

The role of sandboxes in promoting flexibility and innovation in the digital age



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The role of sandboxes in promoting flexibility and innovation in the digital age

Digital technologies and data have unlocked new potential and disrupted entire industries. However, digitally enabled and innovative products and business models often differ significantly to those in traditional markets, and in some cases, they do not fit well with existing regulatory frameworks. In response, policy makers are increasingly experimenting. One approach to developing mechanisms that promote the flexible application or enforcement of policies is the use of regulatory “sandboxes”, which may be particularly useful for certain kinds of digitally-enabled innovation. This policy note discusses the emergence of regulatory sandboxes, analyses common characteristics, identifies potential benefits and challenges, and considers examples in several regulated industries across the OECD and beyond.

Digital technologies and data have unlocked new potential and disrupted entire industries (OECD, 2019^[1]). They have also helped promote new business models, processes and methods that can increase competition, deliver new forms of value creation, open up previously unexploited markets and help spur the creation of new services, as well as increased accessibility and convenience for consumers. However, innovations driven by digital technologies and data often challenge existing regulatory frameworks in various ways (OECD, 2019^[2]), particularly in industries such as financial services (OECD, 2018^[3]), transport (ITF, 2015^[4]), energy (OECD/IEA, 2017^[5]) and health (OECD, 2017^[6]). Regulation in these industries is crucial to safeguard basic safety and quality standards, and ensure the ongoing provision of critical infrastructures and essential services.

Digitally enabled and innovative products and business models often differ significantly to those in traditional markets, and in some cases, they do not fit well with existing regulatory frameworks. For example, many regulatory frameworks were not established with the characteristics of digital business models in mind, including the fact that such business models may rely less on physical presence or “mass” (OECD, 2019^[7]). Digital business models that operate across traditional sectoral boundaries, or transform the roles of users (for example, the platform economy or “prosumer” models), may not easily fit into existing regulatory frameworks.

Where digitally innovative firms face regulatory uncertainty or an absence of regulation, they may be less likely to set up and attract the funding and resources needed to scale up (Pelkmans and Renda, 2014^[8]) (Armstrong, Gorst and Rae, 2019^[9]). This is compounded by the fact that the risks of future regulation fall disproportionately on the first-mover, namely the initial disruptor. Digital business models are often completely new-to-market, and could therefore pose unforeseen risks for consumers and the wider economy (for example, in terms of financial or macro-prudential stability) (Carney, 2017^[10]). At the same time, regulatory uncertainty may deter users from adopting a particular service.

Regulatory frameworks change the structure of incentives by imposing constraints on the behaviour of market participants (OECD, 2018^[11]). There is a need to develop regulatory frameworks that balance the tension between achieving regulatory goals without discouraging innovation. This challenge is exacerbated by the fast pace of digital transformation, which makes market developments and future public policy concerns difficult to predict.

In response to this challenge, policy makers are increasingly experimenting. One approach to developing mechanisms that promote the flexible application or enforcement of policies is the use of regulatory “sandboxes”, which may be particularly useful for certain kinds of digitally-enabled innovation. This policy note discusses the emergence of regulatory sandboxes, analyses common

characteristics, identifies potential benefits and challenges, and considers examples in a number of regulated industries across the OECD and beyond.

Policy experimentation and regulatory sandboxes

Policy makers across the world have recognised the regulatory challenges associated with digital transformation, and have responded in a variety of ways, ranging from “wait and see” to “test and learn” to banning digitally enabled business models outright (OECD, 2018^[11]). Between these two extremes, some regulators have opted to experiment with regulatory environments.

Digital technologies and data can help with policy experimentation. The analysis of data can help enable more risk-based regulatory delivery that responds to potential regulatory breaches in real-time (OECD, 2018^[11]). Digital technologies and data can also enable a more effective, risk-based approach to regulating digital innovations. One example is the forthcoming implementation of the Digital Health Innovation Plan from the United States Food and Drug Administration (FDA), which aims to use a risk-based approach to regulate the increasing proliferation of software-based medical technologies, including mobile medical applications (United States Food and Drug Administration, 2018^[12]).

Another example is the rise of outcome or performance-based regulation, which specifies required outcomes or objectives, rather than the means by which they must be achieved (OECD, 2002^[13]), potentially enabling firms the freedom to innovate while remaining within the spirit of the law. Australia, for example, has adopted performance-based guidelines for the use of autonomous vehicles (Australian National Transport Commission, 2018^[14]).

While interesting policy experiments have abounded in recent years in response to digital transformation, one increasingly popular mechanism of ensuring regulatory flexibility has been the emergence of regulatory sandboxes (Box 1). Regulatory sandboxes are a structured form of regulatory flexibility that enable selected firms to test innovative products or services with minimal regulatory requirements. Regulatory sandboxes are typically administered by regulatory authorities. The innovative nature of sandboxes may require approaches and competences that differ from those required for traditional regulatory approaches.

Box 1. What is a regulatory sandbox?

A regulatory sandbox refers to a limited form of regulatory waiver or flexibility for firms, enabling them to test new business models with reduced regulatory requirements. Sandboxes often include mechanisms intended to ensure overarching regulatory objectives, including consumer protection. Regulatory sandboxes are typically organised and administered on a case-by-case basis by the relevant regulatory authorities. Regulatory sandboxes have emerged in a range of sectors across the OECD and beyond, notably in finance but also in health, transport, legal services, aviation and energy.

Such innovative goods and services are often explicitly digital or digitally-enabled. For example, regulatory sandboxes operated by financial regulatory authorities are used to test innovative and potentially disruptive financial services enabled by digital technologies, also known as “FinTech” (OECD, 2018^[3]). Similarly, emerging regulatory sandboxes (also known as “testbeds”) for the testing of autonomous cars have emerged in Korea (Research Centre for Autonomous Road Vehicles, 2018^[15]), the People’s Republic of China (hereafter “China”) (Financial Times, 2018^[16]), and Germany (BMVI, 2018^[17]). Regulatory sandboxes in the energy sector are often designed to test business models that arise from digital innovations like smart metres (Office for Gas and Electricity Markets, 2018^[18]). Colombia is in the final stages of developing a regulatory sandbox in the information and communication technology (ICT) sector with a view spurring innovation, including in the context of 5G deployment and trials (Comunicaciones, 2020^[19]).

Characteristics of regulatory sandboxes

There are different approaches to regulatory sandboxes across sectors and countries. For example, a financial services sandbox operated by the Australian Securities and Investments Commission offers a class waiver that allows individuals to seek relief either as an alternative path or in addition to the class waiver, an important regulatory innovation (ASIC, 2017^[20]). A similar sandbox operated by the Hong Kong China Monetary Authority is explicitly intended for established, incumbent banks that wish to explore distributed ledger technology and other FinTech innovations (IMF, 2017^[21]). This fragmentation has led some stakeholder groups to call for harmonisation of sandbox criteria to avoid regulatory arbitrage (European Banking Authority, 2017^[22]). Nevertheless, many emerging regulatory sandbox programmes share some common features.

Genuine innovation or novelty

Those firms applying for regulatory waivers under regulatory sandboxes are often required to demonstrate that their business idea is a genuine innovation. This can include the use of a new and emerging technology, such as distributed ledger technologies or artificial intelligence (AI), or the innovative use of an existing technology. In some cases, this can include potential novelty to the relevant jurisdiction or marketplace, such as in the case of the regulatory sandbox established by the Monetary Authority of Singapore (MAS, 2016^[23]).

The demonstration of genuine innovation can avoid “legal ambivalence” in the regulation of products and avoid the creation of asymmetries between different actors (European Banking Authority, 2017^[22]). In some cases, a step change in the scale of a particular business model or product may also constitute genuine innovation or novelty (United Kingdom Financial Conduct Authority, 2017^[24]).

Identifiable consumer or social benefit

Some sandboxes also ask applicants to demonstrate identifiable consumer benefit. This can include outlining direct benefits associated with the innovation or business model, such as how the proposed innovation can lead to higher quality or lower prices, or how the business model addresses an otherwise unmet demand. In some cases, the firm may instead be able to show indirect benefits for the consumer. This may include a demonstration that their innovation heightens competition, thereby driving sector-wide spillovers. It may also include social benefits, such as a more inclusive approach certain kinds of services. For example, France Expérimentation has allowed SEDE Environnement and the National Federation of Agricultural Holders’ Unions (FINSEA) to tackle depleting natural resources and recycle water by developing an innovative irrigation solution that fertilizes crops by reusing wastewater (Direction Générale des Entreprises du Gouvernement Français, 2017^[25]).

Often, the benefits may be theoretical until they are realised through live market testing or actual deployment, but some regulatory authorities request evidence where possible. For example, the Central Bank of Bahrain makes clear that assertions of customer benefits should be supported by “quantifiable estimations or demonstrations where possible” (Central Bank of Bahrain, 2017^[26]).

Need and readiness for sandbox testing

Many sandboxes also require that applicants demonstrate that they need the regulatory exemptions or waivers offered by the relevant sandbox. This can often require the identification of the particular regulatory requirement that constrains the activity of the entrepreneur. This also enables regulatory authorities to identify innovative models that may be able to operate within

the current regulatory framework, and provide them with relevant and appropriate guidance.

For example, in the United Kingdom, those applying to the regulatory sandbox in the energy sector may note that the existing British Balancing and Settlement Code does not enable energy users to have more than one supplier in most cases. Consequently, a regulatory waiver is necessary for business models that involve more than one provider or supplier of energy (for example, peer-to-peer energy models) (United Kingdom Office of Gas and Electricity Markets, 2017^[27]); (ELEXON, 2018^[28]); (Box 2).

Most firms are also asked to demonstrate their readiness to begin testing; namely, that firms are in the development stage and able to test their product in a live-market or controlled environment. Often, this can include well-specified documentation of the proposed testing to be undertaken in the regulatory sandbox, alongside the relevant tools and resources required to realise the testing.

Box 2. Innovation Link in the United Kingdom

Recent analysis underscores the merits of regulatory sandboxes to harness the potential of digital transformation for the energy sector (OECD/IEA, 2017^[5]). For example, in February 2017 the British Office of Gas and Energy Markets (OFGEM) launched a regulatory sandbox programme for innovators in energy markets, enabling them to trial innovative business products, services and business models that cannot currently operate under existing regulations with real-life customers.

Potential entrepreneurs are able to contact OFGEM through their dedicated “Innovation Link” service. In the majority of cases in 2018, the programme was used to deliver rapid regulatory advice about how a proposed innovation could be conducted within the constraints of existing energy regulation. In just three cases to date, a regulatory barrier was identified and a sandbox solution was offered. Two of the three firms that have been offered regulatory waivers explore peer-to-peer energy trading, while the other offers an innovative tariff based on smart home technology (OFGEM, 2018^[44]).

Defined time, sectoral or geographic limits

By the definition used in this policy note, regulatory sandboxes are a form of limited testing and are not intended to enable permanent regulatory waivers or exemptions for innovative firms. Consequently, regulatory sandboxes typically outline limits to the testing enabled under the regulatory waiver. These limits are usually temporal, but can also include sectoral or geographic limits.

These limits are usually in terms of time: namely, the regulatory sandbox enables testing for a limited duration in the live market or in a controlled environment. This period varies, but typically ranges between 6 to 24 months. Some regulatory sandboxes also require clear documentation in advance of relevant testing, and may choose to limit the scope of the relevant testing.

Some sandboxes may also impose restrictions on the sectors in which eligible firms are able to operate. These restrictions are often related to the domains of the administering regulatory authority. For example, activities undertaken in the financial services sandboxes of the Hong Kong China Monetary Authority and the Bank of Thailand are restricted to banking activities (Zetzsche et al., 2017^[30]).

In some other cases, the limit may also be geographic. Notably, regulatory sandboxes for transport innovations, including for unmanned aerial vehicles (UAVs, also known as drones) and autonomous driving cars, typically outline specific areas or streets where the vehicles can be tested without adhering to the full existing regulation (Box 3).

Box 3. Unmanned Aircraft Systems Integration Pilot Program in the United States

In May 2018, the United States Federal Aviation Administration announced the Unmanned Aircraft System Integration Pilot Program to test the safe application of UAVs. Private sector applicants were invited to partner with state, local or tribal governments in order to apply for a waiver from United States airspace regulation to test UAVs for a period of 30 months (United States Federal Aviation Administration, 2018^[31]).

Of 149 applicants, ten were chosen to test operational applications, including night flight, package and food delivery that are currently outlawed under existing United States regulation. These tests were limited to a specific geographic area, which was delineated and assessed through the application process. The US Department of Transportation has noted the imperative of integrating drones into American airspace, estimating a potential economic benefit of USD 82 billion and the creation of over 100 000 jobs (United States Federal Aviation Administration, 2018^[31]).

Safeguard mechanisms

Most regulatory sandboxes include safeguards or mechanisms to achieve overarching regulatory objectives, including with respect to consumer protection, safety and data governance. Some more prescriptive sandboxes outline the specific forms of products or services that can be tested through the sandbox in an effort to limit any potential negative consequences.

Analysis by the International Monetary Fund (IMF, 2017^[21]) on the characteristics of eight FinTech sandboxes in Australia, Canada, Hong Kong, China, Malaysia, Singapore, Switzerland, the United Arab Emirates and the United Kingdom found that all had some safeguards on the potential risks introduced by hitherto untested financial products and services on the open market. These safeguards included limits on the number of customers or value of services offered; additional reporting obligations or closer monitoring; additional consumer protection or risk mitigation; or the specification of regulations that could or would not be waived in the regulatory sandbox.

Other forms of regulatory sandboxes may determine that other safeguards are necessary. In the case of the regulatory sandbox operated by the Singapore Ministry of Health, relevant firms are obliged to bear the regulatory sandbox logo, and adhere to strict minimum standards with respect to health and data governance (Box 4).

Box 4. Licensing Experimentation and Adaptation Programme in Singapore

In 2018, Singapore's Ministry of Health has introduced the Licensing Experimentation and Adaptation Programme (LEAP), a regulatory sandbox initiative to enable the experimentation around new and innovative healthcare services in Singapore in a manner that safeguards public safety and welfare. LEAP allows the Ministry to closely collaborate with the industry to understand the risks of the new care delivery models early, so as to co-create a set of "fit-for-purpose" regulations for such new and innovative healthcare services. For example, in telemedicine, the Ministry sets the safety and service standards related to clinical processes, data protection policies, incident reporting and escalation timelines (WhiteCoat, 2018^[32]) and works closely with the telemedicine providers to develop the telemedicine regulations under the upcoming Healthcare Services Act.

Benefits of regulatory sandboxes

Regulatory sandboxes aim to support competitive innovation in the digital age, and enable the entrance of innovative, often digitally-enabled, products and services to the market. While an emerging regulatory mechanism with few systematic evaluations, regulatory authorities and participants point to a range of benefits of sandbox programmes. For firms, regulatory flexibility can enable live-market testing and market entry that would not have otherwise been possible. This can reduce the time to market for new innovations, driving consumer benefits and broader spillovers in the marketplace.

Reduced regulatory uncertainty and the ability to conduct testing can also help to facilitate financing for innovative firms. In a recent report, the United

Kingdom Financial Conduct Authority found that 40% of firms that completed the inaugural programme of its financial services sandbox received investment during or following sandbox testing (United Kingdom Financial Conduct Authority, 2017^[33]).

Some jurisdictions have also found that simply developing mechanisms like regulatory sandboxes can help to facilitate dialogue with new players in the market, including those from other sectors. An early survey of those that used the regulatory sandbox offered by the United Kingdom Office of Gas and Electricity Markets found that just 17% of the entrepreneurs who reached out for advice were already active in the energy sector (OFGEM, 2017^[34]). More generally, entrepreneurs may be limited in terms of resources and experience when dealing with regulatory authorities and regulatory sandboxes may serve as a mechanism to attract and inform such entrepreneurs.

For regulators, regulatory sandboxes can enable a closer relationship with innovative firms. This can help regulators gain insights from frontier innovators, which can in turn inform the process of policy making and regulation (OECD, 2018^[35]). For example, lessons learned from the Unmanned Aircraft Systems Integration Pilot Program are intended to help develop new enabling rules for more complex low-altitude operations for UAVs (Box 3) (United States Federal Aviation Administration, 2018^[31]).

Challenges of regulatory sandboxes

While regulatory sandboxes can bring benefits, a range of potential challenges could also emerge. For one, early or first-to-market innovations are by definition untested, and their potential risks can be difficult to predict. Further, as noted by Carney (2017^[10]), some digitally enabled innovations like platform-intermediated lending have not yet been tested in an economic downturn. While most sandboxes include extensive safeguards, digital innovations can introduce risks, however small or well-managed, to the market.

Further, in their current form, regulatory sandboxes are small-scale programmes that target relatively few firms that receive personalised advice, assistance and monitoring. Sandbox programmes may therefore put pressure on the time and resources of already over-burdened regulatory authorities. More generally, such programmes cannot scale well, thereby limiting any potential market-wide benefit. A report from the European Banking Institute (2017^[30]) notes the participants in the pioneering United Kingdom Financial Conduct Authority sandbox pale in comparison to the over 56 000 licensed financial market participants in the United Kingdom, and suggests the use of digital regulatory tools (“RegTech”) could be used to further widen access to the benefits of regulatory sandboxes.

Regulatory sandboxes are also typically developed and administered by regulatory authorities, which may not always be able to devote scarce resources in terms of people and skills to develop and implement a sandbox programme. At the same time, regulators are usually legislatively mandated to enforce regulations, promote competition, and ensure consumer protection in a particular domain (OECD, 2014^[36]). This could mean that digitally-enabled innovations that operate across two or more traditional sectoral areas may not fit easily into the remit of regulatory sandboxes, and such regulatory sandboxes may instead entrench sectoral divides.

For example, in countries where financial regulatory frameworks are structured around typical banking, pension and insurance sectoral divides and each has a regulatory sandbox, an emerging and innovative payment services model may not be eligible in any of them. Some countries are trying to overcome this challenge by involving more than one ministry (e.g. the Regulatory Sandbox in Korea programme) or by developing an overarching strategy to regulatory sandboxes that cuts across sectors and ministries (e.g. Germany's Regulatory Sandboxes Strategy (BMW, 2019^[37])).

Finally, there are some questions as to the efficacy of regulatory sandboxes. This may partly stem from their relative newness; indeed, the first sandbox-like initiative was created in 2012, and the term "regulatory sandbox" was not coined until 2015 (Jenik and Lauer, 2017^[38]). Rigorous, cross-country and cross-sector evaluation of sandbox programmes is sparse, making it difficult to unambiguously determine that they are always the best way to approach rulemaking (Allen, 2019^[39]).

One analysis of FinTech sandboxes, for example, suggests that while sandboxes are one way to enhance communication between regulators and innovative firms, other approaches of structured experimentation include class waivers for eligible products, leniency for testing and piloting, and sandbox umbrellas (i.e. a public sector body supported by stakeholder groups that helps set up a fully licensed development platform, run in the public interest, so as to further innovation) (Zetzsche et al., 2017^[30]). Others suggest that Innovation Hubs may be more effective in some circumstances (Buckley et al., 2019^[40]).

Annex. A selection of regulatory sandbox initiatives

Cross-sectoral sandboxes

France Expérimentation

Responsible entity: French Ministry of Economy and Finance

Description: France Expérimentation allows for regulatory exemptions to be made and for legal obstacles to be removed so that projects in any sector may be developed and tested (Direction Interministérielle de la Transformation Publique du Gouvernement Français, 2019^[41]). Accordingly, all innovative products and services are eligible for this sandbox initiative, and not just those based on new and emerging technologies. Projects span a wide range of sectors, including real estate, biotechnology, micro-credit, health, energy performance and waste treatment. Notably, one-quarter of the 85 projects submitted in 2017 were focused on environmental protection (Direction Générale des Entreprises du Gouvernement Français, 2017^[25]). For example, France Expérimentation has allowed SEDE Environnement, a subsidiary of the Veolia group, together with the National Federation of Agricultural Holders' Union (FINSEA), to tackle depleting natural resources and recycle water by developing an innovative irrigation solution that fertilizes crops by reusing wastewater.

Read more: <https://www.modernisation.gouv.fr/nos-actions/france-experimentation>

Germany's Regulatory Sandboxes Strategy

Responsible entity: German Federal Ministry for Economic Affairs and Energy (BMWi)

Description: The BMWi published a Regulatory Sandbox Strategy in December 2018. The Regulatory Sandboxes Strategy seeks to systemically establish regulatory sandboxes in Germany. It consists of three pillars: 1) fostering greater use and development of experimentation clauses, 2) providing information and networking to facilitate the creation of regulatory sandboxes (e.g. by a regulatory sandbox handbook and a regulatory sandbox network), and 3) launching and supporting regulatory sandboxes through competitions or support for specific projects. The strategy does not focus on one specific field of innovation, but rather concentrates on regulatory sandboxes as a cross-cutting instrument useful for different fields of innovation.

Read more: <https://www.bmwi.de/Redaktion/EN/Publikationen/Digitale-Welt/handbook-regulatory-sandboxes.pdf?blob=publicationFile&v=2>

Mauritius Regulatory Sandbox License

Responsible entity: Mauritius Economic Development Board (MEDB)

Description: The Regulatory Sandbox License operated by the MEDB was officially launched in 2016 and is intended to operate in areas in which there are no existing laws or regulation. While many of the projects involve financial products and services, it is available for innovations in general. One of the criterion for eligibility when applying to this sandbox programme is the need to contribute to the development of local skills and know-how in Mauritius. In particular, projects that foster the Mauritian economy, including greater accessibility, efficiency, security, reliability or effectiveness in the provision services and products in diverse sectors, are prioritised (ASIC, 2016^[42]).

Read more: <https://www.edbmauritius.org/schemes/regulatory-sandbox-license/>

Regulatory Sandbox in Korea

Responsible entity: The Ministry of Science and ICT; the Ministry of Trade, Industry and Energy; the Financial Services Commission; and the Ministry of SMEs and Startups

Description: In 2019, Korea launched the Regulatory Sandbox in Korea programme to facilitate new business models. Korea's regulatory sandbox centres are speeding up the process of winning approvals by paving the way for firms to launch new services and goods first, and apply appropriate regulations later. It contributes to regulatory innovations, such as prompt handling, exceptions to substantiation regulations, and temporary permissions. The Regulatory Sandbox in Korea programme is implemented in a wide range of industries including the ICT sector, industrial convergence, and regional innovation. So far, the programme has includes projects that involve key parts of the digital technology ecosystem (e.g. AI, big data, 5G and blockchain).

Read more: <https://www.sandbox.or.kr/>

Energy

Innovation Link

Responsible entity: The United Kingdom Office of Gas and Energy Markets (OFGEM)

Description: In February 2017, OFGEM (2017^[34]) launched a regulatory sandbox programme called Innovation Link for innovators in the energy market, enabling them to trial innovative business products, services and business models that cannot currently operate under existing regulations. The idea for OFGEM's sandbox derives from the field of software development where new code can be tested in

a controlled setting, without impacting the performance or security of the wider software programme. Since its launch, 67 applications were made across the first two test windows of February 2017 and October 2017. Out of these applications, seven were awarded sandboxes (OFGEM, 2018^[43]) (OFGEM, 2018^[44]). Innovation Link offers bespoke guidance and continual feedback throughout as projects develop, especially in terms of navigating energy sector regulations. Past projects include peer-to-peer energy trading and innovative tariff systems.

Read more: <https://www.ofgem.gov.uk/about-us/how-we-engage/innovation-link>.

AEMC's Regulatory Sandbox

Responsible entity: The Australian Energy Market Commission (AEMC)

Description: The AEMC (2019^[45]) (2018^[46]) has proposed the creation of a regulatory sandbox initiative to foster the potential uptake of innovative energy technologies and business models. The sandbox environment would convene interested parties to enable proof-of-concept trials and deliver solutions in the best interest of energy consumers in Australia. The aim is to lower costs and increase the benefits for consumers in the transition to renewable energy.

Read more: <https://www.aemc.gov.au/news-centre/media-releases/aemc-recommends-new-regulatory-sandbox-arrangements>.

Financial services

MAS' FinTech Regulatory Sandbox

Responsible entity: The Monetary Authority of Singapore (MAS)

Description: In 2016 the MAS (2016^[23]) introduced the FinTech Regulatory Sandbox which allows financial institutions to experiment with innovative business ideas in a live environment with relaxed regulatory requirements. During the experimentation phase, this sandbox initiative upholds appropriate safeguards to mitigate any risks to consumer protection and safety. During the application process for this sandbox, each applicant may request for multiple legal and regulatory requirements to be relaxed. Depending on each proposal, MAS considers which requests can be approved.

Read more: <https://www.mas.gov.sg/development/fintech/regulatory-sandbox>.

FCA's Regulatory Sandbox

Responsible entity: The United Kingdom's Financial Conduct Authority (FCA)

Description: Since 2016, the FCA (2019^[47]) has offered a regulatory sandbox that allows firms to experiment with new products and services in a controlled live

market environment without impacting the financial system. This programme, which started in June 2016, operates biannually with two six-month test periods per year. Since its launch, 89 firms were accepted to test their business models and products, with the majority of firms being start-ups. It is suggested that the FCA's regulatory sandbox provides significant value to firms testing their products by mitigating any risks their products may have, as well as by bolstering the firms' credibility with potential investors and consumers (Deloitte, 2018^[48]).

Read more: <https://www.fca.org.uk/firms/regulatory-sandbox>.

LaArenera

Responsible entity: Financial Superintendence of Colombia (*Superfinanciera*), Ministry of Finance and Public Credit

Description: In 2018 Colombia's *Superfinanciera* (2019^[49]) launched a strategy for the promotion of sustainable and responsible innovation in the financial sector. *LaArenera* is a sandbox that is part of this strategy, and it allows firms to test new technological innovations and business models under appropriate supervision. A recent study by the Inter-American Development Bank noted the recent surge in FinTech developments across Latin America, with Colombia being third, after Brazil and Mexico, in the number of companies and initiatives engaging in FinTech as of 2018 (Instituto Nacional de Contadores Públicos de Colombia, 2019^[50]). One of *LaArenera's* principle aims is to contribute to financial inclusion mechanisms by promoting business models for payment and remittance services as well as finance management services for individuals and small and medium enterprises (SMEs).

Read more: <https://www.superfinanciera.gov.co/publicacion/10097165>.

HKMA's FinTech Supervisor Sandbox

Responsible entity: The Hong Kong China Monetary Authority (HKMA)

Description: In 2016, the HKMA (2019^[51]) launched its FinTech Supervisor Sandbox (FSS) to provide a testing environment for banks and tech firms to innovate and create new FinTech products with relaxed supervisory requirements. From 2016 until June 2019, 62 new products and services have been tested as part of the pilot trials, of which 34 have been successfully introduced to the market. In HKMA's FSS, regulatory technology (or "RegTech") was the most tested type of technology. RegTech is considered to hold great potential for improving the interrelation between banks and regulators in Hong Kong China due to its capability of enhancing regulatory processes in the financial sector (Deloitte, 2019^[52]).

Read more: <https://www.hkma.gov.hk/eng/key-functions/international-financial-centre/fintech/fintech-supervisory-sandbox-fss/>.

ADGM's Digital Sandbox

Responsible entity: The Abu Dhabi Global Market (ADGM)

Description: The ADGM's (2019^[53]) Digital Sandbox initiative was launched in 2018 and allows the FinTech industry to innovate, test and develop new products in a secure environment. The Digital Sandbox is supported by the Financial Services Regulatory Authority (FSRA). It aims to spur innovation in financial and digital products and services to advance ADGM's financial inclusion agenda to better serve marginalised portions of the population across the Middle East and North Africa (MENA) region. By addressing shared FinTech challenges, this sandbox initiative supports the creation of Application Programme Interfaces (APIs) APIs, system virtual machines, data and applications. Moreover, ADGM has stated its partnership with the ASEAN Financial Innovation Network (AFIN) to bring closer collaboration between the MENA and Asia-Pacific region through the use of the global API Exchange (APIX) platform. This move will enable sandbox participants to tap into international markets for opportunities to further grow and innovate products and services.

Read more: <https://www.adgm.com/setting-up/digital-sandbox/overview>.

RBI's Regulatory Sandbox

Responsible entity: The Reserve Bank of India (RBI)

Description: In August 2019, the RBI (2019^[54]) released a report outlining the objectives of their own regulatory sandbox. In a similar way to others, this sandbox allows for the live testing of new digital innovations in a controlled environment with the view of developing financial services in India to benefit consumers and advance efficiency of its financial sector. Notably, however, cryptocurrency is one of the areas of finance which RBI has not been included in the regulatory sandbox (The Economic Times, 2019^[55]).

Read more: <https://www.rbi.org.in/Scripts/PublicationReportDetails.aspx?UrlPage=&ID=938>.

Health

Licensing Experimentation and Adaptation Programme

Responsible entity: The Ministry of Health of Singapore

Description: In 2018 the Ministry of Health of Singapore (2018^[56]) introduced the Licensing Experimentation and Adaptation Programme, a regulatory sandbox initiative to enable safe experimentation around new and innovative healthcare services in Singapore. The sandbox was first introduced to support the emergence of telemedicine, and allows regulators to work with providers to understand the operating model and associated risks, and develop regulations.

Read more: [https://www.moh.gov.sg/our-healthcare-system/licensing-experimentation-and-adaptation-programme-\(leap\)---a-moh-regulatory-sandbox](https://www.moh.gov.sg/our-healthcare-system/licensing-experimentation-and-adaptation-programme-(leap)---a-moh-regulatory-sandbox)

Information and telecommunication technology (ICT)

Sandbox Notification

Responsible entity: Thailand's National Broadcasting and Telecommunications Commission (NBTC)

Description: The NBTC has established a sandbox programme to facilitate technology testing for the adoption of 5G in Thailand (Baker McKenzie, 2019^[57]). This entails an area-based regulatory sandbox, whereby experimentation in locations designated by the NBTC are not subject to existing regulations and requirements (NBTC, 2019^[58]). While aiming to facilitate 5G technology trials using 700MHz, 2600MHz and 26GHz frequency bands, this regulatory sandbox is open to interested parties beyond the ICT industry. The testing of this new technology can open up new avenues for digital businesses such as tele-medical services, smart agriculture, remote monitoring, smart power grids and autonomous vehicles.

Read more: <http://www.nbtc.go.th>

Arcep's regulatory sandbox

Responsible entity: French Telecommunications Regulation Authority for Electronic and Postal Communications (Arcep)

Description: Arcep has deployed a regulatory sandbox allowing players to experiment with innovations supported by 5G technology under a temporarily relaxed regulatory framework for a period of up to two years. Innovative projects are based on the frequency band allocated by Arcep, which is looking to identify new use-cases for the technology. Examples of the regulatory sandbox include using the 2600 MHz TDD frequency band to allow real time video streaming from RATP trains to the control station with long-term evolution broadband technology (Arcep, 2018^[59]).

Read more: <https://archives.arcep.fr/index.php?id=13816>

Transport

K-City

Responsible entity: The Ministry of Land, Infrastructure and Transport, Korea

Description: K-City was established in 2018 by the Korean Ministry of Land, Infrastructure and Transport to be the world's first test site for autonomous vehicles based on 5G networks. This 'virtual city' will act as an ideal test bed for SMEs and universities to test their self-driving technology in a real road environment. On a total surface area of 320 000 square meters, K-City will contain numerous road infrastructure simulations, such as toll gates and train track crossings, to test the use of artificial intelligence and collision avoidance systems as well as other breakthrough technologies (Research Centre for Autonomous Road Vehicles, 2018^[15]) (Business Korea, 2018^[60]).

Read more: <https://www.imnovation-hub.com/digital-transformation/k-cit-test-bed-fo-driverless-cars/>.

Unmanned Aircraft System Integration Pilot Program

Responsible entity: The United States Federal Aviation Administration

Description: In May 2018, the United States Federal Aviation Administration (2018^[31]) (FAA) announced the Unmanned Aircraft System Integration Pilot Program to test the safe application of UAVs, also often referred to as drones, over a period of two and a half years. Private sector applicants were invited to partner with state, local or tribal governments in order to apply for a waiver from United States airspace regulation to test UAVs for a period of 30 months. The Pilot Program received 149 proposals, out of which 10 were selected and put into operation. This data collected and the lessons learned from this program is intended to help the FAA and the United States Department of Transport generate new enabling rules related to UAVs, particularly in terms of privacy and security regulation.

Read more: https://www.faa.gov/news/press_releases/news_story.cfm?newsId=22755.

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