

PART 1
Tech Topics

Part 1 of the Commonwealth FinTech Toolkit introduces in brief six disruptive technologies that are transforming financial services and impacting on the lives of Commonwealth citizens.

If they are to effectively design and deploy policy and other interventions that enable the development and application of fintech, government officials must understand—at a summary level—the nature of key technologies that are categorised as fintech, and they must appreciate the potential risks and opportunities that each of these technologies offers.

In arriving at the topics included in the Toolkit, a working group of experts drawn from the Commonwealth central banks, large global banks, start-up companies and non-profits, as well as representatives of the Commonwealth Secretariat, narrowed a list of more than 24 potential areas for discussion.

The group set aside immature technologies that have not yet attained critical mass or which are not ready to be rolled out at scale in the developing world, such as quantum computing or augmented reality. It is possible that one of these technologies will

rise to the fore in the next three, five or ten years and that its impact will be such that a future version of this Toolkit might explain its relevance and a government's likely response.

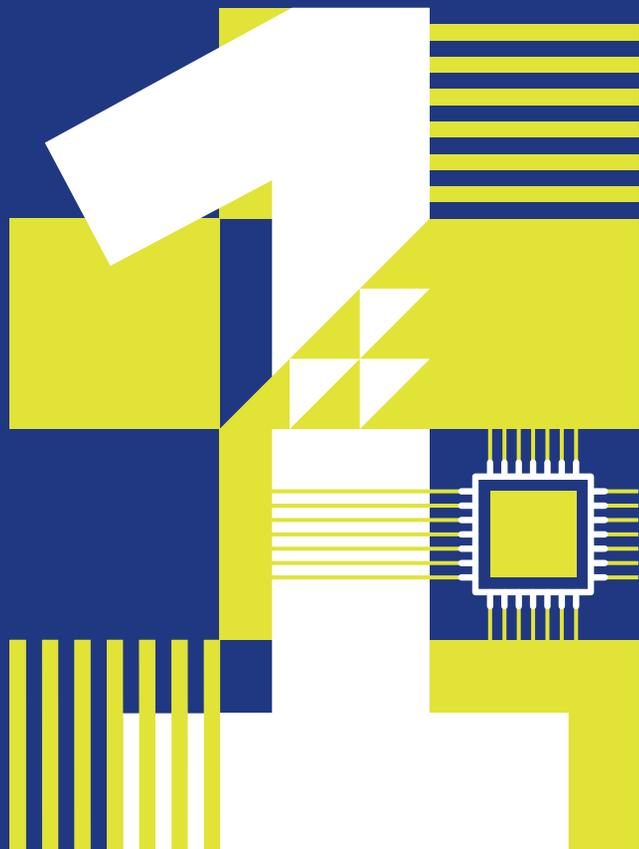
The working group also applied filters on dimensions including, but not limited to, the maturity of the technology, its relevance, its scale, and its potential impact on consumers, businesses and financial systems.

In Part 1, discussion therefore focuses on the following six key areas that the expert working group determined to be most relevant to Commonwealth member countries in the immediate term:

- digital financial services (DFS) (Chapter 1);
- artificial intelligence (AI) (Chapter 2);
- blockchain (Chapter 3);
- digital identity (Chapter 4);
- big data/big data analytics (Chapter 5); and
- cybersecurity (Chapter 6).

Chapter 1

Digital Financial Services



Digital Financial Services

Key points

- Digital financial services (DFS) can unlock productivity and investment, reduce poverty, empower women and help governments to build stronger institutions with less corruption—all while offering a profitable, sustainable business opportunity for financial services providers.
- Digital financial services can include mobile services and other kinds of digital service.
- As well as new opportunities, DFS open up new risks and involve consumer protection issues, of which regulators need to be aware and which they must address.

1.1 Introduction

Digital financial services (DFS) are a vehicle that can help providers to overcome the barriers that leave 3.5 billion people underserved or unserved by financial services today, including by lowering the costs of compliance with international laws and regulation. While many DFS are delivered through mobile devices and hence may be referred to as 'mobile financial services', the Commonwealth prefers to use the more comprehensive 'digital financial services' to also capture

non-mobile technologies such as Paytm, which is used in India.¹

1.2 Context

Any type of financial services should be considered in the context of the financial services ecosystem. Professors Peter Tufano (Saïd Business School, University of Oxford) and Robert Merton (MIT Sloan School of Management) have developed a functional explanation of how the global financial services ecosystem works, as set out in Figure 1.1.

Figure 1.1 The global financial services ecosystem.



Source: Adapted from D B Crane *et al.* (1995). *The Global Financial System: A Functional Perspective*. Boston: Harvard Business School Press.

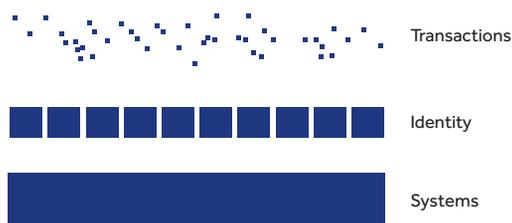
Broadening access to finance through digital means can unlock productivity and investment, reduce poverty, empower women, and help governments to build stronger institutions with less corruption—all while offering a profitable, sustainable business opportunity for financial services providers. The benefits of DFS for individuals, businesses and governments have the potential to transform the prospects of developing economies.²

Digital financial services can fill a gap left by banks that are unable or unwilling to service those at the bottom of the wealth and income scales. They are often driven by non-bank financial institutions (NBFIs) aiming to offer the financially excluded an alternative to cash as a means of payment and transfer.³

Few people and small businesses in today's developing economies fully participate in the formal financial system. They commonly transact exclusively in cash, have no safe way of saving or investing money, and cannot access credit other than through informal lenders and personal networks. Even those with bank accounts may have only limited product choice and face high fees. In more developed countries where participation is wider, the banking experience has left many feeling unhappy and many financial institutions have a customer satisfaction rating—expressed as a Net Promoter® Score (NPS)—that is negative.

Using digital channels rather than bricks-and-mortar branches dramatically reduces costs for providers and increases convenience for users, opening up access to finance for people at all income levels and even in remote rural areas. For businesses, financial services providers and governments, digital payments and DFS can erase inefficiencies and unlock significant productivity gains.

Figure 1.2 The dimensions of digital financial services.



Source: D Shrier (2019). *Digital Financial Services*. University of Oxford, Women's World Banking and Alliance for Financial Inclusion (AFI) Leadership and Diversity Program for Regulators [Webinar].

A second simplified functional model is useful as we consider the ways in which financial services can be digitised. Figure 1.2 sets out three specific dimensions of the digital realm, disaggregating these layers from the broader context of the functional model set out in Figure 1.1.

These three foundational layers can help a central banker to understand readily where a particular DFS offering fits into the financial services 'stack'.

1.3 Description

1.3.1 The Core Elements of Digital Financial Services

We will now examine the core elements of DFS within the simplified three-layer framework.

- **Transactions** At this layer, we are looking at the movement of money from one person to another, from a person to an organisation (such as a bank, a company or a government), from an organisation to a person, or from one organisation to another.
- **Identity** An identity, in the context of DFS, is a model that uniquely represents an individual person or an organisation. Identities can comprise

government-issued documents or corporate-issued identifiers, such as Dun & Bradstreet's D-U-N-S® Number (a unique nine-digit identifier for businesses) or the Legal Entity Identifier (LEI) of legal entities participating in financial transactions, as well as biometric data, financial data and/or myriad other types of data.

- **Systems** This layer refers to the infrastructure that underpins all DFS activities and it encompasses communications networks, hardware, software and a wide range of other technologies.

At the level of **transactions**, DFS have revolutionised payments, remittances and transfers. Payment transactions are perhaps the most common financial activity of any individual and hence the entry point into financial services for millions. By lowering costs, DFS have enormous potential to broaden financial inclusion. Private companies such as M-Pesa and Bitpesa, both based in sub-Saharan Africa, are introducing lower-cost, higher-throughput transactions and reducing cross-border remittance rates from 12–15 per cent to 1 per cent or less by replacing antiquated systems that have historically demanded layers of manual labour and rent-extracting intermediaries. Bitpesa, for example, has replaced the activities of Western Union with Bitcoin technology to manage and track the movement of money from one account to another. For other market providers, mobile financial services have empowered consumers to interact with a human agent in real time—a hybrid DFS model that has helped to overcome some mistrust of digital systems by giving technology a human face. Devolving financial services even further, DFS has enabled peer-to-peer (P2P) payments systems that eliminate some of the conventional functions of the banking system and hence lower costs.



Identity is a keystone issue for financial inclusion. Some 3.5 billion people are underserved or unserved by today's financial services providers, and approximately 1 billion (largely women and children) have no legal identity at all—a barrier to access of financial services.

Identity is a keystone issue for financial inclusion. Some 3.5 billion people are underserved or unserved by today's financial services providers,⁴ and approximately 1 billion (largely women and children) have no legal identity at all⁵—a barrier to access of financial services. In addition, small and medium-sized enterprises (SMEs) may lack adequate corporate identity, and hence some 65 million formal micro businesses or SMEs are underbanked or unbanked.⁶ Access to credit for consumers and small businesses is intimately linked with identity;

a credit profile is a subset of the individual's or business's identity attributes. It is an enhanced set of data that derives from the actions of the consumer or business and it is tied to other identifiers such as an individual's National Insurance (NI) number or a company's business identifier. By feeding new forms of credit modelling driven by alternative data, digital data streams—including streams of transactions-level data—are enabling lending to a broader audience. At the same time, data portability—driven by new open banking regulations⁷—empowers consumers by giving them control over their identity-linked data (see Chapter 4 on digital identity).⁸

At a **systems** level, digital technologies are helping to modernise activities in various banking environments. New digital technologies are enabling improved security across all dimensions of infrastructure and are narrowing the gaps between nations' capabilities. In some cases, those gaps are large: some developing economies lack even basic process flow systems for loans and continue to progress loan applications in hard copy, with inevitable negative implications for cost and speed. New digital platforms support a transition that, accompanied by blockchain (see Chapter 3), is seeing the costs of interbank transfers dramatically reduced and speed increased.

Four building blocks for effective DFS regulation

Based on its work in ten countries in Africa and Asia, the Consultative Group to Assist the Poor (CGAP)—a non-profit think tank—has identified four basic building blocks for creating an enabling and safe DFS regulatory framework.

- **E-money issuance by non-banks** A basic precondition to effective DFS is the licensing of institutions other than banks as e-money issuers (EMIs).
- **Use of retail agents** Retail agents make inclusive DFS possible and are therefore a key focus of enabling regulation. Providers use agents—third parties such as shops—to provide customers with easy access to financial services close to where they live, thus expanding their reach at relatively low incremental cost.
- **Risk-based customer due diligence** Because DFS are offered within the contexts of anti-money-laundering (AML) regulations and other policy measures countering the financing of terrorism (CFT), providers must take care to implement proportionate AML/CFT frameworks. Such frameworks use a risk-based approach to protect the integrity of the system while minimising the constraints on DFS outreach.
- **Consumer protection** To drive financial inclusion, DFS providers must prove themselves reliable and cultivate trust, and this in turn depends on effective financial consumer protection (FCP).

Source: CGAP (2018). *Regulation for Inclusive Digital Finance*. Retrieved from www.cgap.org/topics/collections/regulation-inclusive-digital-finance

While most DFS at the transactions and identity layers are delivered through mobile platforms, some are not. For example, in India, the Paytm is a type of automatic teller machine (ATM) that allows a consumer who has neither a mobile phone or smartphone nor access to the internet to transfer money, make bill payments and engage in other financial services activities without visiting a bank. As such, the Paytm—a form of DFS—is a vehicle for the financial inclusion of some of the poorest individuals among Commonwealth member states.

1.3.2 The Role of Central Banks in Digital Financial Services

Government bodies in general—and central banks in particular—have a crucial role to play in the success or failure of the implementation of DFS in a country.

The local regulatory environment within which DFS are provided is said to be 'enabling' or 'non-enabling'—terms first used by the Global System for Mobile Communications (GSMA), the industry's non-profit trade association.⁹ An enabling environment is one in which non-banks can independently provide DFS without needing to partner with a licensed bank.¹⁰

In most jurisdictions, a country's central bank is its lead regulator on DFS. At a minimum, it will:

- define criteria for the licensing and authorisation of DFS providers and EMIs, as well as standards for agents;
- establish consumer protection mechanisms, including schemes safeguarding pooled funds and customer accounts;
- set out guidelines on the safety and soundness of services, and on quality

of service (QOS) and risk management; and

- develop AML and know your customer (KYC) policies for use within the financial sector.

In some cases, it may also develop and implement interoperability standards and policies, which aim to support a DFS 'ecosystem'. The central bank or regulator may build or facilitate the building of an interoperable platform at national level or otherwise take steps to integrate e-money-based financial services providers and agent networks working with e-money with more 'traditional' financial services, such as those involving ATMs and card networks.¹¹

Businesses and government leaders will need to make a concerted effort if we are to see the potential benefits of DFS realised. Three structural prerequisites will underpin any enabling environment:

- a widespread mobile and digital infrastructure;
- a dynamic business environment for financial services; and
- DFS products that meet the needs of individuals and small businesses in ways that improve on the informal financial tools they use today.

1.3.3 Examples of Digital Financial Services

Several Commonwealth nations have had significant success in deploying DFS.

The Bahamas

In May 2019, the Central Bank of The Bahamas entered into an agreement to deliver the first national digital currency by 2020. Its key collaborator was NZIA.io, alongside Singapore-based software

development firm Zynesis. Named 'Project Sand Dollar', the Bank said that it intended the initiative to be an 'integrated, affordable electronic payment system for all businesses and residents'. The Bank confirmed that the project would comply with local financial regulations and provide equal access to digital payments for the residents of the island country, reducing the costs of cash transactions and other services.¹²

India

Paytm is a digital payments platform that enables online payments, as well as cash deposits via select banks and partners, into an integrated virtual wallet. Customers can then use the Paytm wallet to pay for goods and services such as travel fares and hotel bookings, cinema visits, recharging a mobile phone and paying utility bills, as well as online shopping. The funds held in the wallet are protected under escrow—a type of account from which funds are released only once an agreement is fulfilled.¹³

Kenya

M-Pesa and similar DFS are indicative of a mobile banking revolution in Kenya: financial institutions have embraced M-Pesa as a platform on which to manage micro accounts, to build customer deposits and to broaden their customer networks. Kenya has therefore emerged as a leader in financial inclusion in sub-Saharan Africa. In 2006, just before the launch of M-Pesa, only 26.7 per cent of Kenyans had access to formal financial services (such as bank accounts and money transfers); this figure now exceeds 80 per cent (see Case Study 10.2).¹⁴

Malawi

Since launching its first mobile money pilot in 2012, Malawi has seen the number of people using DFS as of June 2018 leapfrog from 1,000 active users to 2.3 million (measured in a period of 90 days)—a figure that represents

25 per cent of the adult population. The 2017 Global Findex released by the World Bank in April 2018 highlights this remarkable achievement.

The Reserve Bank of Malawi played an important role in creating an enabling regulatory environment that fostered innovation and growth led by the private sector. The Bank permits both banks and NBFIs to offer DFS. Parliament passed critical laws in 2016, including the Payment Systems Act, E-Transactions Act and Communications Act, which have guided further development of the DFS market. In September 2017, the Bank issued a directive mandating DFS interoperability and hence Malawi has now delivered a reality for multinational organisations of which many countries can still only dream.¹⁵

Nigeria

According to the World Bank's World Development Report 2016, Nigeria's 2012 Growth Enhancement Support Scheme introduced mobile technology to transfer fertiliser subsidies directly to farmers, taking the government out of the business of procuring and distributing fertiliser. The Scheme now helps up to twice as many farmers at a sixth the cost of the government's former mechanisms. The transfer system relies on a database of more than 10.5 million farmers, who, as registered recipients of the subsidies, now have a better chance of accessing formal or regulated financial services. Based on this initial success, the system is expanding, with the help of a digital identity system and biometric signatures, to extend the reach of financial services into Nigeria's more remote rural areas.¹⁶

United Kingdom

At digital bank Monzo, chief executive officer Tom Blomfield and his team are harnessing

technology to authenticate and provide basic bank accounts for people who have been granted asylum in the UK. Blomfield has suggested that better digital identification in the UK could help to reduce the cost of providing financial services to disadvantaged groups.

At OakNorth Bank, co-founder Rishi Khosla is using machine learning to apply lending techniques formerly limited to large business to underserved SMEs. By drawing on shared public data (with permission), such as tax returns, OakNorth is helping to unlock savings for small businesses.¹⁷

Zambia

The Zambia National Commercial Bank (Zanaco) has invested in a distinctive brand for financial inclusion. In 2008, the Bank successfully launched Zambia's first mobile banking service, Xapit. Opening a Xapit account takes only minutes, and it allows consumers to access credit and other banking services over a mobile phone. Targeting Zambia's underbanked markets, Xapit now serves more than 200,000 customers and conducts more than 1 million transactions per month. Xapit users include other Zanaco customers that have easy access to the product through their savings and current accounts.¹⁸

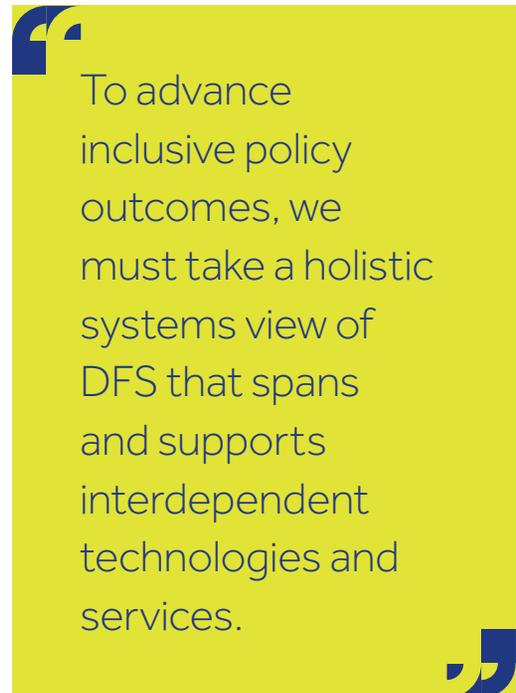
1.4 Key Considerations for Future Development

1.4.1 Critical Issues in and Obstacles to Digital Financial Services

Several critical issues have arisen in the past several years as DFS have been adopted more widely.

Digital Inclusion

Digital inclusion drives financial inclusion, but digital exclusion remains so significant a problem globally that one of the United Nations Sustainable Development Goals (SDG 9)



To advance inclusive policy outcomes, we must take a holistic systems view of DFS that spans and supports interdependent technologies and services.

includes access to information and communications technology (ICT) among its targets.¹⁹ Even though every 10 per cent increase in internet penetration sees gross domestic product (GDP) increase by 1.35 per cent,²⁰ the world seems stuck at around 54.8 per cent connectivity, with a slowing growth rate (2.9 per cent in 2019²¹) inhibiting the potential for financial inclusion. Some 3.8 billion people still lack access to fast and/or reliable internet, making it difficult to deliver financial services digitally.²² And the issue is gendered, with the GSMA finding that 313 million fewer women than men are using mobile internet in low- and middle-income countries.²³

To advance inclusive policy outcomes, we must take a holistic systems view of DFS that spans and supports interdependent technologies and services. For example, Africa should be home to more than 700 million smartphones by 2025—up from 302 million in 2018²⁴—but if access to power and access to bandwidth remain limiting factors, DFS efforts will fail.

Rising Usury

Despite these lofty goals, DFS platforms have come under criticism as imposing a 'poor tax' in the form of the high interest rates charged to people with low incomes in comparison with those granted to the wealthy and financially secure. In an era of historically low (in some cases, negative) interest rates in developed nations, why is it that developing economies and underbanked/unbanked populations remain able to access only high-cost loans? Yet, in some countries, policy initiatives aiming to cap interest rates have had unintended consequences, limiting the capacity of companies to compete and leading several players to abandon those markets as unsustainable economically.

Economists argue over solutions. A 2018 study of developing nations found that, of the 69 studied, 51 had imposed interest rate caps.²⁵ The rationale offered is typically to protect consumers from usury, to improve access to credit and to reduce costs to consumers. Leora Klapper of the World Bank points out the unintended adverse consequences of interest rate caps and instead advocates for policy tools such as fostering competition, reducing the cost of funds to lenders and so on, echoing sentiments dating back to Milton Friedman.²⁶

Know Your Customer (KYC)

One challenge that links with identity relates to KYC regulations. The rules currently require that a customer be tied to a physical address—but even those who have no fixed address may need to access financial services.

In a positive step towards financial inclusion, new technologies delivered by mobile phone can partner Global Positioning System (GPS) co-ordinates with device-acquired biometrics to provide high-resolution means

of identifying an individual that actively improve on current methods and which are more secure. Governments are exploring these and alternative methods of identifying individuals digitally.

Privacy

Importantly, the ability to access alternative data opens up new issues of digital privacy, with personal data stripping citizens of anonymity. Telecommunications and bank datasets may even be misused, breaching personal privacy or targeting groups negatively on the basis of protected characteristics, such as race, gender or religion. In recent years, we have heard much about the part that analysis of this type of data has played in manipulating voters during elections, and while supranational data protection legislation such as the European Union's General Data Protection Regulation (GDPR) aims to secure personal data and model best practices for its use, domestic regulators may struggle to apply it.²⁷

Cybersecurity

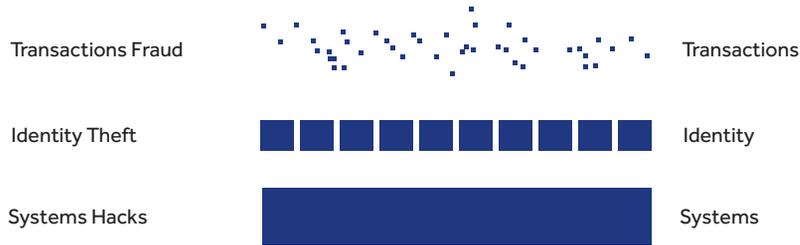
In Figure 1.3, we look at the simplified three-layer model of the DFS realm that we set out in Figure 1.2 through a cybersecurity lens.

At each layer of the DFS stack, new vulnerabilities arise.

- At the level of transactions, we see the risk of **transaction fraud**.
- The identity layer is exposed to the risk of **identity theft**.
- Interoperable and easily accessed digital systems can be subjected to **systems hacks**.

The downstream impacts should cybersecurity risks manifest can be serious.

Figure 1.3 The cybersecurity risks of digital financial services.



Source: D Shrier (2019). *Digital Financial Services*. University of Oxford, Women's World Banking and Alliance for Financial Inclusion (AFI) Leadership and Diversity Program for Regulators [Webinar].

At a personal level, rising fraud and identity theft rates can reverse rising financial inclusion. For example, false decline rates are highest in emerging markets such as Bangladesh, sub-Saharan Africa, Colombia and Mexico: 50 per cent or more of transactions are declined simply because fraud systems are unable to determine whether the transaction originates with a legitimate customer or a hacker. At a systemic level, hackers undermine confidence in the banking system. (See Chapter 6 on cybersecurity for more detail.)

Financial Literacy

Limited levels of financial literacy may limit the adoption of DFS. In interviews, central banks revealed that consumers in their countries commonly questioned new offerings. Some of those currently underserved or unserved simply do not understand the benefit of a savings account or a credit facility—and the necessary remedy is investment in financial literacy.

1.4.2 Future Opportunities for Digital Financial Services

Digital financial services have the potential to be a powerful tool for inclusion and improved economic velocity. A systems view of DFS should include efforts to:

- improve financial literacy;

- invest in modern technology infrastructure;
- shape policy interventions that engage and empower the private sector; and
- protect consumers in light of the sophisticated effects of different DFS offerings.

The rise of non-traditional providers of services such as money transfers, savings and lending is a characteristic of DFS that gives rise to some concerns.²⁸

One concern is that traditional financial regulation does not always cover these companies or holds them to a different (reduced) standard, even though they can scale up quickly. To some extent, these problems mimic the 'shadow banking problem' that preceded the global financial crisis and hence regulators are exploring a shift from regulating entities to regulating activities.

Another concern is that digital finance is drawing large numbers of people into the financial system for the first time. This has consequences should they not be financially literate, and hence DFS efforts must be partnered by consumer education

and consumer protection, including the promotion of fraud prevention, dispute resolution mechanisms and data privacy.

A third concern is that financial innovation could pose a systemic risk to a country's banking sector, involving any and all of credit, liquidity, operational and consumer risk. Prudential regulation of DFS reduces these risks, but it may involve high compliance costs that are barriers to entry and thus to competition. For example, concerns were raised about the risks that Bitcoin posed to the banking system, but the Bank of England's analysis suggested that most digital currencies play too small a role (at present) to threaten financial stability.²⁹ A greater concern may be that financial innovations create distortions in financial markets that could have larger implications. For example, if automation and 'big data' approaches were to make it easier to issue consumer credit but not commercial credit, then financial institutions might over-allocate to the former, potentially creating a credit bubble and reducing the credit available to investments that increase productivity.

Moreover, while the Bank of England may have dismissed the systemic risks posed by Bitcoin, it was more concerned by the advent of multinational digital currency Libra, proposed by a private consortium of companies led by Facebook, and by the digital yuan, or e-RMB, issued by the People's Bank of China. In August 2019, outgoing Bank of England Governor Mark Carney called for a digital currency backed by several countries that would address rising concerns around these two digital currencies and the hegemony of the US dollar.³⁰

Finally, the spread of DFS gives rise to concerns about increased fraud in the financial system. As financial institutions have digitised, they and other sectors

processing electronic financial transactions have been exposed to cyber attacks. The theft of credit card information from retailers at scale has highlighted the stakes and banks have been at the forefront of efforts to develop secure transaction processes. Larger financial institutions have the resources and knowhow to upgrade online and mobile security continuously, with tools such as encryption or strong authentication, but smaller banks and NBFIs may be more at risk.

Perhaps the most significant concern to be overcome is that systemic risk—the risk of a loss of trust in digital financial systems—may hinder further innovation in the sector.

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