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Topical article

Embracing the promise of fintech



Embracing the promise of fintech

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- The UK economy is becoming increasingly digital with high levels of smartphone and internet penetration, a growth in e-commerce, the emergence of new technologies and an enhanced ability to capture and analyse large amounts of data.
- Fintech is supporting this shift by enabling new players and business models to enter the market. This could increase competition, meet unfulfilled customer needs, reduce inefficiencies and change financial services. Overall, this could create a more efficient, effective and resilient financial system. At the same time, new risks to financial stability may emerge and existing risks could be amplified.
- The Bank of England’s mission is to promote the good of the people of the UK by maintaining monetary and financial stability. As such, it seeks to understand what fintech means for the stability of the financial system, the safety and soundness of financial firms, and its ability to perform its operational and regulatory roles.
- The Bank of England is committed to embracing fintech to deliver its mission. As such, it is upgrading its hard infrastructure — particularly its payments architecture — to enhance security and support innovation, while also updating its ‘soft infrastructure’ — including rules and regulations — to mitigate potential risks. The Bank of England is also applying new technology to enhance its own capabilities.

Overview

The word ‘fintech’ is simply a combination of the words ‘financial’ and ‘technology’. It can be defined broadly as technology-enabled financial innovation that could result in new business models, applications, processes, or products with an associated material effect on financial markets, institutions and the provision of financial services.⁽¹⁾

Although ‘fintech’ is a relatively new term, technology has always been important in the financial sector. The key difference now is that the pace and impact of change across the financial system has increased markedly over the past decade. Globally, more than 33% of the digitally active population now use fintech services, more than doubling from 16% in 2015.⁽²⁾

To embrace the potential of fintech the Bank of England is:



Understanding how fintech developments may affect systemic stability



Evaluating how fintech developments may affect the safety and soundness of firms



Applying fintech, where appropriate, to enhance our capabilities

(1) Financial Stability Board (2017), ‘Report on Financial Stability Implications from FinTech’.
 (2) EY (2017), ‘EY FinTech Adoption Index 2017 — The rapid emergence of FinTech’.

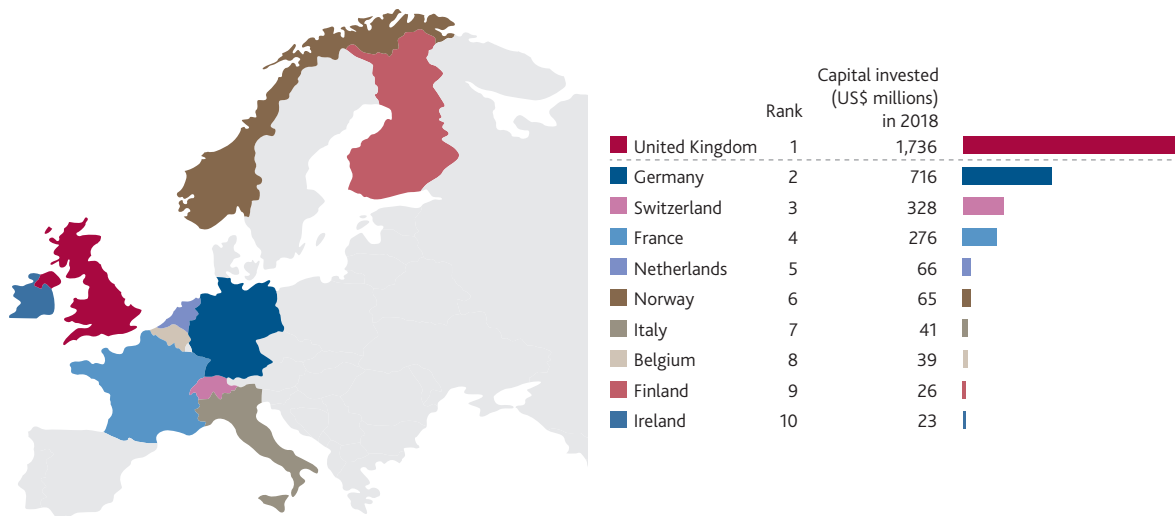
Introduction

Fintech is transforming financial services. In the past 10 years, growth in the digital economy, high levels of smartphone and internet penetration, the emergence of new technologies and an increased ability to capture and analyse large amounts of data have spurred innovation by financial institutions. In the coming years, fintech is expected to enable new players and business models to enter the market. This could increase competition, help meet unfulfilled customer needs, reduce inefficiencies and change the way institutions provide — and consumers and businesses use — financial services. It could also alter the structure of the financial sector, with implications for customers, firms and regulators. At the same time, new risks to financial stability may emerge and existing risks could be amplified.

UK fintech sector

The UK fintech sector comprises both start-ups and established financial institutions. These firms are applying technology to a range of business areas, including banking, payments, lending and investment. Insurance is also being transformed by technology, with start-ups providing policies for previously underserved markets and new digital distribution channels. With clusters of innovative start-ups and established companies in a number of cities, the UK fintech sector is widely regarded as one of the most dynamic in the world. In 2017, the sector contributed 76,500 jobs to the UK economy⁽¹⁾ and received US\$1.8 billion of venture capital investment.⁽²⁾ In 2018, this trend continued⁽³⁾ (Figure 1) and further milestones were reached: the acquisition of a UK-based payment processing fintech for US\$12.9 billion was the largest fintech merger and acquisition deal in the world⁽⁴⁾ and a UK-based fintech received the largest round of venture capital fintech funding in Europe.⁽⁵⁾

Figure 1 The UK is Europe’s leading destination for fintech investment



Source: Innovate Finance (2019), 2018 VC fintech investment landscape.

At the Bank of England (the Bank), we are analysing how fintech can support our mission to maintain financial and monetary stability in the UK, and provide a platform for innovation. History has shown that private innovation works best when it is grounded in the right public infrastructure⁽⁶⁾ (Figure 2). This includes ‘hard’ public infrastructure that supports financial services, such as the system that underpins payment and securities settlement in the UK: the Bank’s Real-Time Gross Settlement (RTGS) system.⁽⁷⁾ We are upgrading our infrastructure, which involves exploring new technologies which will help support further innovation. We are using technology to improve our own operational and regulatory capabilities. We are also making sure our ‘soft infrastructure’, such as rules, regulations and codes⁽⁸⁾ are up to date and mitigate any risks from fintech developments.

(1) Innovate Finance (2018), ‘Supporting UK fintech: accessing a global talent pool’.
 (2) Innovate Finance (2018), ‘2017 VC fintech investment landscape’.
 (3) The UK fintech sector received US\$1.73 billion of venture capital and US\$1.6 billion of private equity investment in 2018. See Innovate Finance (2019), ‘2018 VC fintech investment landscape’.
 (4) KPMG (2019), ‘The pulse of fintech 2018’.
 (5) Innovate Finance (2019), ‘2018 VC fintech investment landscape’.
 (6) Carney, M (2018), ‘New economy, new finance, new Bank’.
 (7) Dent, A and Dison, W (2012), ‘The Bank of England’s Real-Time Gross Settlement infrastructure’, *Bank of England Quarterly Bulletin*, 2012 Q3.
 (8) Carney, M (2018), ‘Staying connected’.

Box 1 The Bank’s evolving approach to fintech

In mid-2016, the Bank launched its **Fintech Accelerator** project, which operated over two years and had two key objectives:

- (i) to improve our familiarity with fintech services, concepts and firms: their strengths and weaknesses, their implications for financial markets, and their potential applications in central bank operations; and
- (ii) to give fintech firms some insight into the emerging questions and needs central banks might have, as policymakers, regulators and operators.

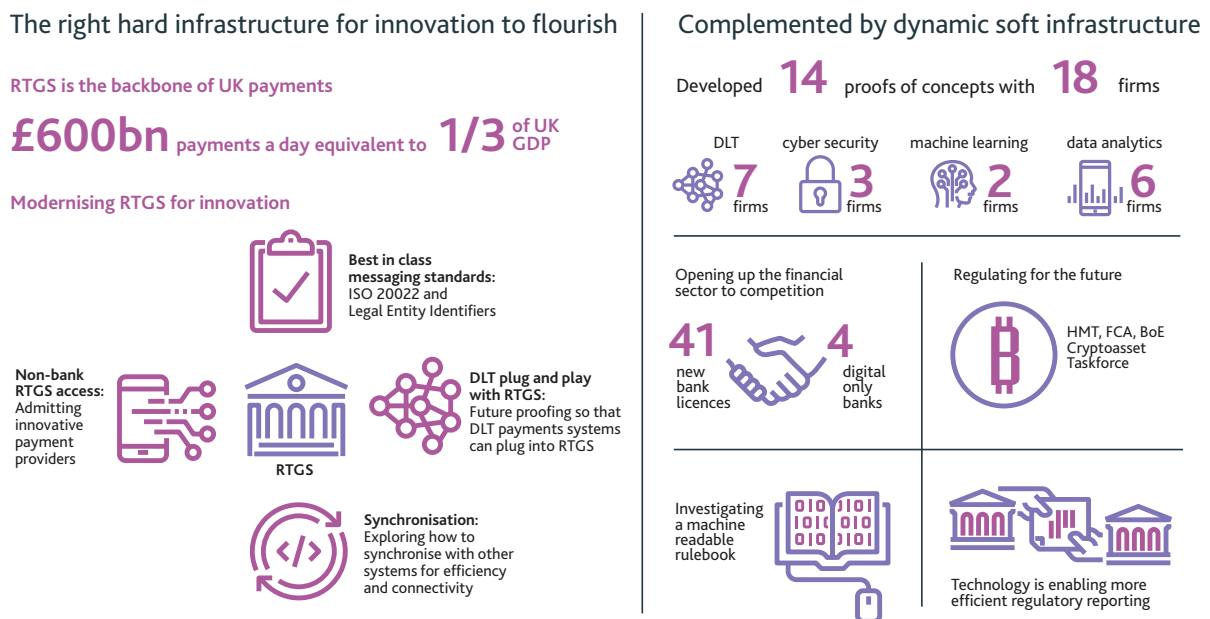
The Accelerator undertook 13 proofs of concept ('PoCs') with 14 firms.⁽¹⁾⁽²⁾ Firms were chosen through an open, competitive selection process on the basis of a well-defined central banking use case. They worked closely with the Bank’s subject matter experts for a time-limited period. The PoCs spanned most aspects of central banking, including those using Distributed Ledger Technology, regtech, machine learning and cyber security. The results and key findings were published on the Bank’s web pages.

The award-winning⁽³⁾ work undertaken by the Accelerator was of significant value for the Bank and its approach was integrated into the Bank’s business-as-usual activities.

Building on the success of the Accelerator, a permanent **Fintech Hub** was set up in March 2018.⁽⁴⁾ Sitting at the heart of the Bank, the Hub brings together the Bank’s work on what fintech means for the stability of the financial system, the safety and soundness of financial firms, and our ability to use technology to supervise firms.

(1) Hauser, A (2017), 'The Bank of England's FinTech Accelerator: what have we done and what have we learned?'.
 (2) The Bank has continued to undertake PoCs after the end of the Accelerator project. Bank of England, 'Fintech proofs-of-concept'.
 (3) Central Banking (2018), 'Initiative of the year: Bank of England's FinTech Accelerator'.
 (4) Ramsden, D (2018), 'The Bank of England — open to fintech'.

Figure 2 The Bank of England is providing a platform for innovation

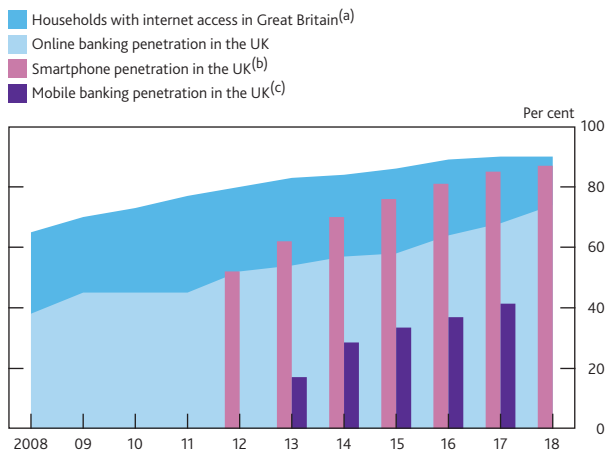


1 The promise of fintech

The digital economy

Technology has become an integral part of our lives and as a result the economy is becoming increasingly digital, platform-based and data-driven. As of 2018, 90% of UK households had internet access⁽⁹⁾ and 87% of consumers own or have access to smartphones⁽¹⁰⁾ (Chart 1). Millions of people now purchase goods and services via the internet (Chart 2), with half of UK consumers (51%) now preferring to shop online rather than in-store.⁽¹¹⁾ As smartphones have become more affordable and mobile apps have grown in sophistication, they have had a tremendous effect on how people access financial services, with 74% of UK adults using online banking in 2018 (Chart 1).⁽¹²⁾ Nearly 22 million people in the UK regularly used banking apps during 2017 — a 12% rise on the previous year. At the same time, the average bank branch received 104 visits per day in 2017, a 26% drop from 2012.⁽¹³⁾

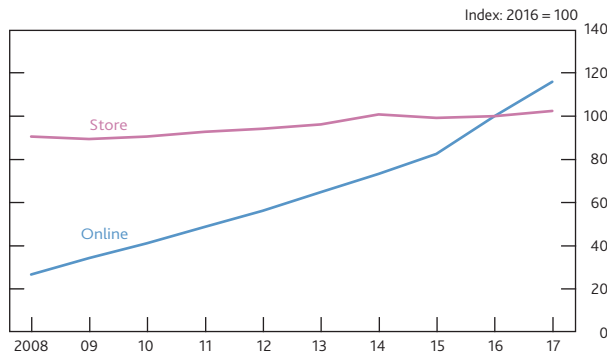
Chart 1 Internet versus online banking (2008 to 2018) and smartphone versus mobile banking (2013 to 2018) in the UK



Sources: Deloitte (2018), 'UK edition: Global Mobile Consumer Survey'; European Commission (2019), 'Eurostat: Individuals — internet activities'; Office for National Statistics (2018), 'Estimates of the population for the UK, England and Wales, Scotland and Northern Ireland'; Office for National Statistics (2018), 'Internet Access — households and individuals, Great Britain: 2018'; and UK Finance (2018), 'The way we bank now 2018'.

- (a) UK estimates from 1998 to 2004. Great Britain estimates from 2005 to 2018.
- (b) All respondents aged 18–75 years.
- (c) 2013 was the first year in which mobile data was collected.

Chart 2 Store-only sales and online-only sales, non seasonally adjusted Great Britain (2008 to 2017)



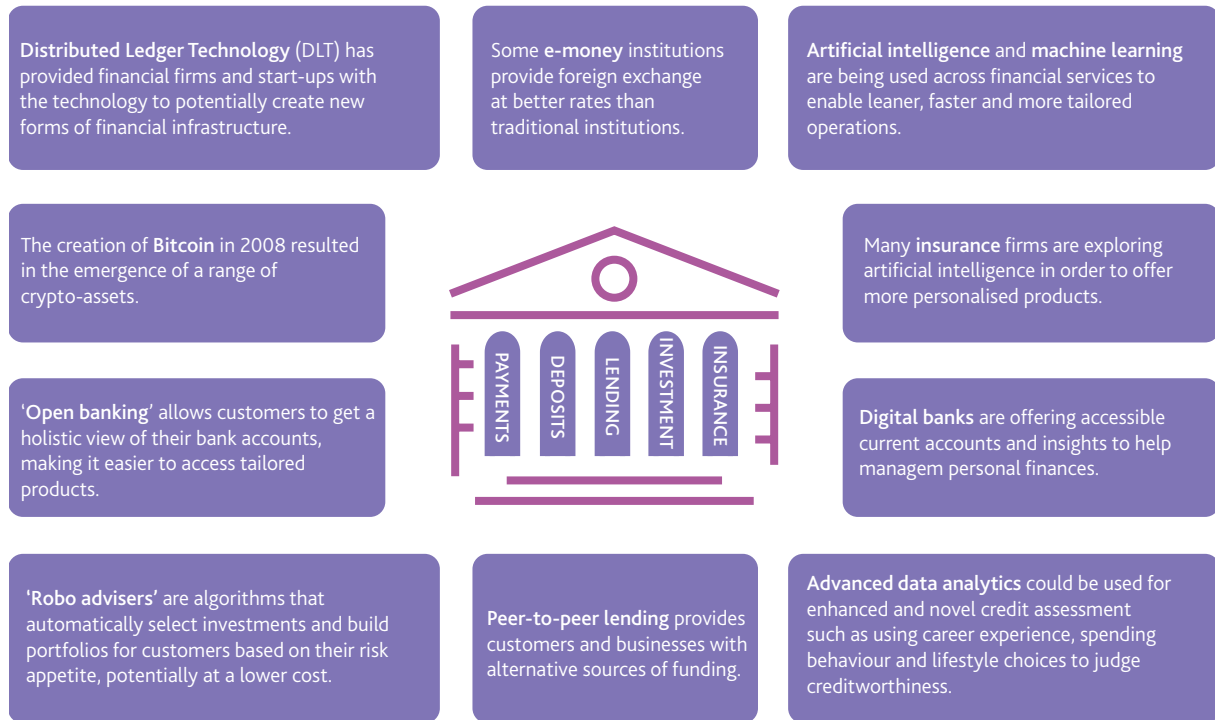
Source: Office for National Statistics (2018), 'Monthly Business Survey, Retail Sales Inquiry'.

Payments are becoming increasingly digital reflecting a change in commerce and consumer preference for accessible, convenient and personalised digital solutions. In particular, the rollout of contactless card and mobile wallet technology has provided consumers and businesses with a more diverse range of payment solutions.

In 2017 Q4, debit cards overtook cash for the first time as the most frequently used payment method in the UK.⁽¹⁴⁾ The number of contactless card payments made in the UK increased by 97% during 2017 to 5.6 billion⁽¹⁵⁾ and there were an additional 5.9 billion payments in 2018.⁽¹⁶⁾ There were 126 million in-store contactless transactions made via a mobile device in 2018 — a 328% increase from the year before.⁽¹⁷⁾ There has also been a diversification of payment companies with new entrants to the market, such as e-money institutions⁽¹⁸⁾ and technology companies.

(9) Office for National Statistics (2018), 'Internet access — households and individuals'.
 (10) Deloitte (2018), 'Global Mobile Consumer Survey 2018: The UK Cut'.
 (11) EmpathyBroker (2018), 'Empathybroker Reveals UK Consumers Prefer to Shop Online Than In-Store'.
 (12) European Commission (2019), 'Eurostat: Individuals — internet activities'.
 (13) UK Finance (2018), 'The Way We Bank Now 2018'.
 (14) UK Finance (2018), 'UK Payment Markets Summary 2018'.
 (15) UK Finance (2018), 'UK Card Payments 2018'.
 (16) UK Finance (2019), 'Card Spending Update'.
 (17) Worldpay (2018), 'Tipping point for 'tap and go' as mobile payments top £975 million'.
 (18) Financial Conduct Authority, 'Electronic money and payment institutions'.

Figure 3 Fintech is changing the financial system



Furthermore, an increase in Open Banking⁽¹⁹⁾ uptake could continue the emergence of innovative solutions that help consumers understand their finances and manage their money.

Unfulfilled demands

Fintech has the potential to help meet unfulfilled customer demands and ease frictions in financial services. These solutions come from fintech’s ability to unbundle traditional financial services activities into core functions such as settling payments, performing maturity transformation, sharing risk and allocating capital. Furthermore, fintech solutions can enhance data analysis, leading to more personalised products. The combination of unbundling and more agile technology could provide customers with more choice, better-targeted services and keener pricing (Figure 3). Two examples where fintech can provide benefits and help meet unfulfilled demands are small and medium-sized enterprise (SME) financing and cross-border payments.

Funding for SMEs, which accounted for 60% of all private sector employment at the start of 2018,⁽²⁰⁾ continues to be a challenge in the UK. In comparison to larger businesses, SMEs face a range of barriers when attempting to access finance⁽²¹⁾ (Chart 3).

Fintech could improve SMEs’ access to finance. For example, peer-to-peer (P2P) lending uses online platforms to match SMEs with funding and open up new pools of finance. P2P lending to SMEs exceeded £6.2 billion in 2018,⁽²²⁾ an increase of 21% on 2017, which brings the total originated to £20 billion.⁽²³⁾ Previous Bank research found that P2P lending can support financial inclusion, by providing access to finance to regions in the UK that have historically faced funding gaps.⁽²⁴⁾ In addition to providing funding, examples like this can help bridge the perception gap among SMEs about the availability and range of funding options. Encouragingly, it appears that SMEs are becoming more aware of alternative financing options. According to one survey, 52% and 70% of SMEs said they were aware of P2P lending and crowdfunding platforms in 2017–18, up from 47% and 60% the previous year.⁽²⁵⁾

(19) The Competition and Markets Authority’s Open Banking initiative requires banks to share customer information with third-party providers, with customer consent. Customer consent is crucial to increasing Open Banking adoption and wider acceptance will require clarity on security, privacy, accountability and liability for losses, while providing a streamlined experience for customers using Open Banking applications. See ‘What is Open Banking?’.

(20) Federation of Small Businesses (2018), ‘UK Small Business Statistics’.

(21) In 2016 46% of UK SMEs faced barriers in accessing finance, with the main challenges being the ability to afford the cost of financing (16%) and a lack of understanding among lenders of the sector (12%) (Close Brothers (2016), ‘Banking on growth: closing the SME funding gap’). Another survey found that 29% of SMEs do not use or plan to use external finance (British Business Bank (2019), ‘Small Business Finance Markets’).

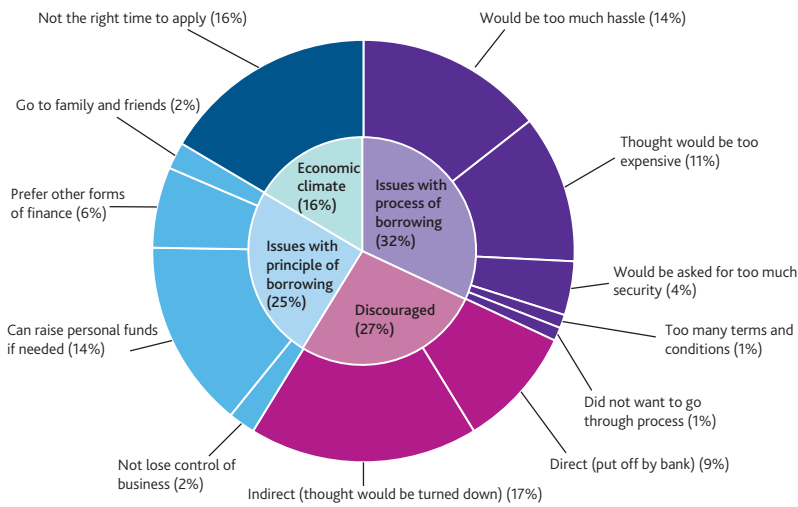
(22) British Business Bank (2019), ‘Small Business Finance Markets’.

(23) Since 2011, when the values started being recorded; British Business Bank (2019), ‘Small Business Finance Markets’.

(24) Atz, U and Bholat, D (2016), ‘Peer-to-peer lending and financial innovation in the United Kingdom’, *Bank of England Working Paper No. 598*.

(25) British Business Bank (2019), ‘Small Business Finance Markets’.

Chart 3 Main reason UK SMEs did not apply for finance 2018 H1^(a)



Source: BVA BDRC (2018), 'SME Finance Monitor', 2018 Q2, page 188.

(a) The chart is representative of 113 total responses from would-be seekers — those SMEs that had not had a borrowing event and said that something had stopped them applying for funding in the previous 12 months.

New technologies, such as point of sale devices, can help lower transaction costs and improve SME productivity and profitability. Fintech can also help companies manage their businesses by integrating fintech products with payroll and accounting services.

Fintech also has the potential to reduce inefficiencies in cross-border payments, which are often regarded as expensive, slow and sometimes lacking in transparency compared to domestic payments. For example, they can cost 10 times more than an average domestic payment⁽²⁶⁾ and take up to three days to clear,⁽²⁷⁾ compared to usually immediate clearance in the UK's domestic Faster Payments System.⁽²⁸⁾

The World Bank estimates that global remittances — the transfer of funds across borders — to developing countries will reach US\$528 billion in 2018:⁽²⁹⁾ three times the amount of global official development assistance.⁽³⁰⁾ As such, many developing economies are highly reliant on remittances.⁽³¹⁾ Yet, globally, fees for remittances are on average 7.01% of the value sent.⁽³²⁾ This is far higher than the goal set by the United Nations of less than 3% (by 2030).⁽³³⁾ These problems persist despite the fact that demand for cross-border payments is growing. The number of cross-border payments increased by 36% between 2011 and 2016.⁽³⁴⁾ Fintech could help address these issues by providing alternative money transfer options at potentially lower costs, which would help generate efficiency and see more of the value of remittance reach end users.

2 Ensuring a resilient financial system

The Bank's mission is to promote the good of the people of the UK by maintaining monetary and financial stability. As such, it seeks to understand what fintech means for the stability of the financial system, the safety and soundness of financial firms, and our ability to perform our operational and regulatory roles (Figure 4).

Fintech and financial stability

As well as having the potential to bring significant benefits, fintech could also create new risks to financial stability and amplify existing ones. Some innovations may result in activity migrating outside of the banking and insurance sectors⁽³⁵⁾ — the Bank's current 'regulatory perimeter'. Many fintech business models have not yet been tested through a market downturn or change in the credit cycle, and may present unfamiliar liquidity and funding risks. Financial institutions are forming new types of relationships and dependencies with technology providers, which could change market structures and introduce outsourcing risks. For example, there would be a serious risk if the

(26) McKinsey & Company (2016), 'Global Payments 2016: Strong Fundamentals Despite Uncertain Times'.

(27) Bank of England (2018), 'Cross-border interbank payments and settlements: emerging opportunities for digital transformation'.

(28) About Faster Payments.

(29) World Bank (2018), 'Accelerated remittances growth to low and middle-income countries in 2018'.

(30) OECD (2019), Net ODA (indicator).

(31) Pew Research Center (2018), 'Remittances from abroad are major economic assets for some developing countries'.

(32) World Bank (2018), 'Remittance Prices Worldwide'.

(33) United Nations (2018), 'Transforming Our World: The 2030 Agenda for Sustainable Development'.

(34) Financial Stability Board (2017), 'FSB Correspondent Banking Data Report'.

(35) PwC (2017), 'UK financial services firms fear up to 40% of revenue at risk from FinTech'.

Box 2 Cryptoassets and financial stability

In March 2018, the Financial Policy Committee (FPC) assessed cryptoassets and determined they do not currently pose a material risk to UK financial stability.⁽¹⁾ In addition, the Financial Stability Board (FSB) has judged that cryptoassets do not currently pose risks to global financial stability.⁽²⁾ The FSB's assessment has also been endorsed by the G20.⁽³⁾

The FPC's analysis focused on the 'transmission channels' which could transmit risks from the cryptoasset market into the financial system and real economy. The FPC determined that, in the case of current cryptoassets, these transmission channels were not significant given that: (i) the use of cryptoassets in payments and settlement; (ii) the exposure of systemically important UK financial institutions to cryptoassets; and (iii) the links between cryptoasset markets and systemically important markets were all limited. However, the market, industry and technology are evolving rapidly and risks to financial stability could emerge in the future.

The FPC will act to ensure the core of the UK financial system remains resilient if links between cryptoassets and systemically important financial institutions or markets were to grow significantly. In the event that one or more cryptoassets were likely to become widely used for payments, or as an asset intended to store value, the FPC would require current financial stability standards to be applied to relevant payments and exchanges.

(1) Bank of England (2018), 'Financial Policy Committee Statement from its meeting — 12 March 2018'.
 (2) Financial Stability Board (2018), 'FSB Chair's letter to G20 Finance Ministers and Central Bank Governors'.
 (3) G20 (2018), 'Communique, Finance Ministers and Central Bank Governors'.

Figure 4 The Bank's approach to fintech



majority of banks relied on one technology provider, which then suffered from a cyber incident. New dependencies on infrastructure providers outside the regulated sector, including cloud computing, also require careful monitoring and management.

The Financial Policy Committee (FPC) is responsible for identifying, assessing and taking action in relation to financial stability risks across the UK financial system.⁽³⁶⁾ This includes ways in which the non-bank financial system, and fintech developments more generally, can affect financial stability.⁽³⁷⁾ The FPC may recommend changes to regulation, either via activities moving into the regulatory perimeter or adjusting requirements for firms that are already regulated.⁽³⁸⁾

Fintech can also help enhance financial stability by reducing financial frictions, fostering changes in market structure⁽³⁹⁾ and increasing efficiency in financial services. For example, machine learning could facilitate improvements in decision-making processes by improving the pricing, risk and credit models that financial institutions and investors use. Increased and better use of data has the potential to reduce information asymmetries, for instance increasing borrowing options for those with limited traditional credit history.

(36) Bank of England (2018), *Financial Stability Report*, November.
 (37) For example, the FPC analysed the implications of P2P lending in November 2018 and judged it was not likely to pose a threat to UK financial stability in the medium term. Therefore in light of this, the FPC agreed that it was not necessary to recommend any changes to regulation at this stage. Bank of England (2018), 'Record of the Financial Policy Committee meetings held on 20 and 27 November 2018'.
 (38) The Financial Services Act 2012 gives the FPC the power to make Recommendations to HM Treasury on regulated activities, as well as more general powers of Recommendation, including to the PRA and FCA; and gives the Bank information gathering powers.
 (39) Financial Stability Board (2017), 'Financial Stability Implications from FinTech'. See section on potential benefits for financial stability.

Box 3

New Bank Start-up Unit

The Bank's Prudential Regulation Authority (PRA) and the Financial Conduct Authority established the New Bank Start-up Unit (NBSU) in January 2016⁽¹⁾ to help prospective new banks through the early stages of authorisation, as well as provide a focused supervisory resource during their first year as a regulated firm.

New banks are important to delivering innovation in the UK financial services sector, particularly where there is an underserved demand in the market. This may be through the services they provide, the customers they serve, the products they sell or the technologies they use. The PRA has authorised 41 new banks since 2013, four of which have been digital-only banks.⁽²⁾

Following the success of the NBSU, the PRA launched the New Insurer Start-up Unit in 2018, which provides information and support for new firms that want to become insurers.

(1) Bank of England (2016), 'New Bank Start-up Unit launched by the financial regulators'.

(2) As of 6 March 2019.

Fintech and the safety and soundness of firms

The Bank's Prudential Regulation Authority (PRA)⁽⁴⁰⁾ pays close attention to the viability of the business models of the firms it supervises. Fintech innovations could be positive for those business models by introducing technologies that boost operational effectiveness and efficiency, allow them to reach new customers and offer better targeted and tailored products and services. However, fintech companies can also be competitors to existing financial firms and may seek to challenge their business models and compete for their customers. Competition is positive, but could have implications for the business models of some firms. Therefore, the PRA seeks to understand the impact on and strategic response of the banks and insurers it supervises to this competitive challenge.

For instance, the PRA runs regular horizon-scanning exercises and stress tests,⁽⁴¹⁾ which examine the potential impact of a hypothetical adverse scenario on the institutions that make up the banking system. In 2017, the Bank used an exploratory scenario⁽⁴²⁾ that considered the competitive challenge fintech might present, and in particular, how the launch of Open Banking may cause greater and faster disruption to banks' business models than their projections might indicate.

Fintech is also increasing third-party dependencies for regulated firms. In response, the PRA has continued to enhance its supervisory approach for operational resilience and outsourcing, including to cloud providers.⁽⁴³⁾ The PRA also evaluates whether firms and their boards, senior management and internal control functions have adequate knowledge, skills and resources to identify, assess, understand and manage risks relating to the adoption of technology, regardless of its type. Ensuring the strategic flexibility and operational resilience of PRA-regulated firms is an integral part of protecting and enhancing the stability of the UK financial system and its ability to adapt safely to structural change, including more and different types of competition.

Fintech and monetary stability

The Bank also has an objective to maintain monetary stability, defined as meeting a 2% inflation target. The Monetary Policy Committee does this by setting Bank Rate,⁽⁴⁴⁾ alongside other tools such as purchases of assets and providing term funding for banks. Bank Rate is the interest rate that the Bank pays to commercial banks that hold money in its reserves accounts. In turn, this then influences the rates those commercial banks charge people to borrow money or pay on their savings. This is part of what is known as the 'transmission mechanism' of monetary policy.

As with financial stability and the safety and soundness of firms, fintech has potential implications for monetary stability. Therefore, the Bank monitors fintech developments such as non-bank lending and cryptoassets to understand their potential impact on monetary policy. For example, the Bank's most recent assessment

(40) Bank of England (2018), 'The Prudential Regulation Authority's approach to banking supervision', October.

(41) Bank of England (2017), 'Stress testing the UK banking system: 2017 results', November.

(42) Bank of England (2017), 'Stress testing the UK banking system: 2017 results', November.

(43) Bank of England (2016), 'Outsourcing functions to the Cloud'.

(44) Bank of England, 'Interest rates and Bank Rate'.

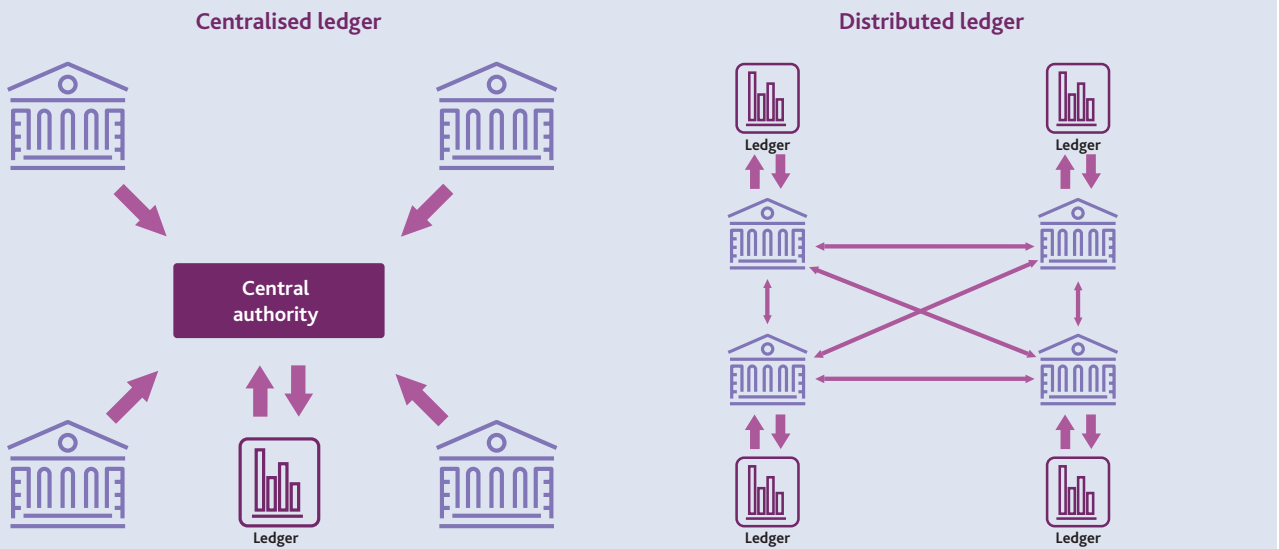
Box 4 Distributed Ledger Technology (DLT)

DLT enables the sharing and updating of records in a distributed and decentralised way (Figure A). In DLT-based systems, multiple participants can propose, validate, and record updates to a single synchronised ledger (a form of database), which is shared between the participants.

The current generation of DLT has its origins in the blockchain that underpins Bitcoin. However, there is no standard form of DLT, and the type of platforms being developed for financial services generally have a number of significant differences to the original blockchain platforms used by cryptoassets, such as restricting access considerably to a group of permissioned users, or a smaller subset of participants.

In the fullness of time, DLT may have the potential to reduce frictions in areas such as trade finance and cross-border payments.

Figure A Centralised and distributed ledger approaches



determined that cryptoassets and digital currencies do not pose a material risk to monetary stability in the UK.⁽⁴⁵⁾ Yet, in the long term, the Bank is monitoring how new innovations could conceivably influence the transmission of Bank Rate on savers and borrowers.

3 What is the Bank doing to support safe innovation?

It is essential that we undertake the right activities to support the safe and resilient deployment of fintech. This includes updating our hard and soft infrastructure for the next generation of innovation.

RTGS renewal programme

The Bank is responsible for a key piece of UK national infrastructure, the RTGS system. RTGS provides accounts for financial institutions and allows for money to be moved in real time between these accounts, delivering final and risk-free settlement.⁽⁴⁶⁾

As the provider of the ultimate sterling settlement asset, and the operator of the RTGS system, the Bank lies at the heart of the UK payments system. Most payments in the UK eventually pass through RTGS, and on average over £600 billion of payments and cash movements are settled by it each day — roughly equivalent to a third of UK gross domestic product.

(45) Ali, R, Barrdear, J, Clews, R and Southgate, J (2014), 'The economics of digital currencies', *Bank of England Quarterly Bulletin*, 2014 Q3.

(46) RTGS supports settlement in central bank money for CHAPS, CREST, Bacs, Cheque & Credit (including the Image Clearing System), Faster Payments (FPS), LINK and Visa. The Bank is also the operator for the CHAPS payment system.

Box 5

Frictions in cross-border payments

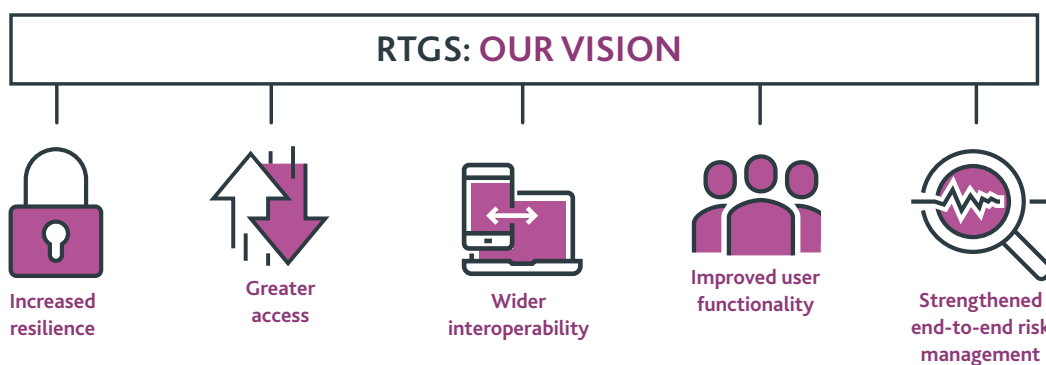
In 2018 the Bank collaborated with the Bank of Canada and Monetary Authority of Singapore to examine challenges in cross-border payments and settlements, and opportunities for technological innovation to help address some of these.⁽¹⁾

The work identified a number of root causes of frictions, such as mismatched operating hours, reliance on multiple intermediaries and a lack of consistent messaging standards across different jurisdictions. It also explored several models for addressing these frictions: including a consideration of current initiatives already under way in the industry; Real-Time Gross Settlement operators taking on a greater role as 'super correspondents' by opening accounts in different jurisdictions; and three variations of a wholesale central bank digital currency, potentially enabled via Distributed Ledger Technology. Each approach raised different considerations and dependencies, and the work represents an initial step in exploring these issues.

(1) Bank of England (2018), 'Cross-border interbank payments and settlements: emerging opportunities for digital transformation'.

The Bank is exploring the use of the latest technology to renew the RTGS system, in order to help reduce risks and increase innovation and competition in payments, as well as the financial sector more broadly. This means supporting a diverse range of settlement models,⁽⁴⁷⁾ including systems operating on innovative payment technologies, such as those built on DLT (**Figure 5**), although the new RTGS system will not itself be built with this technology. In addition to new settlement models, the Bank is exploring improved user-functionality, such as synchronisation,⁽⁴⁸⁾ which is the ability to synchronise cash movements in RTGS with movements in other ledgers. Renewing the RTGS system also provides an opportunity to move UK payment systems onto the ISO 20022 messaging standard alongside our international peers. Greater international harmonisation should make cross-border payments cheaper and faster. Payment messages will include richer, more structured data to enhance institutions' analytics, customer services and compliance activities.

Figure 5 The Bank's vision for the next generation of RTGS



Improving access to RTGS — non-bank payment service providers

In 2018, the Bank of England was the first G20 central bank to expand access to settlement accounts to appropriately regulated non-bank payment service providers (NBPSPs). This means NBPSPs can have direct access to the RTGS system for settling transactions. Increasing the number of parties able to hold accounts in RTGS can provide greater financial stability by lowering the credit exposures between direct and indirect participants and by settling more transactions in central bank money. Direct access also reduces the reliance of NBPSPs on agent banks to offer services to consumers; this in turn should boost innovation and support greater competition.

(47) Bank of England (2018), 'RTGS renewal proof of concept: supporting DLT settlement models'.

(48) Bank of England (2018), 'RTGS renewal programme call for interest: synchronised settlement'.

Box 6

Legal Entity Identifier

Legal Entity Identifiers (LEIs) are universal, unique 20-digit identifiers, allowing firms and regulators to clearly identify the legal structure of entities. The LEI is a leading example of a global data standard and contains critical information about a legal entity, such as where it is based and who owns it. This creates a 'single source of truth', enabling identification of parties across different systems, sectors and jurisdictions. Its adoption can improve transparency in the financial system and, ultimately, increase effectiveness of finance.

To support this initiative the Bank will make LEIs mandatory for all payments going between financial institutions in the new Real-Time Gross Settlement system. Risks will be reduced by allowing payments to be rerouted more effectively between systems, and by standardising and improving the data that supports fraud detection and financial crime.

Enabling dynamic soft infrastructure

The Bank also needs to ensure that its soft infrastructure — codes, rules and regulations — keep pace with the opportunities and risks posed by fintech. For example, the growth of data⁽⁴⁹⁾ and development of advanced analytics has led to an increase in algorithmic trading in recent years. In June 2018, the PRA issued a Policy Statement and Supervisory Statement regarding algorithmic trading, which addresses issues around the approval process, testing and deployment, inventory and documentation, and risk management.⁽⁵⁰⁾

Similarly, the increasing digitalisation of finance has opened up greater potential for cyber attacks. The average cost of cyber crime for financial services companies globally has increased by more than 40% in recent years, from US\$12 million per firm in 2014 to US\$18 million in 2017.⁽⁵¹⁾ In response, the Bank developed CBEST,⁽⁵²⁾ which provides direction on how to conduct a safe yet realistic simulated cyber attack on the people, processes and technology that comprise a firm's cyber security controls. It is also developing severe but plausible cyber stress tests to understand better firms' ability to respond and recover.

Common data standards

Data standards can enable new products, services and powerful networks that can better match savers and borrowers and produce more tailored products that meet the needs of users of finance. They can reduce financial stability risks by increasing transparency in markets and improving the Bank's ability to oversee risks in the system.⁽⁵³⁾ They can also boost the efficiency and effectiveness of finance by reducing processing and administration expenses and giving faster and more certain transactions, therein cutting costs and freeing liquidity and capital to be applied to more productive uses.

Best-in-class messaging standards are a crucial piece of soft infrastructure. The Bank is helping the UK economy to realise the benefits of common data standards by adopting a common global 'language' or messaging standard, known as ISO 20022.⁽⁵⁴⁾ The new RTGS system will mean not just moving to ISO 20022 messaging standards for payment data but also the creation of a Common Credit Message, shared with Pay UK's New Payments Architecture.⁽⁵⁵⁾ The co-ordinated adoption of a single standard across UK payment systems should benefit payment providers, as well as the businesses and households they serve.

(49) 2.5 quintillion bytes of data are created every day. See Alam, J R, Sajid, A, Talib, R and Niaz, M (2014), 'A review on the role of big data in business', *International Journal of Computer Science and Mobile Computing*, Vol. 3 No. 4.

(50) Bank of England (2018), 'Algorithmic trading', *Prudential Regulation Authority Policy Statement PS12/18*.

(51) Accenture (2018), 'Cybercrime Costs Financial-Services Sector More Than Any Other Industry'.

(52) Bank of England (2016), 'CBEST intelligence-led testing'.

(53) Ramsden, D (2018), 'Setting standards'.

(54) The Bank promotes standards like ISO20022 to help realising the promise of big data. In June this year we launched a consultation, together with the Payment Systems Regulator and Pay UK to adopt ISO20022 as a common global 'language', which includes a messaging standard, for payments in the UK. The standard will be adopted by the UK's three main interbank payment systems, CHAPS, Bacs and Faster Payments.

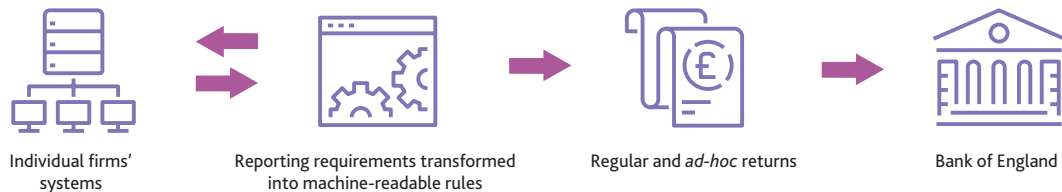
(55) Bank of England (2018), 'A global standard to modernise UK payments', *ISO 20022 Consultation Paper*.

4 Applying fintech to enhance the Bank's capabilities

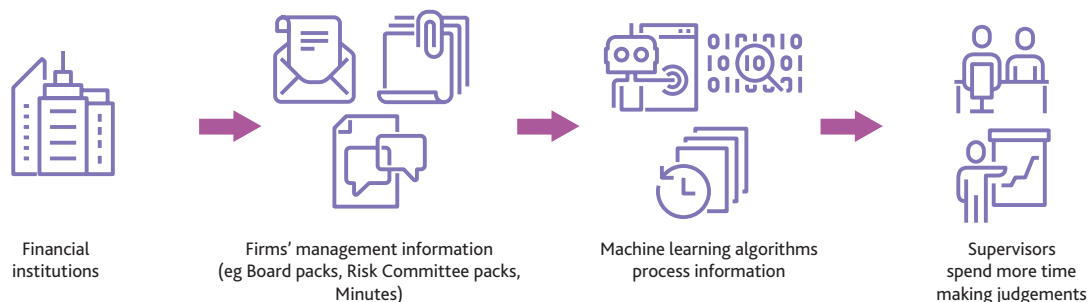
In addition to updating the Bank's hard and soft infrastructure to support the safe deployment of private sector innovation, it is considering how technology can enhance its own capabilities. Two examples of this are Regulatory Technology (regtech) and Supervisory Technology (suptech).⁽⁵⁶⁾ Regtech involves applying technology to help firms manage their compliance, risk management and regulatory obligations (eg better firm reporting), while suptech helps it apply new technology to support supervision and oversight (Figure 6).⁽⁵⁷⁾

Figure 6 Digital regulatory reporting and advanced analytics for supervision: examples of regtech and suptech

Digital regulatory reporting



Advanced analytics for supervision



One area of regtech that the Bank is exploring is digital regulatory reporting, which could yield a more efficient way of sending data to regulators. If some information requirements were machine readable, firms' systems could automatically read and relay them via a secure regulator-firm digital link. This could help firms reduce the cost of implementing regulatory processes and achieving compliance. The Bank has embarked on a series of pilots with the Financial Conduct Authority and a number of other organisations to explore the feasibility of a machine-executable regulatory reporting framework.⁽⁵⁸⁾

As well as routine regulatory reporting, firms also send large quantities of their own management information to regulators (such as board packs and risk committee minutes). The Bank has investigated whether machine learning, as an input, can assist supervisors to process this information, allowing them to spend more time on analysis and forward-looking judgement.⁽⁵⁹⁾ At a more fundamental level, it is investigating whether machine learning techniques can be used to spot anomalies in data that humans may miss due to unconscious bias or time constraints.

(56) Proudman, J (2018), 'Cyborg supervision — the application of advanced analytics in prudential supervision'.

(57) This includes using machine learning models to help improve how we communicate with firms. See Bholat, D, Brookes, J, Cai, C, Grundy, K and Lund, J (2017), 'Sending firm messages: text mining letters from PRA supervisors to banks and building societies they regulate', *Bank of England Staff Working Paper No. 688*.

(58) Financial Conduct Authority (2017), 'Digital Regulatory Reporting'.

(59) Chakraborty, C and Joseph, A (2017), 'Machine learning at central banks', *Bank of England Staff Working Paper No. 674*.

5 Conclusions and looking ahead

The implications of fintech as part of the wider shift to a digital economy are only beginning to be realised, but the potential is substantial. The pace and scale of private sector innovation continues to increase. To support innovation, the Bank must not only embrace fintech, but take tangible steps to enable new technology and empower providers in order to promote competition.

The Bank's role includes providing the right hard and soft public infrastructure required to maximise the benefits from fintech and encourage private sector innovation. In the coming years, the Bank will continue its ambitious rebuild of the RTGS system, including future-proofing it to interoperate with innovative business models and technologies and integrating best-in-class data standards. The Bank will support new entrants through the New Bank Start-up Unit, the New Insurer Start-up Unit and access to RTGS settlement accounts for NBPSPs. It will also continue to examine how the financial services landscape might evolve, and what this means for individuals, businesses and financial services providers.

Research on fintech will help the Bank understand better how it can support this evolving financial system, how it should design future policies and how it should use technology to enhance its capabilities. Part of upgrading its infrastructure involves exploring new technologies and the Bank will continue to undertake PoCs with fintech companies, as well as increase its work on regtech and suptech. Rules and regulations should also keep pace with innovation and mitigate potential risks, while preparing for future innovations.

By taking these steps, the Bank will continue to mitigate risks to monetary and financial stability as well as ensure that the UK financial system is resilient in light of the next generation of innovation.