Institute

inadequate, additional supporting mechanisms may need to be needed (such as the price stabilisation of Venezuela's Petro).

Finally, legal issues around the need to introduce the concept of SDC into the national regulatory system will need to be resolved. This may, in turn, alter the existing approach to regulation of non-sovereign cryptocurrencies.

#### *D. China's Digital Yuan<sup>159</sup>*

China has been researching and developing a Digital Yuan for some years before the announcement of Libra. The People's Bank of China was thus well placed to move swiftly to actual live trials of the SDC.<sup>160</sup> While there are a range of reasons why China is developing the Digital Yuan, Libra was certainly a catalyst.

##### 1. Design Choices

The design of the Digital Yuan is determined by China's monetary, financial, economic and political context and the related objectives of the system.

The Digital Yuan – technically known as the Digital Currency / Electronic Payment (DCEP) initiative – aims at providing a true CBDC (a state-backed monetary system rather than merely a payment system). As to users, the Digital Yuan is to be largely restricted to TTIs, including major banks and large technology firms such as Alibaba/Ant Financial and Tencent, although it will be potentially available to individuals through digital wallets.<sup>161</sup> As to architecture, the Digital Yuan is a hybrid system: the tokens issued by the PBoC to TTIs can then be transferred to retail or wholesale accounts. For technical infrastructure, the Digital Yuan will draw on a token-based DLT, operating on blockchain technology running on a centralized permissioned DLT.<sup>162</sup> It is fundamentally a monetary system designed to underpin the existing electronic payment systems, including traditional bank-intermediated systems and the ecosystems of Alipay and WeChatPay, both of which are currently non-interoperable closed-loop private systems. The full rollout of the DCEP will thus provide a common digital monetary instrument across all major payment systems in China for the first

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<<https://www.cato.org/blog/worlds-first-central-bank-electronic-money-has-come-gone-ecuador-2014-2018>>.

<sup>159</sup> We have used the best sources available to us for this section, but our analysis may be influenced by their reliability or the quality of their translation into English.

<sup>160</sup> Karen Yeung, "China's Digital Currency Takes Shape as Trials Begin with Travel Subsidies and Communist Party Fees", *South China Morning Post* (19 April 2020), online: South China Morning Post <<https://www.scmp.com/economy/china-economy/article/3080594/travel-subsidies-party-fees-chinas-digital-currency-takes>>.

<sup>161</sup> Karen Yeung, "What is China's Cryptocurrency Alternative Sovereign Digital Currency and Why Is it Not Like Bitcoin?", *South China Morning Post* (13 May 2020) online: South China Morning Post <<https://www.scmp.com/economy/china-economy/article/3083952/what-chinas-cryptocurrency-sovereign-digital-currency-and-why>>.

<sup>162</sup> Aditi Kumar & Eric Rosenbach, "Could China's Digital Currency Unseat the Dollar?", *Foreign Affairs* (20 May 2020) online: Foreign Affairs <<https://www.foreignaffairs.com/articles/china/2020-05-20/could-chinas-digital-currency-unseat-dollar>>.

time, achieving interoperability between Alipay and WeChatPay and also between those systems and the bank-intermediated payment system.<sup>163</sup>

The Digital Yuan initially will not replace cash and will be interoperable with existing domestic payment systems but not foreign systems; although foreign participants in China will be able to use it. Competition from private entities will be prohibited.<sup>164</sup>

Governance is centralized, with the PBOC in charge. Finality will be achieved via final settlement across PBOC accounts. Privacy within the private sector is to be ensured, but as is usual in China, the state will have access to the data.

It is thus designed to address a number of issues specific to China but also of relevance to others. In addition to preventing the emergence of alternatives (eg. Libra) in China, it also provides a better source of data for monitoring the economy and market integrity (especially if it eventually replaces cash) as well as centralization of control of the underlying monetary instrument across all payment systems the central bank particularly in the context of Alipay and WeChatPay. It also provides an embedded payment instrument for China's national blockchain framework.

And it provides both a means of controlling currency inflows and outflows into the RMB area, initially Mainland China but with the possibility of eventual expansion beyond its borders, in the form of a potential dollar alternative, Digital Yuan area, outside of the reach of the US but fully under the oversight of China.

## 2. First Mover among Global Major-currency CBDCs: The Geopolitics of CBDCs

When the Digital Yuan launches, it will most likely be the first major-currency CBDC. Its launch will have major international impacts, since it will almost certainly trigger the acceleration, activation or development of a number of similar projects around the world, both among those looking to engage with it and those seeking to compete with it.

The Digital Yuan's impact will flow from its underlying policy rationales, in particular providing an alternative monetary and financial environment which remains in China's purview, in contrast to the US dollar or a potential Libra. The intention is that it will be gradually opened to foreign participation, albeit not necessarily use outside of China's internet and blockchain environment. Once opened to foreign use, it will be a means of internationalizing the Yuan – a stated major goal of China since the 2008 Global Financial Crisis albeit one that has been dramatically slowed since China's financial turmoil of 2015.<sup>165</sup>

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<sup>163</sup> Tim Alper, "Digital Yuan 'Highly Likely' to be Compatible with Alipay, WeChat Pay" *Cryptonews* (20 May 2020) online: *Cryptonews* <<https://cryptonews.com/news/digital-yuan-highly-likely-to-be-comaptible-with-alipay-wech-6598.htm>>.

<sup>164</sup> Laney Zhang, *Regulation of Cryptocurrency: China* (June 2018) online: Library of Congress Legal Reports <<https://www.loc.gov/law/help/cryptocurrency/china.php>>.

<sup>165</sup> See Reserve Bank of Australia, *RMB Internationalisation: Where to Next?* (Bulletin, 20 September 2018) online: <<https://www.rba.gov.au/publications/bulletin/2018/sep/pdf/rmb-internationalisation-where-to-next.pdf>>; Douglas Arner and Andre Soares, *A Globalized Renminbi: Will It Reshape Latin America?* (Washington DC: Atlantic Council, October 2016) <<https://www.atlanticcouncil.org/in-depth-research-reports/report/a-globalized-renminbi/>>; William Overholt, Guonan Ma and Cheung Kwok Law, *RMB Rising: A New Global Monetary System Emerges* (Wiley 2016); Chris Brummer, *RMB Ascending: How China's Currency*

Thus, in terms of internationalization, it is likely that initial use will be limited to those transacting in RMB with China, particularly in the context of trade (imports and exports), with accounts held by approved institutions (ie. regulated banks and payment systems operating) in China and operating overseas through existing RMB swap facilities, thus allowing China to maintain control of the overall use of the Digital Yuan.

At the same time, the Digital Yuan will have the potential to displace other currencies in international transactions involving China, weakening the role of the US dollar in cross-border transactions involving China but not the US. Thus, in order to maintain their own currency's importance major central banks will most likely respond with their own CBDCs. This is because once the Digital Yuan is enabled for use in foreign trade transactions, much trade with China will likely (for reasons of efficiency and convenience) be denominated in it – resulting in the growth of the global importance of the Yuan and much valuable information about each trade ending up in China, not the trading partner's country.

The potential of the Digital Yuan to underpin China's domestic monetary and payment system and provide an RMB-based cross-border monetary and payment system that will support payments, financing and economic activities means it could provide a real alternative to current international arrangements based around the US dollar.<sup>166</sup> The Digital Yuan could thus, at most, create a new non-US dollar currency area or, at least, mark the further profound fragmentation of the post-war international monetary system.

At the same time, while the launch of the Digital Yuan will accelerate CBDC efforts around the world – particularly major-country CBDCs – the COVID-19 crisis is already forcing central banks and governments around the world to consider urgently whether they can and should develop and implement their own CBDCs, in a variety of forms.<sup>167</sup>

And, in fact, this was also the case with China. While the plan to launch the DCEP was announced only months after the announcement of Libra, its actual launch was delayed, despite the technical arrangements being in place, until the COVID-19 crisis provided the final catalyst for China to take the ultimate step of initiating the next step forward towards utter transformation of its domestic monetary and payment system.<sup>168</sup>

## V. COVID-19 AS A SYSTEMIC CATALYST

While Libra generated dramatic responses from regulators and civil society,<sup>169</sup> the bigger impetus for change in money and payment systems has probably come from government and

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*Impacts Global Markets, Foreign Policy and Transatlantic Financial Regulation* (Washington DC: Atlantic Council, June 2015), <<https://www.atlanticcouncil.org/in-depth-research-reports/report/renminbi-ascending-how-china-s-currency-impacts-global-markets-foreign-policy-and-transatlantic-financial-regulation/>>

<sup>166</sup> Kumar & Rosenbach, *supra* note 162.

<sup>167</sup> Nassim Khadem, "Coronavirus Crises Spark Large Bank Withdrawals, Despite Looming Cash Transaction Ban", *ABC News* (26 May 2020) online: ABC News <<https://www.abc.net.au/news/2020-05-26/digital-world-without-cash-post-the-coronavirus-pandemic/12282856>>.

<sup>168</sup> Yeung, *supra* note 161.

<sup>169</sup> Regulatory response was so strong and focused it triggered a complete revision of the structure of Libra -- See *Libra White Paper v2.0*, *supra* note 96; *FSB Consultation*, *supra* note 125; Zetzsche, Buckley & Arner, *supra*



central bank efforts to address the COVID-19 pandemic crisis using electronic payments systems.<sup>170</sup>

The first two systemic catalysts examined in this paper – Libra and the Digital Yuan – challenge money and payment systems, policy makers and regulators around the globe, and give rise to different levels of disruption. Global stablecoins represent a real threat to the existing monetary and payments infrastructure. However, private sector stablecoins are limited in scope. The Digital Yuan seizes the potential of a sovereign alternative backed by the massively deep pockets of a major economy reinforced by its capacity to create money, potentially disrupting established domestic and international monetary and payment systems.

However, the immediate impetus, right now, for governments and central banks to review and redesign existing electronic payment systems is being provided by the COVID-19 crisis, as a result of the need to efficiently and swiftly channel financial support to individuals, firms and healthcare systems. As highlighted above, COVID-19 appears to have provided the final impetus for the Digital Yuan. The pandemic will likely do the same for other central banks seeking to digitally transform money and payments. In this regard it is interesting to compare the approaches of developed economies to CBDCs, with those of Canada, Sweden, the UK and Singapore particularly relevant, along, with the US proposal for a “Digital Dollar” issued at the height of the COVID 19 epidemic.

#### *A. Canada and Sweden: Developed Open Economies but not Major Financial Centres*

The examples of Sweden and Canada are both likely to be of direct relevance to most countries considering similar issues: both are developed countries but not major powers or financial centres. Their rationales and experiences are thus likely to be highly relevant to most other countries seeking to implement CBDCs.

Canada’s preparations to issue a CBDC have been among the more advanced and most sophisticated of the developed economies (China being a major, but not a developed economy), along with those of Sweden (the closest to actual implementation), the UK and Singapore. Following project studies started much earlier, and involving some cooperation with the Bank of England, in February 2020, the Bank of Canada issued a laudably clear document analysing its contingency planning for a CBDC.<sup>171</sup>

This document made clear that the Bank had no plans to launch a CBDC but was building capacity to do so, if it became necessary. The Bank envisaged two scenarios in which such a

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note 4.

<sup>170</sup> See Raphael Auer, Giulio Cornelli and Jon Frost, COVID-19, Cash, and the Future of Payments, BIS Bulletin no. 3 (3 April 2020), <<https://www.bis.org/publ/bisbull03.htm>>; Douglas W Arner, Janos Nathan Barberis, Julia Walker, Ross P Buckley, Andrew M Dahdal & Dirk Andreas Zetsche, *Digital Finance & The COVID-19 Crisis* (University of Hong Kong Faculty of Law Research Paper No. 2020/017, 16 April 2020) online: SSRN: <<http://dx.doi.org/10.2139/ssrn.>>.

<sup>171</sup> Bank of Canada, *Contingency Planning for a Central Bank Digital Currency* (Background materials, 25 February 2020), online: Bank of Canada <<https://www.bankofcanada.ca/2020/02/contingency-planning-central-bank-digital-currency>>.

need may arise: (i) if Canada is moving to a cashless society, or (ii) if Canada's monetary sovereignty is threatened by "a private digital currency not denominated in Canadian dollars".<sup>172</sup>

These two scenarios highlight common concerns across and increasing number of economies around the world. These two scenarios are most revealing also in terms of what they leave unaddressed – the issuance of a CBDC by a major competing economy, which is likely to be an issue likewise for most other countries.

The usage of cash in Canada has been in decline, as it has in most major economies. By 2017, only 33 per cent of transactions at the point of sale (and only 15 per cent by value) were completed using cash, down from about 54 per cent in 2009.<sup>173</sup> This compares with cash being used in some 37 per cent of transactions in Australia and only 10 per cent of transactions in Sweden in 2016.<sup>174</sup>

Sweden is generally accepted as leading the world in the move towards going cashless, and its central bank has produced a series of substantial reports that, if one reads between the lines, imply clearly that the central bank will issue a centralized CBDC before it stops printing cash. The central bank anticipates this happening by about 2023 and anticipates not using DLT or blockchain in its CBDC.<sup>175</sup> In the words of Arvidsson, "Sweden may become a practically cashless society in 2023."<sup>176</sup> Sweden's central bank is not happy with the prospect that commercial interests such as Visa and Mastercard will control the payments capacity of all Swedish citizens – it wants to remain in the currency-issuing business, in part out of concerns regarding the impact of commercial payments providers on the poor and those living in remote parts of the country.

Should the move away from cash necessitate Canada issuing a CBDC, its February 2020 report envisages that this would be "cash-like", ie. "earn no interest and be universally

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<sup>172</sup> *Ibid.*

<sup>173</sup> Kim Huynh, *How Canadians Pay for Things*, online: Bank of Canada <<https://www.bankofcanada.ca/2019/10/how-canadians-pay-for-things/>>.

<sup>174</sup> Mary-Alice Doyle, Chay Fisher, Ed Tellez & Anirudh Yadav, *How Australians Pay: New Survey Evidence* (Reserve Bank of Australia Bulletin, March 2017) at 60; Sveriges Riksbank, *The Riksbank's E-krona Project* (Report No 1, September 2017) at 7. For data on the decline in use of cash over time in each of Canada, Australia and Sweden, see Huynh, *supra* note 173; James Caddy, Luc Delaney, Chay Fisher & Clare Noone, *Consumer Payment Behaviour in Australia* (RBA Bulletin, March 2020) online: Reserve Bank of Australia <<https://www.rba.gov.au/publications/bulletin/2020/mar/consumer-payment-behaviour-in-australia.html#:~:text=The%202019%20Consumer%20Payments%20Survey,to%20that%20recorded%20in%202016>>; Sveriges Riksbank, *Cash Use in Constant Decline* (7 November 2019) online: Sveriges Riksbank <<https://www.riksbank.se/en-gb/payments--cash/payments-in-sweden/payments-in-sweden-2019/the-payment-market-is-being-digitalised/cash-use-in-constant-decline/>>.

<sup>175</sup> This is only implied in the two reports: Sveriges Riksbank, *The Riksbank's E-krona Project* (Report No 1, September 2017) [*E-krona Project Report No 1*] and Sveriges Riksbank, *The Riksbank's E-krona Project* (Report No 2, October 2018) [*E-krona Project Report No 2*].

<sup>176</sup> Niklas Arvidsson, *Building a Cashless Society* (Springer, 2019) at 82.

accessible”.<sup>177</sup> It also envisages that it would offer a “great deal of privacy”<sup>178</sup> but not anonymity.

The second scenario the Bank of Canada sees as triggering the need for a digital Canadian dollar would be if Canada’s monetary sovereignty were to be threatened by a private sector digital currency, in other words, Libra or some Libra-like instrument. The Bank of Canada’s report is interesting in that it focusses very much on the loss of monetary sovereignty whereas the reports of the Sverige Riksbank in Sweden consider the loss of monetary sovereignty but seem more concerned about the impacts on the poor and those living remotely of only having access to commercially provided payment mechanisms. In the words of the Sveriges Riksbank: “For 350 years, the Riksbank has provided the general public with money”<sup>179</sup> and the loss of this function seems to weigh heavily on Swedish minds.

A comparison of the Canadian and Swedish reports is highly instructive. Canada states there is no current need for a CBDC and gives the impression any move in this direction is probably a long way in the future. Sweden’s report largely accepts a CBDC in Sweden is inevitable (without saying so directly, as is typical of central bankers) and implies its issuance is likely around 2023, highlighted by the fact that real-world testing is scheduled to run until February 2021, which would then leave ample time for the necessary preparations.<sup>180</sup>

By February of 2020, China had publicly committed to proceed to issue a Digital Yuan but, interestingly, the otherwise comprehensive Canadian report does not mention this development at all nor does the second Swedish report from February 2020.

Given the perspicacity of these analyses generally, this cannot be an oversight. This is particularly interesting, as the third clear scenario in which Canada may well choose to issue a CBDC would be where a major trading partner such as China, or the US (with a Digital Dollar, *infra* at V(B)), issues a CBDC that is available for use in international trade.

Such a development is highly likely to force Canada’s hand because a CBDC would interact exceptionally well with dematerialized trade documents. The potential savings from the digitization and dematerialization of trade documentation are massive – it is currently estimated that the paperwork associated with international shipments typically comprises about 20 per cent of the total cost of the shipment.<sup>181</sup> Dematerialization is well under way as a result. Digital contracts will work better with a CBDC than with other payment processes, and we would expect China to do all within its power to make the Digital Yuan especially useful in this context, especially given that a major part of China’s underlying motivation for issuing a CBDC is to claim for itself some of the many benefits that currently flow to the US from issuing the dominant global reserve currency. Developments in the Euro area are also

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<sup>177</sup> Bank of Canada, *supra* note 171.

<sup>178</sup> *Ibid.*

<sup>179</sup> *E-Krona Project Report No 2*, *supra* note **Error! Bookmark not defined.** at 2, 5.

<sup>180</sup> *Ibid* at 39; and Sveriges Riksbank, *The Riksbank’s E-krona Pilot* (Report, February 2020).

<sup>181</sup> “The Digitisation of Trade’s Paper Trail May Be at Hand”, *The Economist* (22 March 2018) online: The Economist <<https://www.economist.com/finance-and-economics/2018/03/22/the-digitisation-of-trades-paper-trail-may-be-at-hand>>.

well advanced in this regard, with a series of recent transactions involving debt instruments issued in a blockchain environment and settled with Euro CBDC via the Banque de France.<sup>182</sup>

In this “third” unarticulated scenario, CBDC issuance by Canada or Sweden or any other country for that matter becomes compelling because, without it, much valuable information about trade contracts that use the Digital Yuan will end up in Shanghai or Beijing rather than Toronto, Ottawa, Stockholm, New York, London or Singapore. Perhaps more strongly, countries which do not have major currencies will face increased competition from digital major currency alternatives to potentially replace the role of their own currencies.

Once China has the Digital Yuan working well within its borders, we expect it to expand its geographic scope for the benefits on offer from issuing one of the world’s global reserve currencies. This could be readily done by instructing Chinese trading enterprises to use the Digital Yuan in their trading arrangements (and, if needed, by offering financial inducements to their foreign trading partners to do so). At this point, in our view, other countries will have little choice but to issue their own CBDCs in order to attempt to maintain monetary sovereignty, not dissimilar to the potential challenge of Libra but coming from a major economy central bank rather than from a private company.

### *B. Singapore and the UK: Major International Financial Centres*

While the analyses of Canada and Sweden are most likely to be relevant to the majority of countries around the world as they face similar challenges, the approaches of the UK and Singapore will also be watched closely given their leading roles as financial centres, particularly for FinTech and RegTech. Both have considered issues similar to those of Sweden and Canada. However, both are also carefully focused on their positions and technical and financial leaders and the role that CBDCs – particularly in the wholesale and trade contexts – could have going forward. They are also particularly concerned about their potential intermediary roles between major economies and currency areas: how to be a node between major digital currencies going forward? This is an issue which of course is also central to Hong Kong’s future most clearly, considering how it could emerge as the major point of transit for transactions between the Digital Yuan area and the rest of the world.

### *C. The Digital Dollar*

The US Digital Dollar proposal demonstrates the Digital Yuan is not the only potential major currency CBDC with global implications: clearly a Digital Dollar would potentially have even greater immediate impact, albeit with very different design features from those of the Digital Yuan, reflecting very different domestic and global monetary, financial, economic and political contexts.

It is clear however that a “Digital Dollar” potentially changes everything.

The “Digital Dollar” proposal was included in the US legislative package of responses to the COVID-19 crisis in March 2020. Although not incorporated in the enacted version of the

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<sup>182</sup> *Banque de France CBDC Project Uses Blockchain to Settle Transactions* (21 May 2020) online: Central Banking <<https://www.centralbanking.com/fintech/7548891/bdf-settles-securities-transactions-in-cbdc-pilot>>.

legislation, related discussions continue.<sup>183</sup> In essence, the March 2020 Digital Dollar proposal includes both monetary and payment elements. It is unlike the Digital Yuan (which is solely a digital monetary framework to operate across existing payment systems) as it includes both a digital token (which could be used in both wholesale and retail transactions) and a universal account-based payment system in which each person would have their own account with the Federal Reserve. It would thus enable rapid delivery of financial resources across the economy and technologically enable a very wide range of interventions from the central bank. Such a system would be transformative for the US economy and financial system, and could be for the international financial system, in which the US dollar remains the dominant reserve currency.

A whitepaper from the Digital Dollar Project, a collaboration between the Digital Dollar Foundation and Accenture, highlights the options and rationale, both domestic and global geopolitical.<sup>184</sup>

The Digital Dollar also shows the range of options available to other governments and central banks considering technological redevelopment of their own monetary and payment systems in the wake of the COVID-19 crisis. Although the resulting evolution may take many forms, as identified in this paper, a broader roll-out of sovereign digital currencies globally is now highly likely in the wake of the Digital Yuan and potential US openness to a Digital Dollar.

None of these impetuses for a Digital Dollar demand it be issued by the government. A digital dollar could certainly be done – perhaps most likely as we suggest below – as a hybrid, involving the public and private sector: a stablecoin partnering a private consortium with the central bank or synthetic CBDC (where a private stablecoin has direct access to fiat currency and/or liquidity from the central bank). This could be the US dollar Libra stablecoin – or perhaps more likely – something like FNLITY’s USC, or some other such private sector actor: Amazon coin anyone?

SDCs will interact particularly efficiently with the digitalization of international trade processes and resulting smart contracts. In the absence of a Digital Dollar, the Digital Yuan, once eventually allowed offshore,<sup>185</sup> will thus potentially undercut the dominant role of the US dollar in the denomination of international trade such that it will threaten the many, major benefits from minting the world’s global reserve currency.<sup>186</sup> The US will thus most likely be forced to follow China’s lead and implement a Digital Dollar.<sup>187</sup> To the extent the US needs a

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<sup>183</sup> Jason Brett, *How Project Libra And COVID-19 Drove Digital Dollar Idea in Congress* (24 April 2020) online: Forbes <<https://www.forbes.com/sites/jasonbrett/2020/04/24/how-project-libra-and-covid-19-drove-digital-dollar-idea-in-congress/#4d659a162c51>>.

<sup>184</sup> Digital Dollar Project, *Exploring a US CBDC* (May 2020) online: <<https://www.digitaldollarproject.org/exploring-a-us-cbdc>>.

<sup>185</sup> See Gunter Dufey and Linda Lim, “China’s Digital Currency Getting More Buzz than Warranted”, *The Straits Times* (1 June 2020), <<https://www.straitstimes.com/opinion/chinas-digital-currency-getting-more-buzz-than-warranted>> (highlighting limited RMB internationalization to date).

<sup>186</sup> Eichengreen, *supra* note 130.

<sup>187</sup> See eg. Aditi Kumar and Eric Rosenbach, “Could China’s Digital Currency Unseat the Dollar?”, *Foreign Affairs* (20 May 2020), <<https://www.foreignaffairs.com/articles/china/2020-05-20/could-chinas-digital-currency-unseat-dollar>>; Tim Morrison, “The Greenback Needs a Digital Makeover”, *Foreign Policy* (24 January 2020), <<https://foreignpolicy.com/2020/01/24/dollar-reserve-currency-united-states-china-crypto-digital>>.

domestic reason to force its hand, the difficulties and leakage involved in trying to use its current payment systems to direct stimulus to US individuals in response to the COVID-19 crisis is surely providing it.<sup>188</sup> Similar arguments are also increasingly taking place around a Euro CBDC as well as other ideas for how CBDCs could be designed to address crisis requirements and also build more effective financial infrastructure for the future.<sup>189</sup>

## VI. THE FUTURE DESIGN OF PAYMENTS AND MONEY

The three catalysts of Libra, the Digital Yuan and COVID-19 together provide sufficient ground to rethink the future of payments and money. We are here particularly interested in design choices relating to CBDCs. These design choices must be based on the specific circumstances of individual economic and financial systems rather than on any single model.

### A. Technology: Departure from DLT

An often discussed aspect of CBDCs is technology.<sup>190</sup> Although the examination of the option of issuing a SDC may flow from consideration of the opportunities offered by the technologies underlying Bitcoin against the recurring challenges facing payment systems, it is highly probable that implemented SDCs will use neither DLT nor blockchain.<sup>191</sup>

DLT (especially using blockchain) provides a very resilient storage mechanism that offers various advantages for a CBDC, such as its tamper-evident record of each transaction and elimination of intermediaries and corresponding risks. Fully decentralized systems will need to use permissionless DLTs (most likely with blockchain), while centralized and hybrid SDCs will rely on permissioned DLTs. In terms of issuance control, the system is likely to be centralized. Yet DLT often suffers from performance, data protection/privacy, liability and other difficulties. Systems designers seem to prefer DLT for token-based systems, while account-based systems mostly rely on conventional infrastructure.<sup>192</sup>

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currency/>.

<sup>188</sup> See eg. Michelle Singletary, “IRS Says \$1,200 Stimulus Payments Sent to Dead People Have To Be Returned”, *The Washington Post* (7 May 2020) online: The Washington Post <[washingtonpost.com/business/2020/05/06/irs-says-1200-stimulus-payments-sent-dead-people-have-be-returned/](https://www.washingtonpost.com/business/2020/05/06/irs-says-1200-stimulus-payments-sent-dead-people-have-be-returned/)>.

<sup>189</sup> See eg. Geoffrey Goodell, Hazem Danny Al-Nakib and Paolo Tasca, *Digital Currency and Economic Crises: Helping States Respond* (June 2020), <<https://arxiv.org/abs/2006.03023>>.

<sup>190</sup> For discussion of related issues, see Matthieu Bouchard, Tom Lyons, Matthieu Saint Olive and Ken Timsit, *ConsenSys Whitepaper: Central Banks and the Future of Digital Money – A Practical Proposal for Central Bank Digital Currencies on the Ethereum Blockchain* (January 2020), online: <<https://pages.consensys.net/central-banks-and-the-future-of-digital-money>>.

<sup>191</sup> Although many existing SDC projects implement, or plan to implement, DLT, a recent discussion paper by the Bank of England argues that different technologies may be used to implement sovereign digital currencies in practice: “Although CBDC is often associated with Distributed Ledger Technology (DLT), we do not presume any CBDC must be built using DLT, and there is no inherent reason it could not be built using more conventional centralised technology”. *BoE CBDC Discussion Paper*, *supra* note 79 at 6.

<sup>192</sup> See Auer, Cornelli & Frost, *supra* note 150.

Another concern is privacy and data protection: Can each unit of SDC be traced back to its source and, if so, how would such a system scale over time and what are its data storage requirements? What information about users and their transactions will be public and what only available to the regulator? Choices like those made with the Digital Yuan seems to strike one possible balance, yet the potential for undue influence over individuals of state access to payments is highly concerning – imagine, for instance, the consequences if “the state” decides to switch off an individual’s, or a group’s, “financial life” in response to their participation in certain political activities?

Further design choices made more difficult to address by a DLT environment relate to cybersecurity, the rectification of mistakes/erroneous payments and user identification (via biometric/multifactor identification or otherwise). In light of all these factors, we expect most SDCs not to use DLT or blockchain.<sup>193</sup> While the concept of an SDC has its roots in the technologies underlying Bitcoin, SDCs will, most likely and highly ironically, develop in the future without resort to such technologies.

#### B. *Central Bank Access: Efficiency vs Financial Inclusion*

Another concern is central bank access. As we have laid out, issues of users, scope, architecture, and technology lie at the heart of a CBDC. These four factors interrelate: If user groups are strictly limited, efficiency can be the guiding rationale. That is because most TTIs, as large financial intermediaries, can withstand short-term shocks and periods of non-operation. If absolutely necessary, TTIs can refinance themselves in the capital markets and discuss compensation with the central banks. All this can occur internally, secretly, without threatening public trust.

But the same is not true for most retail and many wholesale users – any service interruption would immediately erode trust in the financial system. For these user groups safety and consistency is paramount. In other words, the more user groups in a system, the more the focus of necessity shifts from efficiency to safety. There is evidence for this claim with Bitcoin – its structure as a robust, permissionless system prioritizes safety, and explains the huge effort (in terms of energy and time) to ensure that its database is accurate and settlement of transactions actually occurs. Given that intermediation isolates some operational risk in the organization of one intermediary, where central banks follow the safety paradigm, a hybrid (semi-decentralized) model is most likely.

The focus will differ in many *developing* countries. For them, the main concern will be *creating an inclusive* infrastructure; any stable system – even a slow one – that includes all (in particular rural residents and the poor) will be welcome. Here, full disintermediation may be favored since intermediary-based coverage does not exist. However, a developing country choice in favour of a centralized SDC may only be temporary. Once additional services are provided by the private sector, the respective central banks may return to a hybrid SDC

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<sup>193</sup> At the time of writing many prospective SDC issuers have not decided what kind of technology to use. According to a BIS report, only five out of 17 general access SDC projects focus on DLT – a technology criticized by some central banks as lacking adequate scalability, offering no fundamental advantages over existing systems or failing to ensure cash-like resilience during blackouts. See Auer, Cornelli & Frost, *supra* note 150.



model (which could be similar to that of the Bank of England in the 1950s, with gradually receding *optional* central bank access replaced by the private sector).

Another factor involves the operational resilience of the issuing central bank: If a central bank is reliable, tech savvy and able, and seeks to enhance financial inclusion, a centralized architecture will probably be more suitable, and where it is unreliable (due to a history of defaults) or unable to operate retail accounts well, a decentralized architecture will, in principle, be advisable.

From this design choice will follow who has access: where efficiency is paramount, access will be limited to TTIs (although the definition of TTI may be widened depending on which actors offer financial reliability, a test some BigTechs may well be able to meet). Where financial inclusion matters most, central banks may well prefer retail access.

### C. Towards Public-Private Partnerships

Within this framework we envisage three alternative approaches: (i) central bank accounts with general access, (ii) central bank accounts with intermediated access, and (iii) new digital forms of fiat currency.<sup>194</sup>

Within these three approaches option (i), a *fully* disintermediated SDC, while conceivable in theory and desirable from a financial inclusion perspective, is unlikely to be maintained by central banks in the long run. With a fully disintermediated architecture, operational malfunctions of the system (in the event, for instance, of a cyberattack or a deficient software update) will impact directly on the economy, without intermediaries diversifying the risk and partially mitigating its impact. There is little evidence central banks could handle efficiently day-to-day operations with millions of retail clients and even less evidence to suggest they have any appetite to do so. Central banks tend to lack both the infrastructure and expertise for such a role. Full disintermediation would require central banks to significantly enhance their operational capacities,<sup>195</sup> entering, *inter alia*, into (1) credit scoring, (2) AML/KYC checks, (3) rebooking of erroneous transactions, and (4) building large scale retail infrastructure equivalent to ATMs and payment terminals for SDCs. Very few central banks will have the resources and willingness to do so, and even fewer the appetite to trigger the resultant job losses in the regulated commercial banking sector, though a number have done so for privileged customers.<sup>196</sup> At the same time, “monobank” structures in centrally planned systems were never known for their efficiency though technological may be altering the frontier in this respect.<sup>197</sup>

Finally, while SDC mining and destruction could be monopolized in the hands of the central bank to ensure monetary stability, a truly decentralized SDC would likely come with reduced

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<sup>194</sup> For a more detailed discussion of available approaches see Didenko & Buckley, *supra* note 8 at 1085-1093.

<sup>195</sup> See also Auer & Böhme, *supra* note 135 at 90.

<sup>196</sup> See *supra* note 135.

<sup>197</sup> See Agustin Carstens, “The Future of Money and Payments”, 2019 Whitaker Lecture, Central Bank of Ireland, Dublin, Ireland (22 Mar. 2019), <<https://www.bis.org/speeches/sp190322.htm>>.

enforcement of KYC/AML standards and reduced information flow to the respective central bank.

For these reasons central banks and regulators will most likely collaborate with commercial banks, TechFins and FinTechs to utilize their existing infrastructure. To our minds, successful CBDCs will most likely be public-private partnerships, with the central banks providing the definitions, interfaces and accounts and the private sector offering the applications and operations to mass clients. Such systems will most likely be complemented by a range of CBDCs, in many cases combined with new forms of FPS, potentially eliminating traditional intermediated structures in some cases, and being operated by them in others. Hence, a mix of option (ii) and (iii) is likely to prevail.

Regardless of the benefits, a PPP may also come with downsides: Partnership with private entities may require more information sharing with the private sector (as the later needs to build interfaces); and if proprietary information needs to be shared this could offset the beneficial effect created by the additional resources available to private entities.

#### *D. Governance: Participation of Central Banks*

A key consideration is governance. For the time being – until the core challenge of cross-border cooperation has been solved – we mostly expect domestic projects. Exceptions may apply where cross-border cooperation is ensured through additional institutional safeguards such as in the European Union, the West African Economic and Monetary Union and in the Eastern Caribbean. This means, for the time being, most governance efforts will assume the lead of *one* central bank in developing and maintaining the system.

This does not mean the central bank has to “own” the system. Rather, as with some existing systems, the central bank may reserve to itself certain essential functions such as key operations, account balancing and consent for material redesigns, while the legal ownership of the system may be spread across the TTIs. Where the central bank functions as operator, information flow to the central bank and supervision is assured. To avoid any doubt: as a nationalization in function, yet not *de jure*, participation of central banks in network-like critical market infrastructure is not new, but an established method of the central banks’ *modus operandi*.<sup>198</sup>

Through this participation, the central bank monopolizes certain core functions – and may allow for greater competition on others, facilitating innovation under the central bank’s watchful eyes, and enhancing the benefits for the system from private participants’ incentives. Another aspect may be external competition by *other* currencies. Economies with free-floating currencies may be able to allow for more competition than those trying to control the exchange rate.

#### *E. Money vs Payment?*

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<sup>198</sup> See *Decentralized Finance Brief*, *supra* note 65, at 19.

A real opportunity in particular exists to address the separation between transactions (such as securities or derivatives transactions) and payment for those transactions, particularly at the wholesale level.<sup>199</sup> A trusted central bank cryptocurrency would likely be attractive in a range of other DLT applications. This is one rationale for the Digital Yuan. It also explains a range of wholesale projects particularly in major financial centres, such as Singapore (Project Ubin) and Paris.<sup>200</sup> In particular, rather than issuing a SDC, a central bank might allow the creation of a stablecoin, backed by deposits of fiat currency with the central bank – what the IMF has called a “synthetic stablecoin”,<sup>201</sup> which could effectively serve as sovereign currency in specific systems, for instance applications developed on Corda.<sup>202</sup>

Fundamentally, regulators must determine whether they want to build a monetary or a payment system. The word *currency* implies building the former. But this is only achievable if the SDC is designed to substitute for cash, that is with anonymous transactions and payment finality. As we have shown both the decentralized and the hybrid SDC models are able to have these features (but the Digital Yuan has not been designed to do so). If these features are implemented, the distinction between payment and monetary system – previously so important due to credit, transactional and operational risk – ceases to exist.

With the fourth catalyst of the COVID crisis now providing a pressing incentive it is time to rethink the future of payments and money, and for this design matters. Different jurisdictions can and should take different design approaches.

We suggest that the hybrid model will prove to be the most widely adopted but that the greatest benefit in many cases may come not from a digital monetary instrument alone but rather from a merger of monetary and payment arrangements as highlighted in the context of the Digital Dollar. A DCEP approach is likely to be the most effective where comprehensive electronic payment arrangements (such as in China or the EU) currently exist. In jurisdictions where there are substantial numbers of people without access to accounts (including the US, UK and most developing countries), a centralized account structure may well prove more efficacious.

## CONCLUSION

The catalysts examined in this paper – Libra, the Digital Yuan and COVID-19 – have each challenged policy makers and regulators around the globe. While Bitcoin and its progeny have been able to be safely ignored to date, global stablecoins represent a real threat to existing payments infrastructure and a unique opportunity for payment systems to evolve. A

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<sup>199</sup> See eg.: <https://www.societegenerale.com/en/NEWSROOM-first-financial-transaction-settled-with-a-digital-currency>

<sup>200</sup> See eg.: <https://www.banque-france.fr/en/financial-stability/market-infrastructure-and-payment-systems/call-applications-central-bank-digital-currency-experimentations>

<sup>201</sup> See Tobias Adrian and Tommaso Mancini-Griffoli, “From Stablecoins to Central Bank Digital Currencies”, IMF Blog (26 September 2020), <<https://blogs.imf.org/2019/09/26/from-stablecoins-to-central-bank-digital-currencies/>>; Adrian and Mancini-Griffoli, *supra* note 76.

<sup>202</sup> <https://www.coindesk.com/wells-fargo-to-pilot-dollar-linked-crypto-for-internal-settlement>.

broad roll-out of SDCs triggered by the Digital Yuan and COVID-19 is now likely across the globe.

While many different design choices are discussed in the literature, we have argued the key parameters of design choices are, in fact, largely determined by the efficiency vs safety paradigm that shapes most central banks' and regulators' decisions. In light of this paradigm the Hybrid SDC model is most likely where increasing efficiency is the motive for introducing SDCs, while the centralized SDC model may be initially adopted in places where financial inclusion is the paramount policy goal (and then be replaced by the hybrid SDC model over time). In turn, highly *efficient* digital monetary and payment systems will likely be neither "public" nor "private" but rather arise from some type of public-private partnership. And while DLT/Blockchain has kickstarted the discussion, governance concern may result in the use of more traditional, and better tested, technology. As such in terms of architecture they will not look very much different from conventional payment systems that are structured most often as semi-private, semi-public, and often mutualized organizations.

However, one important difference from conventional systems may arise where central banks decide to grant certain cash features such as anonymity and settlement finality to users. In such cases, we may see the monetary system converge with the payment system towards a new digital financial system, potentially at both domestic and international levels.

One fascinating development centres upon whether, and when, China allows the Digital Yuan to be used offshore. The challenge however – as we highlighted earlier – is that use of the Digital Yuan offshore and/or outside China's Great Firewall means a loss of control of capital flows to an extent that so far China has been unwilling to accept. However, for the Digital Yuan to reward China with the benefits of minting a global reserve currency, the Digital Yuan will need to be usable outside of China's control. Even without allowing use outside of China, the Digital Yuan nonetheless offers the basis for the most credible effort since the Cold War to develop a fully functioning monetary and payment system which could operate outside of the US dollar system. If the bubble of the Digital Yuan were to expand outside China over time, it could effectively underpin a digital divide between two largely separate and competing monetary and financial worlds. At the same time, the way in which a Digital Dollar and/or Digital Euro evolve will be central to the future contours of the world's monetary and financial systems.



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