Regulating Financial Services in an Era of Technological Disruption

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ABSTRACT

Financial regulators are challenged to respond to the innovation opportunities presented by financial technology (fintech). Current rules are not necessarily sufficient or effective to adequately regulate new business models and new products relating to innovations such as crypto assets or digital financial services. Regulators that fail to respond in a timely manner may drive innovation offshore and deprive their markets and consumers of appropriate, new services. To respond to new financial innovation, regulators have been establishing innovation hubs and regulatory sandboxes. Innovation hubs enable them to engage innovators more effectively. Sandboxes allow the products to be tested in a controlled environment and enable regulators to consider whether existing laws are appropriate to regulate such products and, if not, what measures may be required. Sandboxes are however resource intensive and they hold a number of risks. Financial regulators are, of course, not alone in having to address the regulatory challenges of innovation. This article therefore also considers other non-financial regulatory experiences of innovative products and services, namely automated vehicles; emissions trading in China; and Uber and its clones, to consider whether those experiences hold lessons for financial regulators.

Keywords – Fintech, Regulation, Innovation, Regulatory sandbox, Innovation hub

Acknowledgements. The authors would like to thank Steven Rogers for his research assistance, which was financed by a grant from La Trobe Law School.

Disclosure statement – No potential conflict of interest was reported by the author.

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Suggested citation: De Koker, L, Morris, N. and Jaffer, S. 2019. “Regulating Financial Services in an Era of Technological Disruption.” Law in Context, 36 (2): 90-112. DOI: https://doi.org/10.26826/law-in-context.v36i2.98

Summary

1. The challenge for regulators
2. Financial innovation – fintech, regtech and suptech
3. Benefits for remote, regional and rural poor
4. Managing innovation
5. “Test-and-learn” approaches
6. Benefits and risks associated with sandboxes
7. Other experimental cases
   7.1 Autonomous vehicles
   7.2 Uber
   7.3 China’s emissions trading pilot schemes
8. Lessons for the regulation of innovation
9. Conclusions
10. References
1. THE CHALLENGE FOR REGULATORS

Established regulatory systems have evolved to meet the challenges of the past, but are struggling to deal with current demands (Royal Commission into Misconduct in the Banking, Superannuation and Financial Services 2018 p. 291), and are likely to be quite ineffective in the future unless they adopt new approaches (di Castri and Plaitakis 2017, p. 5). All regulated markets now face a bewildering array of technological “disruptors” – new ways of doing business which pose significant challenges for those who seek to regulate complex industries. Unless these disruptors and their implications are understood, and appropriate legal and regulatory actions taken, regulation may become increasingly ineffective and innovation may be stifled (Deloitte Centre for Regulatory Strategy 2018). There are associated dangers that those with superior knowledge or technology, unchecked, will take advantage of the most vulnerable in society or may gain a market stranglehold that undermines competition (Mazer and Rowan 2016).

All industries, including financial services, benefit from innovation and the introduction of new products and processes. An innovation becomes disruptive when it challenges well-established companies and ways of doing things: for example, emails eventually replaced fax machines. The range of potential disruption is wide, with new service models and products arising from enhanced data analytics, increased global – and mobile – connectivity, cloud-based computing, the “internet of things” (IoT), advanced robotics, and digital identification. These in turn feed increased online commerce, big data (Casanovas et al 2017), artificial intelligence technologies and autonomous vehicles, among others. Although many disruptors primarily affect non-financial industries, it is worth examining the lessons that experiences in non-financial sectors bring for the financial sector. Globally, financial regulators are challenged to respond to the opportunities and risks of innovative, technology-rich financial services, products and business models (so-called “fintech”) as well as the opportunities to embrace regtech (regulatory technologies) and especially “suptech” (technology that can support supervisory functions). Disruptors in the financial sector includes high frequency trading, digital payments (CGAP 2019), peer-to-peer lending (P2P), robo-advice, distributed ledger technology such as Blockchain, virtual assets such as Bitcoin and related developments such as Facebook’s proposed Libra (Libra 2019). These disruptions are set to expand well beyond the scope of current disruptors (World Economic Forum 2017).

These new technologies promise to reshape the financial services market and potentially systemic regulatory approaches and regulatory structures too (Omarova, 2019). Appropriate regulatory measures are required to respond to the innovation that such technologies can bring to the market. All of these come with advantages but also risks that require a considered and effective regulatory response, as well as a measure of flexibility to respond to unforeseen risks and consequences. Regulators are challenged to determine whether the existing rules fit a proposed fintech product, service or model and, if not, how best to design appropriate rules, given that it has not been observed or experienced in the market. Simply waiting for more innovative foreign regulators to take the lead is not attractive, as it may undermine innovation and the competitiveness of the local market players.

This article provides a brief overview of the fintech developments and the regulatory responses to support innovation, in particular the introduction of regulatory sandboxes (Policy Interns 2018). Sandboxes serve as an effective way to promote innovation whilst still protecting consumers, promoting inclusion, and ensuring stability (Cambridge Centre for Alternative Finance 2018, p. 9; di Castri and Plaitakis 2017, p. 2; Financial Stability Board 2019a). These are defined by the United Kingdom’s Financial Conduct Authority as “a ‘safe space’ in which businesses can test innovative products, services, business models and delivery mechanisms without immediately incurring all the normal regulatory consequences of engaging in the activity in question” (FCA 2015a). However, regulatory sandboxes create further risks and, as they are still relatively new, it is not yet clear how good they are at mitigating those risks.

Financial regulators are, of course, not alone in having to address the regulatory challenges of innovation. This article therefore also considers other non-financial regulatory experiences of innovative products and services, namely automated vehicles; emissions trading in
China; and Uber and its clones, to consider whether those experiences hold lessons for financial regulators.

2. FINANCIAL INNOVATION – FINTECH, REGTECH AND SUPTECH

A range of technological, socio-technological and policy developments have, since the turn of the millennium, spurred transformative developments in the delivery and management of financial services, and informed increasing disintermediation in financial services (Lin 2015; Cai 2018; Frost, 2020; Ehrentraud, et al, 2020). These in turn require changes in regulatory and supervisory approaches. Pervasive digital connectivity, especially via mobile phones, has enabled a move towards branchless banking (Staschen and Dermish 2014). Cloud computing is supporting enhanced information technologies of providers, while big data and enhanced analytics are shaping new and more personal services to customers (World Economic Forum 2017). These trends will deepen with the adoption of artificial intelligence (AI) technologies, especially when supported by the IoT. In addition, distributed ledger technologies and increased commercial usage of data derived from biometric national identification systems will accelerate the impact of technology on financial services.

The new levels of connectivity have not only enabled providers to reach new customers and offer different services. They also facilitated the introduction of new business models. For example, banks are not able to offer mobile banking services without using mobile network provider services. In the mid 2000s already some mobile network providers had been allowed to start offering such services in their own right, with banks playing a minor role safeguarding customer funds (Lyman, Pickens and Porteous 2008, p.3; Chatain et al 2011, p. 11). Unbundling and fragmentation of banking services have also become evident as more specialised new providers have challenged the vertically integrated banking model of the 20th century (Haering 2019; Accenture 2019).

Broader digital connectivity spurred the rise of social media and the development of giant ecommerce and social media platforms. Chinese super-platforms like Alibaba and TenCent are offering competitive financial services, and American super-platforms like Apple, Google, Facebook and Amazon are also investing in new payment services and methods (Rai 2019; Baxi 2019; FIBR 2017).

The past ten years have also seen the emergence of crypto currencies or digital assets. While these have not yet been able to retain their market value, many developers are excited about the transformative potential of the distributed ledger technology that underpins these currencies. Central banks are researching the possibility of issuing central bank digital currencies (Committee on Payments and Market Infrastructure 2018), China has adopted a framework for such a currency (Xiao and Wibawa 2019), and regulatory interests in stablecoins are sharpening (Financial Stability Board 2019; FAFT 2019).

Digital services operate in a data rich environment, leading to the emergence of more tailored services for customers. These services typically analyse data such as customers' prepaid mobile phone usage to enable the provision of microcredit to consumers who do not have formal credit records, see for example CGAP (2018). Super-platforms have vast data holdings and, combined with big data analytics, may be able to provide targeted, personalised services to an extent never seen before. With increased concerns about cyber security and privacy, this has been a particular concern in relation to Facebook's Libra digital currency project (Libra 2019; Office of the Australian Information Commissioner 2019).

Important developments have also taken place in the monitoring of regulatory compliance by providers of fintech and existing services. These services, called "regtech", improve for example the performance of customer due diligence and risk assessments, and also support transaction monitoring. Technology is also enabling important "suptech" developments¹. Suptech includes new technologies that enable financial supervisors to supervise existing services as well as fintech. Suptech can allow

¹ For suggestions regarding a clearer definition of suptech, see deCastri, Hohl, Kulenkampff and Prenio (2019). They define suptech as the use of innovative technology by financial authorities to support their work. For the purposes of their paper, they use the term “innovative technology” to refer to the application of big data or AI tools used by financial authorities.
supervisory bodies to collect and analyse more provider and other data faster and more accurately, enabling them to intervene faster when compliance failures occur or risk rises to unacceptable levels (Broeders and Prenio 2018; El Hassan 2015).

3. BENEFITS FOR REMOTE, REGIONAL AND RURAL POOR

The new era of mobile connectivity has supported the ecommerce market and provided new ways of reaching the remote, regional and rural poor with financial and information services (Mbise et al 2018; Alliance for Financial Inclusion 2018; UN Department of Economic and Social Affairs 2020, p.74). The development in technology also informed policy changes, with policymakers embracing digital inclusion policies and digitally-driven delivery of services to combat poverty and support sustainable growth. Financial inclusion policies – aimed at providing the poor with an appropriate range of formal financial services – derived particular benefit from mobile phone penetration (GPFI 2016). In 2017 the GSMA estimated that more than 500 million mobile banking accounts have been opened.2

While mobile phones were initially aimed at higher end users in developed economies, they have proved surprisingly important to users in developing countries. The number of mobile subscribers passed the number of fixed lines in Africa in 2001 and by 2004 9.1% of Africans were subscribers (Gray 2006). By 2005 the mobile industry had driven the wholesale cost of mobile phones to below USD 30 per handset, making them far more accessible to poorer users (Telenor Group 2005). By 2017 African subscription had increased to 44% (444 million) (GSMA 2018b, p. 9). The growth in the Asia Pacific region was even more spectacular. At the end of 2017, there were 2.7 billion unique subscribers in this region, accounting for two thirds of the region’s population (GSMA 2018a, p. 2).

While this usage increased telecommunications linkages, the increased use of smartphones also deepened digital connectivity (Mumbere 2018; GSMA 2018c p.8).3 According the ITU, an estimated 3.5 billion people were accessing the internet in 2016, of which 2.5 billion people were from developing world markets (ITU 2016).

However, it is important not to regard this increased connectivity and financial inclusion as a panacea for the problem of rural poverty. As highlighted in a recent Expert Group Meeting on eradicating rural poverty:

Complex challenges such as those facing the rural poor cannot be addressed by a single technology, actor or coalition. (Hansen 2019, p. 5)

4. MANAGING INNOVATION

To respond appropriately to fintech, regulators and supervisors have had to change some of their approaches. Traditionally they limited their engagement with the financial industry. They were largely reactive, responding to license and product applications and overseeing compliance with laws and licensing or registration conditions. Extensive overhauls of regulatory frameworks were often in response to a crisis, sometimes informed by the findings of a Commission of Inquiry (Masciandaro and Quintyn 2013). These are not ideal approaches in relation to new technologies that require a nimble, proactive approach.

Understanding the technology and new business models and shaping these to fit national financial policies require a greater degree of interaction with the industry than was the norm in the past. Leading regulators therefore created innovation programs or hubs to build the required agency capacity to engage the industry. Regulatory frameworks, policy and flexible supervisory approaches were adopted to enable the domestic financial industry, city, region or country to become a leader, attracting more fintech providers, or simply to provide an improved regulatory environment that would foster innovation.4

An early innovation framework, Project Catalyst, was created by the US Consumer Financial Protection Bureau in 2012 to promote consumer-friendly innovation in the marketplace. This initiative – a then novel concept for a

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2 Not all these advances have the desired traction. The GSMA reported also that only 170 million of those accounts were in active use. See GSMA (2017b).

3 The GSMA estimated in 2017 that 4 billion smartphones were in use (GSMA 2017, p.8). As a result of limited coverage in some countries and regions, not all smartphones would provide a user with full functionality or internet access.

4 See for example Chan (2016) par 19; Zetzsche et al (2017); NSW Government (ND); de Waal et al (2019).
banking regulator - aimed to establish communication channels with a diverse group of stakeholders; develop programs and policies that support consumer-friendly innovation; enable pilot projects through regulator waivers; and engage in research collaborations (Bureau of Consumer Financial Protection 2016; McHenry 2017).

In 2014 the UK’s Financial Conduct Authority (FCA) took an important leading role, first launching its consultative “Project Innovate” (FCA 2014, p. 4) and then establishing an innovation hub. A regulatory innovation hub is a dedicated point of contact for firms to raise enquiries with the regulator about fintech-related issues and to seek non-binding guidance on the conformity of innovative financial products, financial services or business models with licensing or registration requirements and regulatory and supervisory expectations (European Supervisory Authorities, 2019, p. 5). The hub enabled new and established businesses to introduce innovative Fintech services that complied with regulatory requirements and met the expectations of consumers (el Hassan 2015; FCA 2015b). In essence it spearheaded the FCA’s fintech outreach, providing a means of research as well as regulatory experimentation and exploration in the form of a sandbox (discussed below). The Australian Securities and Investments Commission (ASIC) launched its own innovation hub in March 2015 to assist fintech businesses to navigate the regulatory system “without compromising investor and financial consumer trust and confidence (ASIC 2017, p. 4). A range of other regulators have followed suit.

The domestic focus of these hubs soon proved limiting for businesses that wanted to operate across borders. In 2016, therefore, the FCA and ASIC signed a cooperation agreement to facilitate the development of fintech providers and eliminate some of the entry barriers to both markets (Patterson 2016). This was followed in 2018 by an enhanced cooperation agreement for fintech innovation, agreeing to expedite licensing for fintech businesses already licensed by the other regulator and collaborating on research, experimentation and joint policy work (Finance Magnates 2018). These bilateral agreements foreshadowed the establishment of a more global and multilateral regulatory sandbox, discussed below.

Regulators have also been taking a more proactive approach to solving problems in the market and to developing appropriate regtech and suptech. The FCA for example launched the first of a number of “techsprints” in April 2016 (FCA 2016). In practice, these techsprints (also called codeathons or sometimes hackathons) are events where innovators are invited to work competitively to formulate the best solution to a set problem, usually with access to data and information that is not generally available to the market. Winners receive support to develop their idea further, ideally for commercialisation.

These events have proved valuable and the need to move beyond domestic borders was again soon evident. AUSTRAC, Australia’s anti-money laundering and counter terrorist financing (AML/CFT) regulator, joined with Bank Negara Malaysia, the central bank and AML/CFT regulator of Malaysia, to host the first International Financial Intelligence Unit Codeathon at the Counter-Terrorism Financing (CTF) Summit in Malaysia in November 2017 (AUSTRAC 2017a). The event brought together 69 participants from 11 different countries who worked to solve the specific challenges. The following year AUSTRAC hosted the 2018 ASEAN-Australia Codeathon in Sydney (AUSTRAC 2017b). At this event teams worked to solve specific challenges such as “Applying blockchain technologies to improve financial services, AML compliance or secure intelligence sharing” (AUSTRAC 2018). In June 2019 the CFA hosted the 2019 Global AML and Financial Crime TechSprint that took place simultaneously in London and Washington DC. Innovation is borderless and these developments reflect the need to engage broader than domestic borders (FCA 2019a).

5. “TEST-AND-LEARN” APPROACHES

Fintech innovation often moves beyond current laws and regulation. The law and rule-making process is generally informed by past practices and experiences. Current rules are therefore generally not sufficiently flexible to appropriately regulate products and features that have not

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5 The Bank for International Settlements (BIS) has signed operational agreements to set up innovation hubs in Hong Kong SAR, see BIS (2019) and Monetary Authority of Singapore (2019). See also (Central Bank of Ireland 2018) aal et al (2019).
been seen or experienced before. In a heavily regulated field such as finance there are legal, financial, operational, or physical burdens that may discourage or prevent new entrants, new ideas, and new technology from entering the field (Jenik 2018 pp. 1 – 2; Shroff 2018). The regulatory burden placed upon entrants weigh particularly heavily on small business and start-ups that often lack the resources to comprehensively and confidently comply with all regulatory obligations from the start (di Castri and Plaitakis 2017, pp. 4-5).

Regulators have therefore embraced “test and learn” approaches to provide an opportunity to pilot a new service or product under certain conditions, in order to observe, learn and inform a sound regulatory approach (Zetsche et al 2017). An important example of a bold regulatory response can be found in the response of the Central Bank of Kenya (CBK) to the 2007 proposal to launch mobile money services in Kenya. In 2007 Safaricom, Kenya’s largest mobile network operator and part of the Vodafone Group, approached the CBK for approval to launch M-PESA, a new mobile money service, nationally. Safaricom teamed up with Kenya’s Commercial Bank of Africa (CBA) to enable this offering but with the bank performing essentially only a deposit-taking function (Muthiora 2015) and with Safaricom being the main provider of the mobile money financial service. Two years earlier Safaricom launched a small pilot, involving eight agents and about 500 clients (Hughes and Lonie 2007, p. 74).

While the pilot provided a good indication of the basic operation of the mobile money, agent behavior and consumer responses, it was a very limited study for policymakers interested in what the implications would be for consumers and for financial policy objectives if it operated at a national level. Controversially it also allowed a mobile network operator to play a leading role in the provision of bank services, despite not holding a bank license (Muthiora 2015, p. 9). Notwithstanding these concerns, CBK agreed to issue a letter of no objection to allow mobile money to be offered, in order to observe it in the market place to inform later regulation. M-PESA has proved spectacularly successful, transforming the Kenyan economy and turning Kenya into a global trendsetter in mobile money. In October 2018, for example, there were more than 45 million mobile money accounts and 200,000 agents in Kenya, processing more than a 150 million transactions to the value of more than Ksh 343 billion per month (approximately USD 3.37 billion) (Central Bank of Kenya 2019). Informed by actual experiences, Kenya was able to draft and adopt an enabling Act, the National Payment Systems Act 39 of 2011, followed by National Payment System Regulations in 2014 (Muthiora 2015, p. 19).

The US Consumer Financial Protection Bureau (CFPB)’s Project Catalyst also adopted a policy of issuing no-action letters providing applicants with a measure of comfort that no enforcement action will be taken to enable innovations to be tested (CFPB 2016, p. 16), but its approach was criticized in 2017 (McHenry 2017):

*When it comes to Project Catalyst’s no-action letter policy, the CFPB has become at worst a punch line, and at best a cautionary tale. The CFPB’s no-action letters are non-enforceable and non-transferrable, and they can be revoked at any time. It is little wonder that a total of zero no-action letters have been granted since the policy was announced last year. In short, the program has been a flop.*

In 2019 the CFPB adopted changes to its no-action letter policy to provide an improved response to the extent of innovation occurring in markets for consumer financial products and services (CFPB 2019).

Regulatory sandboxes have therefore emerged as a major regulatory tool to enable responsible and compliant fintech innovation. ‘sandboxing’ is a widely used technical term in information technology, where it refers to a testing environment that isolates untested, unsafe code to enable experimentation and improvement without impacting on any other running code or operating system. Fintech innovation has given rise to a similar need for regulatory testing and observation of new products or models in a controlled environment before deciding whether they could be licensed for broader release and, if so, under what conditions. A controlled environment also provides the regulator with an opportunity to consider whether and, if so, how the law should be amended to allow for the general release of similar products.

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6 See for example Prevelakis and Spinellis (2001) and Keahey et al (2004).
The FCA devised the first testing framework called a "regulatory sandbox" in 2015 (Jenik and Lauer 2017, p. 1; FCA 2015b; Truby 2018). Jenik and Lauer define a regulatory sandbox as "a framework set up by a financial sector regulator to allow small scale, live testing of innovations by private firms in a controlled environment (operating under a special exemption, allowance, or other limited, time-bound exception) under the regulator’s supervision (Jenik and Lauer 2017, p. 1)." The precise differences between general “test and learn” environments and “sandboxes” are however not always perfectly clear.

As the Toronto Centre (Toronto Centre 2017, p. 4) puts it:

*There is no standard definition of what are regulatory sandboxes. Their stated objectives vary, and can include: i) enabling innovation; ii) encouraging innovation; iii) improving the regulatory framework; iv) improving licensing procedures; iv) informing policymaking; v) being a channel for engagement with FinTech firms; and vi) contributing to economic growth. These objectives can be interrelated and overlapping.*

Regulatory sandboxes have one defining characteristic: the establishment, by a financial authority, of a formal and structured mechanism to receive applications by innovators to work with the authority to test innovative products, services or business models, before they are launched commercially.

The FCA opened its regulatory sandbox to the first cohort of applicants in 2016. Operating in the FCA sandbox provides firms with a range of advantages, for example, access to guidance regarding regulatory compliance, and obtaining waivers or ‘no enforcement’ letters in relation to certain FCA rules that are not appropriate or unduly burdensome to the specific product or innovation. By 2018, 89 companies had been accepted to test their products and services in the FCA sandbox while indications are that participating companies believe their participation delivered real value (Deloitte 2018; Tefaye 2018).

New forms of financial services leverage many new technologies, which often emerge from smaller, innovative companies. If the regulatory burden is reduced for small business and start-ups, then it can encourage increased competition and the creation of new products (Duff 2017, p. 3). Increased competition can allow for the creation of new and better products as industry must respond to competitive market forces (di Castri and Plaitakis 2017, p. 3). Similarly, the introduction of new entrants to the market place will allow for products that cater to new and niche markets that may have been previously untapped, which promote financial inclusion (Jenik and Lauer 2017, p. 5; Jenik 2018, p. 2). Both will bring direct benefits to consumers in the forms of better targeted, advanced, or new services and technologies (Thomas 2018, p.2 80; Huertas 2018, p. 55).

Sandboxes are a mechanism that provides flexibility to regulators and industry by creating a safe environment to test technologies in real world conditions, providing valuable information to industry (Baker McKenzie 2017, p. 4). The information gained from sandboxes is not only useful for industry, but also provide regulators with insight and understanding of new fields of technology. The testing environment provides them an opportunity to identify key questions that may arise in relation to the innovations and how best to ensure stability, consumer protection and integrity (Cambridge Centre for Alternative Finance 2018, p. 7).

The regulatory sandbox concept in different forms is spreading to a growing number of countries. In their 2017 study Jenik and Lauer found that many regulatory sandboxes follow the FCA blueprint but differ in relation to the following design elements (Jenik and Lauer 2017, p. 3):

i. **Objectives of the sandbox** (often determined by the regulator’s mandate and commonly including promoting competition and efficiencies in the fintech market and industry)

ii. **Eligibility to apply to the sandbox** (for example whether only current licensed providers or new start-ups, or both, are allowed to apply)

iii. **Conditions** (specified in the sandbox framework) for example regarding risk mitigation requirements and general restriction that apply to the product or services in the testing phase)

iv. **Timing for applicants and sandbox entities tests** (i.e. readiness for and duration of the test phase).

v. **Costs implications to the regulator and the sandbox entities** (for example, whether the regulator carries the cost of the sandbox and associated tests); and
6. BENEFITS AND RISKS ASSOCIATED WITH SANDBOXES

Regulatory sandboxes may hold a range of benefits and risks. It is still too early to judge to what extent these views and concerns may prove correct.

Sandboxes can, for example, enable regulators to assess and improve the policy and regulatory framework through testing and observation. Sandbox participants benefit from communication with the regulators and also from clearer and streamlined authorisation processes and reduced regulatory uncertainty. Consumers also benefit from improved, tested products and policies (Zetzsche et al 2017, pp. 78-79; Jenik and Lauer 2017, p. 4; FCA 2019c; UNSGSA FinTech Working Group and CCAF 2019, p. 30; Buckley et al 2017, pp. 16-22). While traditional test-and-learn options are typically one-on-one models that do not necessarily scale easily to large groups, sandboxes may be able to assist a broader group of innovators.

Some of the benefits associated with sandboxes may, however, follow from the general innovation support provided by regulatory authorities, rather than the sandbox itself. Innovations hubs and hotlines that can answer the regulatory questions of start-ups may address many of the core needs of innovators (FSD Kenya 2018; UNSGSA FinTech Working Group and CCAF 2019, p. 31; Centre for Alternative Finance 2017). Innovation hubs also provide a valuable and cost-effective way of helping bigger groups of innovators understand how the current law applies to their innovation (Buckley et al 2019). However, they do not necessarily reflect on what the law should be, or assist regulators in developing appropriate regulations.

Buckley et al. have argued that innovation hubs and regulatory sandboxes are aligned but note that hubs are less resource intensive and may, for example, by clarifying how regulation applies to the new product or by issuing an appropriate regulatory exemption, be sufficient to support many innovations. Consultation processes can reduce the need to correct misunderstanding: for example, the UK’s Financial Conduct Authority has had some success with consultation over Fintech 3.0, and created an innovation hub to support start-ups (Buckley et al. 2019, p. 26-27). They also argue that innovation hubs avoid “most downsides of regulatory sandboxes”.

vi. Regulatory actions following the sandbox (what the potential outcomes may be for example full or conditional approval to proceed to market; changes in regulatory rules, etc).

Some sandboxes are more focused on product testing while others prioritize policy testing (UNSGSA FinTech Working Group and CCAF 2019, p. 27). Thematic sandboxes have also emerged, where regulators focus on a specific type of participant (for instance small and medium enterprises) or on participants that advance a specific objective (such as financial inclusion) or that use specific new technologies. While most are domestic, multi-jurisdictional sandboxes are also increasing (ASIC 2019; Reserve Bank of Fiji 2019; UNSGSA FinTech Working Group and CCAF 2019, pp. 27-28).

Over the past few years regulators with sandboxes have been signing bilateral agreements to assist firms that wanted to operate in more than one market (FCA 2018a). In February 2018 the FCA suggested the creation of a “global sandbox” (FCA 2018a, p. 4). Building on that proposal the FCA, in August 2017 in collaboration with 11 financial regulators and related organisations, launched a global consultation regarding the creation of a Global Financial Innovation Network (GFiN) (FCA 2018b). GFiN itself was formally launched in January 2019 by an international group of financial regulators and related organisations (ASIC 2019). By June 2019 GFiN’s membership had grown to 35 financial services regulators with 7 observers, including the IMF and the World Bank Group (GFiN 2019). It was also working with 8 applicants chosen from 44 initial applications to develop testing plans with the relevant regulators for their cross-border trials (FCA 2019b). Meanwhile the Pacific Islands Regional Initiative (PIRI) and the Alliance for Financial Inclusion (AFI), are working towards the development of a regional regulatory sandbox, earmarked to be the first multi-jurisdictional regulatory sandbox (Reserve Bank of Fiji 2019). By September 2019, Buckley, et al identified more than 50 sandbox initiatives that were announced or launched (Buckley et al 2019).
including that they “could lead to a race-to-the-bottom style competition” (Buckley et al. 2019, p. 21). But the question as to how best to inform the shape of the law to respond to innovation remains: addressing this is the role of a regulatory sandbox.

Moreover having a sandbox or committing to one performs an important signalling function, reflecting to the market that the regulator is prepared to actively embrace innovation and to learn about it in a collaborative environment (Jenik and Lauer 2017, p. 4).

Weschler, Perlman and Gurung argue that regulatory sandboxes have a particularly useful role in developing countries. They suggest that the establishment of “thematic regulatory sandboxes which focus on specific national financial and developmental priorities - such as remittances - rather than spanning multiple national agendas may be preferred as a more efficient use of scarce resources” (Weschler et al 2018).

There are also dangers and risks involved in their use. These dangers may harm consumers, financial markets, and industry when regulatory failure occurs or where oversight over a sandbox is inadequate (Zetzsche et al 2017, pp.79-81; Cambridge Centre for Alternative Finance 2018, p.18).

Sandboxes provide a short-term and limited piloting of a new product, service or model. This may not be sufficient to identify all the major impacts it brings. If the pilot is not designed or managed appropriately, consumers, the provider; the industry and even financial markets may be negatively impacted when it is released into the market. The regulator and the other products that were part of the sandbox may also sustain reputational damage in the event of a post-sandbox failure of a tested product, service or model.

The success of a sandbox system is also highly reliant on the skills, information, knowledge and integrity of regulators. Capacity and resources to manage a sandbox are crucial (Moore 1995). If regulators lack the operational capacity to understand the implications of a product when fully released in the market, they may be placing consumers at risk. The sandbox may be testing some but not all relevant considerations and may be released with inadequate controls.

Linked to the capacity concern is the impact of sandbox investment on the regulator itself. If scarce human capacity and resources are diverted to the sandbox, the sandbox may operate at the expense of other regulatory functions (FSD Kenya 2018; UNSGSA FinTech Working Group and CCAF 2019, p. 30).

The risk of regulatory capture should also be recognised and managed (Kwak 2013, p.75). The novelty of the products may lead to situations where regulators are reliant on the provider and on the industry to understand the technology and products they are working with. This provides an opportunity for skewed information to be provided, either intentionally or by mistake. However, even where the regulator has sufficient capacity and information, the collaboration during the sandbox phase may give rise to relationships that can influence regulatory conduct. The mere fact that the regulator has been involved in the sandboxing and release of a new product may also lead to a reluctance to acknowledge early signs that mistakes were made.

Another potential danger is that entry to the sandbox develops into a privilege. Only a small number of participants can be accommodated at any given time. It provides one business with the opportunity to test its product while denying it to another (Cambridge Centre for Alternative Finance 2018, p. 18; Huerats 2018, p. 55). The entry and acceptance into a sandbox can provide a competitive advantage. It also provides participants with an opportunity to shape and influence regulation in a way that may be more advantageous to their own position than those of non-participant competitors. Whether it be by influencing how regulators see and understand an area of technology, or by creating a working relationship with regulators, being first may hold a range of advantages.

The impact of these advantages must be monitored by regulators and the industry and processes and rules may need to be changed if sandboxes prove to provide an unfair competitive advantage.

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7 The UK’s FCA sandbox, for example, draws on the expertise of more than three dozen staff members (Appaya 2018). This level of expertise and staffing is not available to smaller regulators.
While debates are continuing about sandboxes and appropriate regulatory approaches to innovation in financial services, it is helpful to consider how non-financial regulators have been dealing with similar pressures arising from innovation.

7. OTHER EXPERIMENTAL CASES

Other experimental settings provide useful lessons for the development of sandboxes in financial services. In what follows we provide background briefing on how regulatory and legal systems have evolved in response to three different technological and policy innovations: autonomous vehicles; Uber and similar companies; and emissions trading pilot schemes. In all three cases, extensive and detailed interaction between regulators and the relevant innovators has been necessary. In some countries, this has involved “sandbox-like” discussions, in others (for example, the Transport for London (TfL) challenges to Uber in the UK (Marique and Marique 2018)) it has involved the courts. Some innovations, for example Uber, are developments of innovations in other industries such as Google Maps. All provide useful lessons for the regulation of technological innovations in financial services.

7.1 AUTONOMOUS VEHICLES

Autonomous vehicles use an automated driving system which can take control of steering, acceleration and braking. The degree of automation can vary from partial automation (whereby system control is taken only in defined circumstances) through conditional automation, high automation or full automation (when all driving tasks are undertaken all of the time by the system and no monitoring is required by a human driver) (National Transport Commission (NTC) 2017b, p. 17). Autonomous connected vehicles are able to communicate with each other, and as a consequence are able to drive closer together (McKinsey Centre for Future Mobility 2019).

Autonomous vehicles have the potential to provide very significant benefits. These include reduced traffic congestion with faster vehicle speeds and improved flow (KPMG 2016a), greatly improved road safety outcomes (eliminating up to 90% of traffic accidents) (Gao et al 2014), improved mobility for the aged and disabled (NTC 2017a), reduced costs of vehicle travel including the freeing of drivers’ time, reduced costs of ride-sharing (KPMG 2016b) and reduced insurance costs (KPMG 2016b). Automated vehicles also have the potential to improve fuel efficiency, although there are concerns that induced demand for autonomous vehicle travel may limit the overall reduction in pollution (Taiebat et al 2018).

However extensive use of autonomous vehicles will be disruptive, with many public policy and regulatory issues needing to be addressed.

1. Planning and land use: By freeing the driver from concentrating on driving, autonomous vehicles may make long distance driving easier and cheaper. This may encourage longer commutes and more urban sprawl (KPMG 2016b), carrying implications for land use planning and urban design (Anderson et al 2016).  
2. Road pricing reform: Likewise induced demand for vehicle travel raises the potential for increased congestion (and increased environmental pollution), notwithstanding the more efficient traffic flows, because more trips will be undertaken. Implementation of road pricing may become essential to managing demand for car travel (KPMG 2016b).  
3. Ride sharing: Autonomous vehicles could cut the cost of arranging ride sharing by up to half (KPMG 2016b). Consequently ride-sharing has the potential to ameliorate future induced demand for autonomous car trips, however it will require regulation which supports and encourages ride sharing.  
4. Safety: While autonomous vehicles have the potential to limit driver error, the technology can itself create risks for passengers and other road users which existing road safety regulations do not address (NTC 2017b, p. 17). Since 2016 there have been around four fatalities involving self-driving cars world-wide (Norton Rose

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8 UBER’s IPO filing, see https://www.sec.gov/Archives/edgar/data/1543151/000119312519103850/d647752ds1.htm#toc647752_9, lists Google as a key supplier of mapping technology.  
9 Conditional automation requires the driver to resume control if requested.  
10 Under high automation the system drives the vehicle for sustained periods or all of the time in defined places.
and much of the attention of vehicle trials has focused on safety. (Including the safety of the transition from automated driving systems to driver under partial autonomous systems). Other safety issues being addressed include the need for explicit regulation of automated driving functions, how safety should be assessed and how safety assurance systems could be implemented (NTC 2017b, p.17).

5. **Liability and Insurance**: Questions also surround who is liable if an autonomous car causes injury or damage, or breaks road rules. Responsible parties could include the vehicle manufacturer, the software programmers, and human owners or operators, with liability laws needing to address the potential for conflicts of interest between these groups and to specify liability (Anderson et al 2016). For example, laws need to address where liability resides if the owner modifies the software or fails to install important upgrades (Brian 2017). Similarly insurance needs to cover all situations, whether the car or the driver is in control, and ensure that those injured are no worse off than if they had been injured by an ordinary car with currently mandated insurance (Wright 2018).

6. **Cyber security**: There is also a risk that autonomous vehicles could create new safety issues through cybersecurity risks (NTC 2017b, p. 17). Thus it is crucial for systems to be designed to be resilient (NTC ND; Centre for the study of the presidency & congress, 2017).

7. **Privacy**: Autonomous cars also raise issues of privacy, since they gather many streams of information including location, voice and video recording, and use of social media (Lafrance 2016).

8. **Ethics**: Another safety related issue concerns the moral dilemma that arises when programming an autonomous vehicle, concerning the trade-offs which are made in an emergency situation. Utilitarian algorithms dictate that the vehicle should make decisions for “the greater good”, for example sacrificing the passenger to save a group of several pedestrians. However while studies suggest that utilitarian algorithms meet with approval, in the sense that people would like others to buy such autonomous vehicles, respondents would rather not buy or ride in such vehicles themselves, preferring to purchase vehicles that protect the passenger at all costs (Bonnefon et al 2016). An alternative approach that has been proposed is the implementation of ethical AI, which learns from users’ preferences (Etzioni and Etzioni 2017).

9. **Road infrastructure**: Autonomous cars will also carry requirements for governments to provide and build the infrastructure required to support them, such as signalling suitable for smart highways (NTC ND).

10. **Employment**: Autonomous vehicles are widely predicted to result in the loss of driving-related jobs, for profession drivers such as taxi drivers and road transport drivers, as well as service industries such as crash repair garages (Frey, C.B. and Osborne, M.A. 2017). In Chandler, Arizona (where Waymo’s self-driving fleet has been tested since 2017), police have reported at least 21 instances of people attacking autonomous vehicles or threatening their human safety drivers – an indication of their fear of technological innovations (Rapier 2018).

Trials of autonomous vehicles are being conducted across the developed world (NTC 2017b). In Australia, as elsewhere, legal barriers mean that autonomous vehicles must obtain a permit or exemption from the relevant (in the case of Australia state or territory) road transport authority regulations, which include obligations on Australian Road Rules (Austroads and NTC 2017). The agencies have an obligation to ensure that the trials are safe, with safety risks and liabilities managed appropriately. Under the Road Safety Amendment (Automated Vehicles) Act 2018, autonomous vehicles have been able to gain permits for trials on public roads.

Austroads and the NTC (NTC) have produced guidelines for the trial of autonomous vehicles which are intended to support nationally consistent conditions for trials, provide certainty and clarity to industry, establish minimum standards of safety, ensure public roads are being used safely, and help raise awareness and acceptance of autonomous vehicles in the community (Dept of Infrastructure, Regional Development and Cities ND).

The guidelines set out the information that is required to be provided about the vehicle and the trial, including

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11 There has also been one case of a driverless car running over and destroying a robot (Turner 2019).
what control measures will be used if the vehicle does not meet Australian Design Rules\textsuperscript{12} (ADRs). They are intended to allow for a range of autonomous vehicle technologies, encouraging innovation while maintaining safety. The guidelines cover management of the trials (including location, description of the technology being trialled and traffic management plans), infrastructure requirement, stakeholder engagement and management of technical change in the vehicles. Trialling organisations are required to show that they have appropriate insurance and abide by requirements for the reporting of serious incidents. They are also required to provide an end-of-trial report on research outcomes, with commercially sensitive information and intellectual property being respected.

Australia’s existing laws and regulations do not recognise autonomous vehicles, in that they assume the presence of a human driver. To remedy this, Australian Governments have agreed to have “end-to-end” regulation in place by 2020 (Transport and Infrastructure Council 2017). To meet this commitment, the NTC is leading a phased program of national regulatory reform (NTC 2018b), covering:

- Safety assurance systems for automated vehicles, with a Decision Regulatory Impact Statement (RIS) released in November 2018
- Legislative reform to clarify the application of driving laws to autonomous vehicles and to establish legal obligations for automated driving system entities
- Review of motor accident injury insurance to ensure that autonomous vehicle crash victims are no worse off than those injured by a vehicle with a human driver
- Regulation of government access to C-ITS and automated vehicle data

The November 2018 RIS recommends a safety assurance system that is based on mandatory self-certification and operates within the existing vehicle certification framework. This is to apply at first supply of autonomous vehicles, with further work to be done to develop an approach for in-service safety assurance (NTC 2018b). Ministers have agreed to the NTC’s policy paper “Changing driving laws to support automated vehicles” (NTC 2018a), and recommendations on insurance and government access to I-CTS and automated vehicle data are expected in May 2019.

The findings of the first phase of Transurban’s Victorian trials were published in April 2018 (Transurban 2018). The trials (conducted in conjunction with VicRoads and RACV) involved partially automated vehicles and were heavily focused on safety-related issues, such as the ability of driving systems to identify road markings, stopped vehicles, and electronic and static signs. They were also concerned to identify the circumstances when other vehicles and objects remained undetected and whether any existing infrastructure disrupted autonomous driving systems. Through a survey of Transurban’s customers, the progress report also sought to explore community attitudes towards automated vehicles. Most respondents (84%) were keen to have automated features in their next car, however for those who were very hesitant a number of barriers were identified.

The NTC is conscious of the need for a national and co-ordinated approach to automated vehicle regulation, to ensure that inconsistent and/or over-regulation does not discourage or delay the offering and take-up of autonomous vehicles (NTC 2017b, p17). The NTC also recognises the importance of ensuring that Australia is aligned with international developments (although international approaches to regulating the safety of autonomous vehicles are still in the early stages of development) (NTC 2018b).

In the US for example, a range of approaches are being taken. Some states are adopting a “light touch”, allowing policy makers to learn more about the technology before bringing in legislation. In other states, such as Michigan, there is concern that a strict definition of “manufacturer” has locked all but incumbent automobile manufacturers out of the autonomous vehicle market. In California there is concern that data sharing requirements are creating a competitive disadvantage for companies operating in that state (Centre for the Study of the Presidency and Congress 2017).

By contrast, the UK has sought to develop an innovation hub through its Centre for Connected and Autonomous Vehicles. The funding provided by the centre supports

\textsuperscript{12} ADRs set the standards for new and imported vehicles.
over 70 projects with more than 200 partners, and provides a resource for those seeking future collaborators (Centre for Connected and Autonomous Vehicles 2018). In March 2018 the UK Government announced a three year review of how road laws need to be adjusted for autonomous vehicles, to be conducted by the Law Commission of England and Wales and the Scottish Law Commission (Perkins 2018).

7.2 UBER

Uber was founded in San Francisco in 2009, to challenge the city’s inefficient and inadequate taxi service. Today it operates in more than seventy countries, and, with an estimated market capitalization of more than $100 billion (Morningstar Equity Analysts 2018). It is the World’s most valuable privately-held technology company.

Its main product is a ride-sharing application which can be used to link drivers with potential travellers. Similar applications exist in several countries, including Grab in much of SE Asia; Didi in China, Japan, Australia and South America; Gett in Israel; Ola in India; and Lyft in some 300 US cities. At scale, ridesharing can reduce private vehicle ownership and congestion. Proponents of ridesharing point to greater safety and consumer protection (relative to taxis and hire cars), created by digital records, GPS tracking, disclosure and mutual feedback, and the beneficial impact on congestion and driver utilisation, created by the application matching supply to demand.

Uber followed a strategy of acting as a market ‘disruptive innovator’, exploiting weaknesses in competitors and in regulatory systems. Uber seeks to differentiate itself from its competitors by describing itself as a technology platform (rather than a taxi company) and its drivers not as employees but as ‘registered partners’. As a result, regulators have been forced to react within a framework of systems that were not designed to deal with the technological and operational challenges presented by Uber (Dudley 2017).

Uber has needed to respond to regulatory challenges in different ways in different countries. In the UK, TfL initially embraced Uber in 2012, partly as a solution to a perceived lack of capacity for the Olympic Games, although Uber then faced strong opposition (and organized protests) from the city’s ‘Black Cabs’, many of whom have now developed their own, similar, applications. Although TfL subsequently challenged Uber in the High Court, it failed to establish that the application constituted an illegal taximeter. The Chief Executive of the Competition and Markets Authority backed Uber against TfL attempts to increase the difficulty of the topographical test to be taken by private hire drivers, deeming this to be anti-competitive.14

In China, Uber was forced to merge with its main competitor, Didi Chuxing. In the US, it is forming alliances with the public sector in order to expand into suburban and smaller urban areas. In many SE Asian countries, it has formed alliances with taxi companies, so that taxi drivers now use the Uber application both to obtain customers and to navigate. In both cases the necessary adaptation of corporate strategy and regulatory approach has involved extensive discussion with regulators (Allon 2019).

Across Australasia, governments have responded fairly quickly to the need to adjust regulatory arrangements. India, Cambodia, Malaysia, Singapore, Indonesia, Australia and New Zealand all introduced new regulations to make ridesharing widely accessible in 2016 and 2017. Vietnam implemented a “pilot” framework to trial new regulations in January 2016, and subsequently held interactive workshops which included both regulators and Uber representatives. In many countries, taxis now use the Uber application to seek customers and enjoy the benefits of more flexible pricing.

7.3 CHINA’S EMISSIONS TRADING PILOT SCHEMES

At the Copenhagen summit of 2009, China committed to a carbon reduction of approximately 3% per year from 2016 to 2050, and has subsequently sought to cap

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13 A recent study (BCG 2017) estimated reductions in key SE Asian cities in the number of private vehicles of between 42% and 73%, and in peak congestion of between 51% (Jakarta) and 92% (Bangkok). The study assumed that ridesharing would become the most popular form of private transport and took into account vehicle utilisation, pooling, interaction with public transport and optimization of infrastructure planning.

14 Further detail of the political and regulatory challenges faced by Uber in London can be found in Dudley et al. (2017).
its carbon emissions around 2030. Prior to 2013, China relied on command-and-control regulations to achieve these ambitious goals, based on the Environmental Protection Law of 1989, amended in 2014 (Jin et. al. 2016). Although effective in reducing emissions, the implementation of these regulations turned out to be both expensive and inefficient. So China decided to create seven pilot schemes to explore market-based solutions, in Beijing, Shanghai, Tianjin, Chongqing, Guangdong, Hubei province, and Shenzhen.

These pilot schemes have many sandbox-like qualities. The existing administrative regulations were relaxed, and the local municipalities were given considerable leeway to design their own schemes. The design of emissions trading schemes is complex, and innovative solutions are often needed to overcome local problems. All seven schemes, which were initiated in 2013 and 2014, have been carefully monitored, and a new national scheme for power generation and heat industries was launched in December 2017 based in part on how the pilot schemes performed (Grigg 2017).

The implementation of market-based systems—carbon taxes or emissions trading schemes (ETS)—is widely accepted as a method of internalising environmental costs into the wider energy system (Baumol and Oates 1988). However, exactly how such schemes should be structured is still a matter of international debate and experimentation. Unlike the European Union or Californian schemes, the Chinese schemes cover enterprises in the relevant locality, and unlike the EU, scheme emissions from electricity generation (both internal to the region and imported from other regions) are included (Zhang 2015). Each pilot scheme includes allowances for new entrants, auctioning and price stability, but the schemes vary in the extent to which China Certified Emission Reductions (CCERs) can be used, and some impose local origin requirements. The pilot schemes vary in sectoral coverage, apply different thresholds and have different mechanisms for initial allocation of allowances. Some have taken innovative approaches, for example the Shenzhen pilot includes a competitive game-based allocation of allowances (Shenzhen Municipal Government 2014). The pilot schemes also vary in how far auctions can be used to top up allowances, with Shanghai and Shenzhen encouraging such auctions, but Beijing choosing not to do so.

The design of the pilot schemes was complicated by the price distortions which exist throughout the Chinese energy market. Electricity tariffs, as well as gas prices, are set by government, often at levels which inhibit new investment (Zhang 2015). As a result, all the pilot schemes have included mechanisms to deal with supply-demand imbalances and the resulting price uncertainty. For example, in the Beijing and Shenzhen pilot schemes, some allowances can be reserved and auctioned where necessary for cost containment purposes. Localities with dominant players, for example Baosteel in Shanghai, have included special arrangements to limit the use of market power by these entities. Non-compliance arrangements vary across schemes, with, for example, both fines and deduction of shortfall allowances in the Hubei scheme.

8. LESSONS FOR THE REGULATION OF INNOVATION

The testing of autonomous vehicles under special permit regimes has many of the characteristics of a regulatory sandbox, with regulatory requirements being reduced to encourage innovation in self-driving cars. In many jurisdictions, regulation is developing more slowly, seeking to learn from the trials conducted. Some of the lessons we can take away from the experience of autonomous vehicles are:

1. The relaxing of regulatory requirements is important if innovation is to be encouraged: regulatory requirements that are too heavy can serve to protect the interests of the incumbents.
2. It is important for trials of innovative technology to take place in home markets, as differences in context (e.g. geography or infrastructure), the market and/
or consumer behaviour may cause unexpected difficulties when technology is imported from other countries. For example, Transurban found that the CityLink Sound Tube art installation disrupted the technology – a problem that emerged only in the Melbourne trial (Transurban 2018). Similarly, Volvo admitted that its animal detection system (which was devised to avoid deer, elk and caribou) did not work for kangaroos (Zhou 2017).

3. Moreover, it is likely that extensive “virtual testing” is going to be required to fully validate autonomous vehicles, in order to ensure that all potential hazards (potentially millions of “edge cases”) will be recognised by driving systems (McKinsey and Company 2017).

4. Trials have to date largely focused on technical issues, with only limited exploration of social attitudes. One example of the failure of policy to respond to social concerns, such as impact on employment, can be seen in the protests against Waymo’s self-driving cars in Arizona (Rapier 2018).

5. To date there has been relatively little explicit feedback from trials into regulatory policy. However it is relatively early days in terms of the formulation of policy. The approach taken by the NTC suggests that the approach of self-certification, which is an important element of current autonomous vehicle trials, is likely to be carried across into permanent regulation.

6. In jurisdictions such as Australia, regulatory policy is explicit in seeking to avoid over-regulation. One example is the ethical considerations raised above. The NTC notes that there is as yet no consensus around acceptable decision-making, nor are there metrics to evaluate against. According the NTC’s RIS has not included ethical considerations in its safety assurance criteria, although this would be re-considered if there is clearer international consensus (NTC 2018b). The challenges that Uber has faced in establishing itself have varied considerably across countries. Finding solutions has required interaction with a variety of political systems and multiple regulators, as well as responding to different societal pressures. Uber has proven to be flexible in finding these solutions, and many countries have benefitted from the innovations that Uber pioneered. The emergence of successful clones, such as Grab, Didi, Ola and Lyft has been made possible by the flexibility of regulatory authorities. Taxi firms, from UK to Vietnam, have also been able to improve their operational efficiency by utilizing or mimicking Uber-like technologies. All of these factors provide positive evidence on the benefits of the kinds of regulatory interaction that sandboxes permit.

Yet the Uber case also demonstrates the dangers of too much leniency in the regulatory environment. Uber has been able in some cases to establish a market-dominant position by testing the limits of regulatory constraints. The Transport for London case shows how a well-resourced company can resist calls for improvements in service standards such as the stringency of the topographical test. Well-structured regulatory sandboxes, in contrast, can ensure that regulations develop in a co-operative, rather than confrontational, environment.

To some extent the Chinese invented sandboxes long before they became popular following the UK financial sector initiatives. Faced with the need to develop market-based solutions, but fearing that it might lose political control if they were implemented across the whole of China, the Chinese government chose to set up ring-fenced, experimental, special economic zones (SEZs), starting in Shenzhen in the early 1980’s. Within these zones, many of the stringent regulations which govern most of China – especially relating to foreign participation – were relaxed. Once Shenzhen had demonstrated what worked, the government then permitted other zones to emerge. By 2014 there were 6 SEZs, 14 open coastal cities, 4 pilot free trade areas and five financial reform pilot areas. There were also 31 bonded areas, 114 national high-tech development parks, 164 national agricultural technology parks, 85 national eco-industrial parks, 55 national ecological civilization demonstration areas, and 283 national modern agriculture demonstration areas.\(^{20}\)

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19 Examples of “edge cases” given by McKinsey include a construction site where a construction worker waves cars through a red light, and a sign which universally ignored by normal traffic.

20 For more detail see World Bank (2015).
The Chinese emission trading pilots have continued in this experimental tradition. Faced with uncertainty about just how a market for emissions should be developed, and might work, the Chinese government set up the seven pilot schemes to test whether it made sense to roll the concept out across the country. Having seven, rather than one, has permitted different approaches to be tested and also provided insight into how the systems work in different situations. The matters which have been tested include how to apply penalties for non-compliance.

9. CONCLUSIONS

Technological disruptors in financial services seem certain to change business practices fundamentally, and to create new threats to the fair treatment of customers and the overall sustainability of the industry. Regulators need to understand these technologies, and to frame regulatory responses quickly enough to prevent lasting damage. In doing this, technology provides both a threat – because new technologies permit unprincipled actors to evade existing regulations – and an opportunity – because there are new and powerful tools which regulators can use to improve their responses. The discussion above has highlighted how Regulatory Sandboxes can serve as an effective way to promote innovation and enable regulators to learn about the new technologies, but also pose risks for which responses have not yet been developed.

Digital connectivity, especially via mobile phones, has created opportunities for branchless banking; cloud computing has changed the way we access data; while Big Data and enhanced analytics are allowing more focus on individual needs. All of these again carry both threats and opportunities. Traditionally, regulators have limited their engagement with the financial industry to being reactive, only adjusting regulatory process when faced with crises or scandals. But leading regulators are trying to be more pro-active, which means they need to acquire knowledge and expertise about disruptors.

Regulators in advanced countries (such as the UK and the US) have responded to the challenge by creating innovation offices and hubs and pioneering specific “test and learn” environments called regulatory sandboxes. 21 With the GFiN this approach now enables cross-border testing of new innovation. Regulators have also sought to harness competitive innovators in developing regtech and suptech, for example the “techsprints” and “codeathons” arranged by the FCA and other leading regulators.

A major challenge facing regulators is the rather sophisticated version of regulatory capture which hubs and sandboxes can facilitate. By apparently assisting regulators to acquire skills, unprincipled actors with greater knowledge and resources can potentially drive and capture the regulatory agenda. Under-resourced regulators may have no realistic method of employing sufficient talent even to know that this is happening. This in turn means that those who do have the relevant knowledge, perhaps in university research groups, need also to become involved in an open and transparent way. Gaining entry to a sandbox is a privilege that may provide a competitive advantage, thus preventing other, perhaps more innovative, players from entering the market. Hub and sandbox design needs to take these dangers seriously, and ensure that there are sufficient checks and balances to the privilege afforded to industry participants.

We have also highlighted above the other risks which are associated with sandboxes, including impacts on consumers, the provider, the industry and even financial markets when a ‘sandboxed’ product is released onto the market. The sandbox may be testing some but not all relevant considerations and may be released with inadequate controls. Skewed information may be provided, either intentionally or innocently. There can be severe reputational damage if such a launch is not orchestrated carefully, implying a need for serious quality control of the sandbox process itself.

We have explored the lessons which can be learned from how technological disruptors in other industries have been handled, focusing on ride-sharing, autonomous vehicles and, briefly, on Chinese experiments with pilot schemes. All three examples have had a major impact on the industries concerned, facilitating the development of new products and processes that would not have been possible otherwise. However in all three cases, community resistance to change has been underestimated,

21 For example, ASIC launched its own Innovation Hub in March 2015.
requiring further retrofitting of regulatory procedures. Also ethical issues risk being recognized too late for an effective response to be possible. In the case of autonomous vehicles, the “sandbox” trials have focused on a particular issue, namely safety. While safety is clearly the crucial first step, it is too early to see whether the regulatory sandbox approach will be able to usefully contribute towards the myriad of other issues that the introduction of autonomous vehicles will raise – such as the demand for and pricing of road infrastructure and consequential pressure on land use.

Regulatory sandboxes incorporate many of the principles employed in relation to the non-financial innovations discussed above. Sandboxes do seem helpful in relation to clearly defined financial services innovations with a limited footprint. Where the disruption spans agency and disciplinary boundaries, broader and more flexible testing and study approaches may prove more helpful: it is important to recognise that sandboxes are not the only way to support and assess, new innovations.

Sandboxes are helpful to test new financial products and service, the appropriateness of existing rules and the need for new rules. They do not provide a comprehensive picture and some of the findings may need to be revisited down the line. Expectations will need to be managed with care to ensure that trust in the sandbox model is not shaken when that occurs.

Managing sandbox processes are complex but regulatory challenges do not only arise at the inception phase. Uncertainty is not only generated by the innovation but also by regulatory changes, some of which may lie outside the control of the technical regulatory experts, i.e. the levying of new taxes or charges once innovation has proved successful, impacting on business models and undermining trust that the regulatory environment will remain supportive.

Technological disruptors are a fact of life, and are emerging at a bewildering rate. Governments, legislators and regulators have to recognize both the benefits and the dangers of this trend and to create effective responses. This means that regulators need to be fully supported as they seek to understand each new technology, but they must do so with open eyes, recognizing that self-interest may well lead the commercial actors to be less than open when offering technical information. The use of hubs and sandboxes is a very valuable method of achieving the appropriate regulatory response, but the design of such tools needs to be done very carefully, with appropriate quality controls. Ideally, even sandboxes and regulatory tools to support innovation will be “sandboxed” as experimental learning programs on how to respond to innovation, allowing for rules to be finessed as more is learnt about the benefits, risks and impacts of sandboxes.

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