BANK OF ENGLAND

Speech

The Bank of England's FinTech Accelerator: what have we done and what have we learned?

Remarks given by

Andrew Hauser, Executive Director, Banking, Payments and Financial Resilience

At a meeting for FinTech contacts of the Bank of England's Agency for the South East and East Anglia at the offices of Mills & Reeve, Cambridge

6 October 2017

I am grateful to Sharmista Appaya and the Financial Accelerator team for their help and assistance in preparing these remarks.

Introduction

It is a pleasure to be with you here in Cambridge to talk about the Bank of England's work on financial technology ('FinTech') – and to hear from you about the latest developments in your businesses.

It is sometimes said that the UK's thriving technology sector is all about London. But nothing could be further from the truth. Forty-four of the UK's 100 fastest-growing technology firms are based elsewhere in the country[1]. And some of the most exciting of all are right here in Cambridge – and speak regularly to our excellent local Bank of England Agency team, Phil Eckersley, Tim Pike and Alex Golledge.

In fact, I have first-hand knowledge of Cambridge's long and proud history of hi-tech innovation, having grown up only a short distance from here, at the height of the 1980s personal computer boom centred around Acorn and Sinclair. As a somewhat nerdy child, I attended an inspirational maths and computing club at Homerton College where we learned, amongst other things, how to do recursive coding using a robot turtle. We purloined one of the earliest Local Area Networks for our ramshackle school computer shed. And I had a holiday job at the Cambridge Science Park – right at the start of its astonishing growth story. I recall one particularly memorable experience working on a robot designed to extract the meat from shellfish: let's just say the results were messy!

FinTech and the Bank of England

Nearly three decades on, my current role in charge of the Bank's banking and payments infrastructure gives me a bird's eye view of how technology is transforming financial services. From the very visible application of the latest mobile technology in retail banking, to the much less visible but just as important application of cloud computing, cryptographic techniques and ultra-high speed processors to the wholesale and back office functions that keep the financial markets running.

Some say there is nothing fundamentally new here: technology has always played an important role in driving change in the financial sector: from the telegraph to the ATM (celebrating its fiftieth birthday this year); from screen-based trading to online banking. Harsher critics even suggest the very phrase 'FinTech' is little more than a marketing tool, promoting hype over substance. But this time is different, I believe, in four key ways:

- First, since the financial crisis, financial intermediaries have faced unprecedented pressures to reduce costs to ensure their business models can deliver the sorts of returns expected by investors. Some estimates put the necessary cost reductions as high as 35-40%[2]. Savings of that scale

[1] Sunday Times Hiscox Tech Track 100 league table 2017, available at: http://www.fasttrack.co.uk/league-tables/tech-track-100/
[2] McKinsey estimate of cost reduction required for UK and European banks to meet an 8% cost of capital: see http://www.mckinsey.com/industries/financial-services/our-insights/a-brave-new-world-for-global-banking.

require transformational, not incremental, change – and that inevitably involves technology.

- Second, technology has become much more easily and cheaply available in recent years, reducing entry costs sharply. Until surprisingly recently, standing up competitive financial services technology required access to expensive dedicated systems and communications links – something rarely if ever available to new entrants. Perhaps for that reason, key parts of the financial system have remained based on a patchwork of reliable, but sometimes startlingly old, hardware and software. The development of secure internet communications, service-based applications allowing firms to buy as much (or as little) support as they need, open-source code and other key pieces of infrastructure have changed all that, making it radically cheaper to build potentially transformational technologies whilst only incurring the marginal costs of doing so.

- Third, major advances in the services available to consumers of non-financial products have made them much more demanding of a similar consumer experience from banks and their peers. Younger consumers in particular now rely totally on their phones, and expect the same ease of use, choice and service integration they get from the so-called 'GAFA' (Google, Apple, Facebook and Amazon). Firms in Asia and elsewhere, such as Alipay and Tencent, unencumbered by legacy systems, have perhaps moved furthest and fastest in that direction.

- And, fourth, public authorities are putting more weight on competition, reflecting a frustration in some quarters with the pace of consumer-benefiting change, and a recognition that innovation and competition may actually boost, rather than harm, prudential stability, where it helps reduce single points of failure and replace operationally vulnerable legacy systems. In the UK, the Bank of England has a New Bank Start-up Unit and has recently broadened access to its Real-Time Gross Settlement service[3]; the government created a new Payments Systems Regulator, focused on competition, and is implementing Open Banking, itself the result of recommendations from the CMA; and the FCA has pioneered the use of a so-called 'regulatory sandbox' as part of its Project Innovate.

These are strong and persistent forces. The resulting technological change and innovation, though uncertain in timing, will have profound implications for the nature and range of financial services available to households and firms. Traditional distinctions between regulated and unregulated activities, retail and wholesale, on-shore and off-shore, will blur as conventional models of intermediation are progressively 'unbundled'. And new networks will emerge to change the way economic agents interact. Some of these developments will be positive. Some may not be. Either way, central banks cannot afford to stand on the sidelines if they are to continue to deliver their mission of monetary and financial stability.

[3] See http://www.bankofengland.co.uk/pra/nbsu/Pages/default.aspx and http://www.bankofengland.co.uk/publications/Pages/news/2017/048.aspx respectively.

Many of the most profound policy questions central banks will have to answer relate to financial stability. Would a financial system based around narrower, more specialist payments, lending or asset management entities be more or less safe than one based around universal banks? If banks themselves increasingly morph into utility providers, acting as platforms for others to sell their wares, what does that mean for the distribution of risks in the system? How does one judge the appropriate positioning of the regulatory perimeter to ensure that risks are appropriately overseen whilst allowing valuable innovation to flourish? Do financial intermediaries and market participants understand the operational and financial risks posed by new models of service provision, communications and technologies, and can they control them effectively? What does the introduction of ever-faster trading and banking systems, and the increasing use of algorithm-based trading and financial advice mean for market dynamics?

But FinTech also poses practical opportunities and challenges for central banks' own operations. Could countries with declining transactional cash usage[4] see the need to issue their own digital currencies? Could new technologies such as the distributed ledger help central banks' to improve the resilience and efficiency of their own payments and settlements infrastructure?[5] How do central banks protect their own operations from ever more sophisticated forms of cyber threat? And how do supervisors keep up with ever more detailed and high-frequency regulatory and market data reporting, and use it to make more informed and timely decisions?

The Bank of England has been a leading voice in these policy debates, and has produced, or contributed to, a wide range of speeches, policy reports and technical analysis[6]. But talk is not enough: true understanding also requires central banks to roll up their sleeves and get their hands dirty with the technology itself.

The Bank's FinTech accelerator: what is it?

That is why, in mid-2016, the Bank of England launched its FinTech accelerator project. We had two objectives in mind. First, to improve our familiarity with FinTech products, concepts and firms: their strengths and weaknesses, their implications for financial markets, and their potential applications in central bank operations. And, second, to give FinTech firms some insight into the emerging questions and needs central banks might have, as policymakers, regulators and operators.

[4] The urgency of this question depends heavily on individual countries' circumstances. In the United Kingdom, the demand for cash continues to rise. In Sweden, by contrast, the demand for cash has fallen sharply in recent years and the central bank is actively considering the costs and benefits of issuing its own 'e-krona': see for instance http://www.riksbank.se/en/Financial-stability/Payments/Does-Sweden-need-the-e-krona/.

[5] Similar themes were recently also highlighted by Christine Lagarde, Managing Director of the IMF, at the Bank of England's conference on monetary policy independence, 20 years on: https://www.imf.org/en/News/Articles/2017/09/28/sp092917-central-banking-and-fintech-a-brave-new-world.

[6] See for instance the Governor's speech in April 2017: http://www.bankofengland.co.uk/publications/Documents/speeches/2017/speech974.pdf, a compendium of the Bank's work on digital currencies: http://www.bankofengland.co.uk/research/Pages/onebank/cbdc.aspx, and the recent report by the Financial Stability Board: http://www.fsb.org/2017/06/financial-stability-implications-from-fintech/.

Now these clearly aren't the goals of traditional private sector accelerators, which aim to make money by helping nascent businesses refine the design of their products in ways likely to attract both investors and customers. We make no financial investment in the firms we work with. But we do I think share the underlying objective of 'accelerated mutual learning-by-doing'[7] – since central banks are likely to be key stakeholders for many forms of FinTech over the medium term, both in shaping the rules that bear on them, and as technology users.

TABLE 1 THE BANK AND PRIVATE SECTOR ACCELERATORS COMPARED[8]

	Private sector accelerators	Bank of England (BoE) accelerator
Purpose	To help ventures define and build initial products and identify consumers and investors	To work with innovative firms, helping them to understand the BoE's needs, and the BoE to understand the technology
Duration of firm engagement	3-6 months	1-3 months
Business model	Investment in successful firms (can also be non-profit)	Non-profit, no equity taken
Selection	Competitive, in cohorts	Competitive, in cohorts
Venture Stage	Early	Generally later stages
Programme	Structured programme similar for all firms in the cohort, culminating in a demo day	PoCs structured according to central bank use cases and success criteria. No comparison between firms
Resourcing and Mentorship	Primary resourcing from start-up staff but with support from mentors	Start-up staff work with BoE subject matter experts
Venture location	On-site	Mostly off-site

In other respects, the Bank's Accelerator operates in a similar way to traditional accelerators (Table 1). We undertake structured Proofs of Concept ('PoCs'), organised in cohorts to ensure appropriate resource allocation and focus. Firms are chosen through an open, competitive selection process on the basis of a well-defined central banking use case. They work closely with the Bank's subject matter experts for a time-limited period. And the results and key findings are published on the Bank's web pages, and factored

[7] See for instance Ian Hathaway's Brookings study of accelerator performance at https://www.brookings.edu/research/accelerating-growth-startup-accelerator-programs-in-the-united-states/.
[8] Framework adapted from Susan Cohen 'What Do Accelerators Do? – Insights from Incubators and Angels' innovations' (Innovations, volume 8, number 3/4, MIT Press).

into the Bank's future work programme. Firms we have worked with have been invited to join the Bank's FinTech community, which meets periodically to share insights and assess developments in the sector.

The Bank's FinTech Accelerator: what have we done?

The Accelerator has done quite a lot in a short time. In the 16 months since the Accelerator was established, it has completed 9 PoCs with 10 firms across three cohorts (Table 2). And we are announcing a further cohort of 4 PoCs today – the details of which I will come back to shortly. In total, some 200 firms have applied to work with us across a wide range of disciplines. The process is resource intensive for both sides. But our broader interactions with those firms, even those not successful in their application, have been of great value, allowing us to reach a much wider external audience keen to interact, collaborate, teach and learn with us.

The PoCs span most aspects of central banking, but can be grouped together into four broad technologies: distributed ledgers; data storage and analysis; machine learning; and cyber security. Let me discuss each in turn[9].

Distributed ledger technology (DLT) (3 PoCs)

DLT has in many respects been the poster-child for FinTech. Thrown into prominence by the advent of bitcoin and other cryptocurrencies, the attraction of DLT to central banks really lies in the potentially highly attractive resilience characteristics of the underlying technology. In its purest form, a DLT network operates with no centre, and every node in the network holds a full copy of the ledger. So the failure of a node has no impact on the overall resilience of the system, with transactions simply rerouting elsewhere. A single ledger could also eliminate the need for costly reconciliations between market participants, increasing efficiency and reducing operational risk. For central banks currently operating centralised payments and settlements systems with only limited redundancy and facing growing cyber and operational threats, such a model has obvious attractions.

Our first DLT PoC, undertaken with **PwC**, proved it was possible to build a multi-node scalable DLT environment enabling the transfer of ownership of a fictitious asset. But it also demonstrated that the technology was some way from being sufficiently robust or scaleable to form the core of live central bank infrastructure such as the Bank's Real-Time Gross Settlement (RTGS) service – a conclusion that helped inform the Bank's plans for its RTGS renewal programme. PoCs by other central banks have reached broadly similar conclusions[10].

[9] More detailed write-ups of completed PoCs can be found at: http://www.bankofengland.co.uk/Pages/fintech/default.aspx.
[10] See for instance the Bank of Canada's Project Jasper (http://www.bankofcanada.ca/research/digital-currencies-and-fintech/fintech-experiments-and-projects/), the Monetary Authority of Singapore's Project Ubin (http://www.mas.gov.sg/Singapore-Financial-Centre/Smart-Financial-Centre/Project-Ubin.aspx) and the European Central Bank and Bank of Japan's Project Stella (http://www.boj.or.jp/en/announcements/release_2017/rel170906a.htm/).

DLT-based systems may well reach critical mass in the private sector rather sooner however – and many firms and consortia have projects underway in this field. We want to ensure that the next generation of RTGS is able to support such systems, as and when they achieve sufficient market reach. With that in mind, our second DLT PoC explored the potential to use a DLT system, developed by **Ripple** using the open source Interledger protocol, to link two simulated but otherwise standard RTGS systems, built in the cloud, to enable cross-border payments to settle in central bank money simultaneously: a long-standing policy goal of central banks. This PoC was particularly helpful in identifying some of the operational and technical challenges of such synchronisation.

Our most recent DLT PoC, which we are announcing today will be done with **Chain**, is designed to examine a key tradeoff in DLT design. The highly desirable resilience characteristics of DLT require sharing data on the ledger across a number, or all, network participants. But a fully replicated ledger poses clear privacy issues, and may be vulnerable to a cyber attack on whichever is the weakest link. The PoC will examine the extent to which DLT based systems can be configured to enable privacy amongst participants, whilst keeping data on a shared ledger: one of the holy grails of DLT design.

RegTech: data storage and analysis (4 PoCs)

As central bankers, we have always needed to process, store and analyse data to inform our policy and operational responsibilities. But that need has grown enormously in recent years, reflecting the increased reporting requirements on supervised firms since the financial crisis, greater availability of high frequency and qualitative data from public and private sources, and new policy responsibilities (eg for macro-prudential supervision). Making sense of such large and diverse data sets is not straightforward. But central banks need to do so to discharge their responsibilities, whilst respecting increasingly demanding data protection requirements.

Of course regulated firms face a similar challenge marshalling all of these data in the first place – and a sub-branch of FinTech, sometimes known as 'RegTech', has grown up to facilitate the associated monitoring, compliance and reporting demands. More recently, that term has expanded to cover the use of similar technology on the regulatory side, and a good number of the Accelerator's PoCs have been in this space, looking either at data analysis or the more advanced field of machine learning.

Our first data analysis PoC, undertaken with **Privitar**, looked at ways to desensitise mortgage data collected by the Bank so they could be shared more widely and used alongside other more aggregated data to draw conclusions about developments in the financial system as a whole. Another PoC, with **Enforcd**, examined tools allowing the Bank's legal team to draw out common trends in publically available regulatory enforcement actions in order to inform their own work. The third PoC worked with **Experimentus ORB** to visualise the performance of internal Bank projects against a range of performance metrics. And our fourth PoC, which we are announcing today will be done with **NTT Data and Reportix**, will explore ways of storing,

organising and combining the Bank's regulatory and analytical data in a more flexible or 'multi-dimensional' way based on the XBRL standard, rather than the current 'form-centric' (or tabular) format. Although on the face of it a rather dry and technical issue, improving the storage of data in this way would allow us to make broader connections between data sets, help analyse and visualise trends in new and innovative ways, and make it faster and easier to implement new XRBRL-based taxonomies in the future, without having to reformat all of our databases.

RegTech: machine learning (4 PoCs)

Machine learning (and its close bed-fellow artificial intelligence) builds on the basic tools I have just summarised, but takes them a stage further, using algorithms to learn iteratively from data and drawing out potential patterns. In the near term, this could be used to complement and strengthen central bank analysis and supervisory activity. In the more distant future, it could do people like me out of a job! This is perhaps the most challenging and experimental area of FinTech in the Accelerator programme, and the results are therefore necessarily more speculative than in the other categories.

Our first PoC, conducted with **BMLL**, examined algorithms designed to analyse high resolution limit order book data from trading exchanges. The second used tools provided by **Mindbridge Analytics** to detect anomalies in anonymised regulatory data from credit unions. The PoC combined conventional data science techniques (including clustering and classification algorithms) with a feature allowing users to flag items as suspicious or safe, permitting the program to 'learn' from the user which items could be of potentially more interest and adjusting its risk scores accordingly. And a third PoC with the same firm, announced today, will look to expand these findings to larger and more diverse data sets, including transaction data, and a broader range of classification and machine learning algorithms. Our fourth and final PoC in this category, also announced today with **Digital Reasoning** will examine the extent to which analysis of the large quantities of weakly-structured textual data on regulated firms available from multiple public data sources can yield insights on intent and sentiment. The PoC will look at whether those insights are capable of complementing analysis of more formal data reporting.

Cyber security (2 PoCs)

The Bank, in common with other major financial institutions, spends a lot of time on cyber security – both for its own systems, and in terms of its requirements and expectations of regulated firms. Much of this takes place as part of the Bank's core work programme, but a number of more exploratory exercises have taken place through the Accelerator. In particular, we undertook a PoC with **BitSight** aimed at assessing the extent to which a firm's cyber resilience can be evaluated using publically available data. And we worked with **Anomali** and **ThreatConnect** to explore ways of consolidating threat intelligence into a format that can be used to optimise information collation, enrichment and sharing.

Non-PoC work of the FinTech Accelerator

In addition to enabling PoCs, the Accelerator team has also been able to leverage off the contacts and relationships made with firms and public authorities in the UK and overseas to provide a wider intelligence-gathering and horizon scanning function on FinTech to inform the Bank's policy and operational work. This has included convening topic-specific roundtables and seminars, supporting analytical and policy initiatives, and providing periodic updates on hot topics in the sector.

What have we learned? Some tentative conclusions

The work undertaken by the Accelerator has been of significant value, both for the Bank and, we believe, for the broader FinTech community.

For the Bank, we have gained first-hand experience of a range of new technologies, helping us to evaluate their application both to the Bank's own functions and in the wider market. Our work on DLT has helped us start to think through how the financial networks of the future may be able to operate in safer and more efficient ways, and how we can ensure they can continue to benefit from access to central bank money. Our work on data analysis has thrown light on how we can manage ever larger data sets to monitor the economy and the financial system in real time and draw out patterns that might help us set better policy or spot the next crisis coming before it happens. And our work on machine learning has helped us take the first baby steps towards engaging with that data in a more interactive way, putting computers alongside our staff to help them form the judgments on which monetary and financial stability depend.

Through the Accelerator and the Bank's broader Fintech work, we have made valuable connections with important parts of the financial and technology sector beyond the regulatory perimeter – relationships that could matter greatly in the years to come.

And those engagements with FinTech firms have also exposed central bankers to some very different ways of working and thinking: more agile, more willing to experiment, less bound by convention. Internal 'hackathons' run by our Technology department along similar lines, and aimed at identifying innovative solutions to Bank-specific problems, have been extraordinarily popular and have shown central banking officials to be capable of much more radical thinking than is sometimes supposed.

The firms we have worked with have also valued the experience, giving them insights on the wider application of their technologies, and the needs and thought patterns of regulators and policymakers. Our feedback has been honest: positive where that is due, but also highlighting challenges or gaps where they are evident. And our work has in turn been part of the broader effort by the UK authorities to support and guide the sector.

The latest wave of innovation in financial technology has shaken up traditional thinking about how to deliver financial services, defining the pace and shape of innovation in what has sometimes been quite a slow-moving industry technologically-speaking. And those four driving forces I mentioned at the start – the economic pressures on traditional business models, sharply-reduced technology barriers to entry, changing consumer preferences and pro-competition regulation – will only intensify the pace of change in the years ahead. So what are the challenges? I would pick out two[11]. First, customer acquisition is hard! Households and firms are loyal to their traditional suppliers: they will only switch if the offering is genuinely innovative, not just a good-looking piece of marketing. Similar considerations apply to central banking applications. Second, widespread adoption also requires attention to those two traditional characteristics of successful financial systems: scaleability and resilience. It is striking how much our conversations with leading firms have increasingly turned to these issues, even over the short period we have been running our Accelerator project. These topics are dear to central bankers' hearts, and will play a central role in shaping the next stage in our engagement with FinTech.

I look forward to our conversation today.

[11] For a similar perspective, see also the most recent World Economic Forum report on FinTech: https://www.weforum.org/reports/beyond-fintech-a-pragmatic-assessment-of-disruptive-potential-in-financial-services.

TABLE 2 BANK OF ENGLAND FINTECH ACCELERATOR PROOFS OF CONCEPT

Cohort	Project area	Company	PoC	Status
Cohort 1	Cybersecurity 	**BitSight**	We wanted to understand if we could get a view of a firm's cyber resilience based on publically available data.	Completed
	Data analysis 	**Privitar**	This PoC explored a tool to desensitise data with the aim of being able to share data more widely within the Bank.	Completed
	Distributed ledger techno 	**PwC**	We built a multi-node scalable distributed ledger environment in-house that enabled the transfer of ownership of a fictitious asset.	Completed
Cohort 2	Machine learning 	**BMLL**	Experimented with the alpha version of a machine-learning platform that used cloud computing to evaluate patterns in data from a number of trading exchanges.	Completed
	Cybersecurity 	**Anomali** **ThreatConnect**	Both firms were asked to create a searchable database where intelligence on cybersecurity threats could be optimised and stored. They helped enable the automation of what was a very labour intensive analysis process.	Completed
	Data analysis 	**Enforcd Limited**	In this PoC we wanted to understand the benefits in viewing publically available enforcement action from different perspectives and the high level trends.	Completed
Cohort 3	Machine learning 	**Mindbridge Analytics Inc**	The firm was asked to prove the value of their analytical tools for detecting anomalies in anonymised regulatory data collected from a sample of credit unions.	Completed
	Distributed ledger techno 	**Ripple**	This PoC explored the synchronisation of two different fiat currencies between two simulated RTGS systems built on the cloud. We wanted to understand the impacts on settlement risk, speed and the efficiency of cross-border payments.	Completed
	Data analysis	**Experimentus ORB**	We applied the firm's tool to historic projects to visualise how they had performed against a range of standard key performance indicators.	Completed
Cohort 4	Distributed ledger techno 	**Chain**	This PoC is intended to explore how distributed ledgers can be configured to enable privacy amongst participants whilst keeping data shared across a network.	In progress
	Data analysis	**Reportix and NTT Data**	This partnership of firms will investigate innovative storage solutions for regulatory reporting data. In particular, the processing and storage of XBRL based data to facilitate analysis and visualisation.	In progress
	Machine learning 	**Digital Reasoning**	In this PoC we want to understand the sentiment in a sample of publically available unstructured text data and how this might support the work of our supervisors.	In progress

	Machine learning 	**Mindbridge Analytics Inc**	This second phase PoC will examine the ability of the tool to analyse larger data sets and a broader range of classification schemes and learning algorithms.	In progress