FINTECH

NOTES

Institutional Arrangements for Fintech Regulation: Supervisory Monitoring

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Acronyms

ASIC .... Australian Securities and Investments Commission

API……….. Application Programming Interface

ASEAN……Association of Southeast Asian Nations

BFA .... Bali Fintech Agenda

DLT............ Distributed Ledger Technology

EMDE........ Emerging Market and Developing Economies

FCA .... UK Financial Conduct Authority

KYC........... Know Your Customer

RegTech ... Regulatory Technology

SupTech.... Supervisory Technology

TechSprint..Technology Sprint

Executive Summary[1]

Reflecting potential efficiency and inclusion gains, technology-enabled innovation in financial services (fintech)[2] has increased greatly over the past decade, and a regulatory response is needed to ensure that new risks are promptly and accurately identified and addressed. Fintech is being used across financial services to generate efficiencies and lower costs for firms, improve compliance (RegTech), and help regulatory authorities achieve their objectives (SupTech). Importantly, fintech is having an impact on markets worldwide in both advanced economies and emerging market and developing economies (EMDEs).

In many jurisdictions, the use of fintech is driven by start-ups; in others, it is most often deployed by large technology conglomerates (BigTech) and incumbent financial institutions. Regulatory responses should identify and address the risks generated by fintech, and the approach should be tailored to the nature of the fintech innovation and its impact on financial services provision.

Where fintech is used to deliver existing products or services at lower costs and/or in superior ways, a technology-neutral approach to regulation might sensibly manage risks. Where products and services change considerably due to the impact of fintech, new bespoke regulation provides a better approach. Where fintech has spurred new business models or the technology has generated new risks, a "test-and-learn" approach has been used to better understand these new technologies. This note summarizes existing key institutional arrangements for fintech regulation with a focus on supervisory monitoring, covering risks, particularly where these might affect financial stability (Table 1).

To determine the size and type of new risks generated by fintech, it is important for authorities to closely monitor developments. Fintech can affect market conduct and integrity, and financial system soundness in several ways. If the use of fintech grows rapidly outside of the regulated sector, it can generate risks to market conduct and integrity if developments aren't sufficiently monitored and regulatory action taken (for example, crypto asset markets, where the lack of conduct and prudential regulation has led to significant user losses and market manipulation). Fintech can affect the wider financial system through the interconnectedness of start-ups or BigTech with regulated financial institutions, with the latter partnering or outsourcing certain elements of their business (for example, the use of cloud computing). Finally, new fintech developments might quickly become systemic due to network effects (for example, when BigTech provides financial services). To manage risks, authorities need to monitor new developments effectively.

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[2] Fintech refers to technology-enabled innovation in financial services. We do not refer to firms as fintechs, nor do we refer to fintech activities, because these are often traditional activities that use new delivery mechanisms (i.e., fintech).

In most jurisdictions, existing supervisory structures can support the effective monitoring of new developments. Supervisors generally have established relationships with regulated entities and can identify risks and gather insights related to fintech developments in a timely manner. Supervisory teams often have a sound understanding of financial markets and can call on subject matter experts where necessary. This allows supervisors to triage new developments and risks and prioritize accordingly, contextualizing fintech developments with other risks to the broader financial system. Existing supervisory structures can also embed fintech expertise within the team or make use of engagement touchpoints like demonstration days to improve monitoring of new trends and developments. The goal for authorities should be to consider fintech as part of their broader work rather than a standalone discipline.

Existing supervisory structures work best where fintech developments are limited, resources are constrained, or fintech is considered part of the mainstream due to maturation and large-scale adoption. In jurisdictions where the fintech ecosystem is small or growing slowly, existing supervisory structures can support effective oversight of new developments and risks. Likewise, where fintech development is led by regulated financial institutions, supervisory teams are best placed through their existing supervisory portfolios to monitor new risks. This is also the case where adoption is spread across sectors and borders and has matured into the mainstream with little distinction between fintech-enabled innovation and mainstream financial services. In such cases, existing supervisory structures will likely be able to capture new risks effectively. This may also be the best approach when an authority has constrained resources, since monitoring carried out within existing structures would avoid diverting resources from areas of greater priority. Measures may also be taken to dampen growth through targeted restrictions.

Innovation hubs can play a role in improving supervisory monitoring but should not be considered a panacea. Where the impact of fintech is growing rapidly and is poorly understood, the use of regulatory touchpoints like innovation hubs is a sensible step to strengthen monitoring, improve understanding, and provide feedback to firms. Interagency innovation hubs might be particularly useful in jurisdictions with multiple-sector or regional regulators. In these jurisdictions, the evolving nature of fintech might justify new institutional arrangements even within a steady state. However, successful innovation hubs require feasibility studies, the development of clear objectives, and strong organizational buy-in. They can be costly and could divert resources from other priority areas; where inherent structural deficiencies in supervisory structures exist, they could amplify those weaknesses.

In some jurisdictions, approaches like sandboxes can support supervisory monitoring under certain conditions. Sandboxes are resource-intensive hypothesis-led initiatives that allow firms to test innovative propositions with real consumers in a controlled environment. Where resources are available and fintech developments are likely to have a considerable impact on existing regulation, sandboxes allow authorities to monitor developments closely and can help them to get comfortable with new technologies and business models. Sandboxes, however, are expensive and diverse in design, and require significant resources dedicated to supporting a small number of firms. Other tools, like TechSprints, can also help inform regulatory authorities of new fintech-enabled developments. Used as monitoring tools only, existing supervisory structures and touchpoints like innovation hubs are likely to deliver better outcomes.

Regardless of the institutional arrangement, appropriate deployment of specialist resources within authorities can serve multiple important goals, such as helping to monitor and respond to risks properly, supporting a better mapping of innovative technology to supervisory needs, and assisting firms in developing fintech-based propositions.

Where the fintech ecosystem is growing at pace and authorities need to get a better understanding of how fintech might affect the financial system, specialist resources are needed to better monitor and respond to risks. In most cases, this specialist resource can—and should—be embedded into existing supervisory structures, both when it is being used to monitor the impact of fintech on financial markets and when authorities are using technology to improve their own capabilities (SupTech).

While data scientists in authorities around the world have created interesting and innovative projects, these often fail to reach production within frontline supervision teams. Embedding data scientists within frontline supervision teams can allow them to better identify the needs of supervisors.

For many authorities, the most important next step is one of bringing fintech into the mainstream, which, if successful, can help them and firms to develop fintech-based propositions. Moving in this direction would mean equipping policymakers and supervisors with training on key fintech developments in local and global markets.

Collaboration with regulatory peers and international bodies strengthens monitoring. Given the cross-border nature of fintech, new technologies, business models, and products and services driven by fintech are likely to affect financial markets across borders. The ability to share information and insights and exchange learnings and best practices can help authorities—particularly those with less fintech expertise or resource availability—to better monitor new fintech developments, understand emerging risks, and create frameworks to mitigate these risks while harnessing their benefits. Such collaboration can be bilateral with close regulatory peers, through technical assistance programs led by international organizations, or multilateral through standard-setting bodies and other organizations. International cooperation is a necessity—regardless of other considerations of institutional arrangements.

Table 1. Pros and Cons of Institutional Arrangements for Fintech Regulation

Institutional Arrangement	Factors for Application	Benefits	Risks
Existing Supervisory Structure	• Can be used to monitor and respond to most regulatory and supervisory challenges of fintech regulation • Particularly useful where fintech is being deployed by regulated firms • Where fintech is mature, using existing supervisory structures can allow fintech to be contextualized within broader work • First step to tackling challenges of fintech regulation and supervision using existing resources • Ideal end goal where fintech is not considered a separate discipline	• Makes use of existing structures and resources, thereby cost effective • Immediate engagement with innovators, as opposed to setting up new structures • Likely to deliver most benefits of specialist institutional arrangements like innovation hubs and sandboxes • Already has links to other parts of the regulatory authority • Existing links with global peers	• Lack of specialist resource under existing supervisory structures • Supervisors are required to be trained to identify risks and benefits of new technologies, but training could be crowded by with other competing priorities • Limited testing ability • Given the evolving nature of fintech, where innovation is happening rapidly and continuously across multiple sectors, there might be a stronger rationale for new institutional arrangements even in a steady state • Potential regulatory arbitrage, especially when an activity does not fit neatly into one supervisory agency or within any authority's regulatory framework
Innovation Hub	• First step when using specialist resource • Can be used to provide light-touch support to a larger number of entities • Often used where fintech is being deployed rapidly • Primarily used for outreach and engagement	• Dedicated resource can better engage with innovator community and entities operating outside the regulatory perimeter to monitor developments • Regulatory authorities can better attract and retain specialist resources • Platform to provide guidance to entities • Useful platform to engage directly with innovation hubs globally	• Requires new institutional arrangements that can be costly and time-consuming • Requires organizational buy-in • Less additional value added where fintech is deployed only by regulated firms • No testing ability • Providing guidance can generate reputational risks

			• Potential regulatory arbitrage in the absence of a joint innovation hub when an activity does not fit neatly into one supervisory agency
Regulatory Sandbox	• Deployment of substantially new technologies, products, or services • Used to test new technologies and business models in a controlled environment • Can be implemented after an innovation hub	• Testing allows for lessons to be learned that can inform policymaking • When implemented correctly, sandboxes might allow products to come to market quicker • Allows authority to understand new technologies and business models in depth • Regulatory authorities can better attract and retain specialist resources	• Unclear vision and goals can result in poor outcomes and reputational risk • Lower standards of design can generate risks to users, markets, and financial stability • Costly to set up and maintain • Supports only a small number of entities at any given time • Requires deep organizational buy-in • Long-term impacts on market are untested • Protection of intellectual property rights • Potential regulatory arbitrage in the absence of a joint sandbox when an activity does not fit neatly into one supervisory agency
TechSprint	• Providing solutions to clear problems that require a critical mass to solve • Primarily used to solve problems related to RegTech or SupTech	• Can quickly produce solutions to difficult regulatory problems	• Generates theoretical proof of concepts only • Requires access to accurate data, either real or synthetic • Costly and resource intensive • Requires internal and external buy-in

Introduction

The use of technology in financial services is not a new phenomenon, but recent developments have increased its pace, scope, and impact. While the financial services sector has historically been at the cutting edge of technological innovation, a combination of factors driving this current generation of fintech separates it from previous innovations, including enabling technologies in the form of increasing internet and smartphone availability around the world; the democratization of finance; the availability and use of big data; and the existence of enabling policies, such as data protection, cybersecurity standards, and open banking.

New technology can propel efficiency when it lowers costs for firms and can promote inclusion when these efficiencies are passed on to end users and when they enable an expansion of service provision to a wider cross-section of society. Using the internet as a foundation, enabling technologies like machine learning, distributed ledger technology (DLT), distributed computing, cloud computing, biometrics, and application programming interfaces (APIs) have led to new methods of design, development, and delivery of new and existing products and services to a larger number of consumers. It has allowed for the creation of new ways of carrying out traditional financial services, including robo-advice and WealthTech, e-money and digital payments, crypto assets and decentralized finance, dynamic fraud detection, crowdfunding and peer-to-peer lending, digital banking, and InsurTech.

Fintech can facilitate financial inclusion, albeit supporting effort by authorities may be essential to securing such social gains. For example, the growth of mobile money in Ghana has increased the access to financial services of previously unbanked demographics, particularly adults in rural areas: 35 percent of adults in rural areas report having used the service between 2014 and 2017 (Pazarbasioglu and others 2020). However, the rapid pace of digitization has created a danger of leaving some parts of the population behind, particularly where digital literacy is low or the availability of the underlying infrastructure is underdeveloped.

Activities supported by fintech are delivered by both new and existing entities. Much of the early fintech revolution was delivered by smaller so-called fintech start-ups and larger fintech-driven firms. More recently, fintech is increasingly being used by digital native entities like large technology conglomerates, initially based outside of financial services (commonly known as BigTechs), and by regulated incumbent financial institutions such as banks, insurers, and asset managers that are shifting toward more digital models of operation.

The development and implementation of fintech has differed across jurisdictions in terms of size, speed, and areas of focus. In many jurisdictions, fintech innovation occurs initially in the payments space, particularly where existing payments infrastructure might be slower or more cumbersome.

The use of new technologies in financial services can also generate new risks. New technologies can allow entities to set up operations more easily in one jurisdiction and market their services globally,

making regulation and supervision challenging. The provision of cloud computing has the potential to shift risks from regulated financial institutions to entities that are not as well regulated, such as BigTechs. Where a small number of entities provide services, concentration risks may arise. The use of digital identification can alter the balance between preserving privacy and maintaining access to finance. APIs with poor security architecture could lead to leaks of potentially sensitive data. Excessive use of complex data-driven algorithms could potentially lead to biases and discrimination as well as challenges to explainability[3] and accountability. Often, the use of labels and marketing can obfuscate the underlying goals and capabilities of a product or service; for example, many types of stablecoins are neither stable nor coins, while certain decentralized networks are often heavily centralized.

Global standards are important to developing national regulatory frameworks. While global standard–setting bodies take a technology-neutral approach to fintech regulation, new technologies can challenge these assumptions. The notion of "same risk, same regulation" might be replaced with "same risk, same regulatory outcome." Comprehensive, coordinated, and consistent global standards are important to managing risks to users, markets, and financial stability. But new technologies provide new challenges. While global standards are being developed, targeted and pragmatic local regulation with active cross-border and cross-sectoral cooperation are important to managing risks.

A fintech strategy is important in delivering good outcomes that are consistent with public mandates. In most jurisdictions, a fintech strategy is set at the government level, frequently led by the Ministry of Finance, and delivered by central banks, sector regulators, and other relevant stakeholders in line with their mandates. Open consultations should ensure that the views of a cross-section of interested stakeholders are taken on board. Domestic collaboration among relevant authorities is indispensable to achieving good outcomes and for authorities to meet their public policy objectives.

Regulatory authorities have responded in differing ways to challenges generated by fintech. For fintech regulation and supervision, authorities have generally responded in five ways and in many instances by moving between these approaches as mandates have expanded, risks have increased, and markets and policy objectives have evolved. These five approaches are not mutually exclusive, and some can be carried out in parallel, but a sequential approach that results in clear outcomes is preferred. Outcomes will depend on several factors, including the level and areas of fintech deployment, supervisory capacity, impact on markets, risks, end users, and financial stability. The five main approaches are as follows:

- **Wait and see:** In jurisdictions where there is little to no use of fintech, many authorities have adopted an active wait-and-see approach. In these instances, authorities allow some small development of fintech-driven products and services outside of the regulatory perimeter. At the same time, authorities closely monitor developments to understand if, or when, the impact of fintech grows to a size that might generate risks to consumer protection, market integrity, financial integrity,

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[3]   Explainability is the process by which a decision made by a machine learning model from input to output can be explained by, and to, a human in ways in which a human can understand.

and/or financial stability. Some jurisdictions with growing fintech ecosystems and low regulatory resources have also adopted an active wait-and-see approach to determine when fintech generates unacceptable risks or obstacles to their authorities' mandates.

- **Test and learn:** In jurisdictions where the use of fintech is diverse and growing quickly, a test-and-learn approach has been successfully used. This approach involves the use of custom frameworks to allow the authority to be exposed to different technologies and business models in a controlled environment. Examples include innovation hubs, regulatory sandboxes, and TechSprints. The test-and-learn method allows authorities to gain a more accurate understanding of the impact of new technology on policy.

- **Adjust existing frameworks:** In many instances, existing regulatory frameworks are receptive to new technologies and may need only small changes to account for different risks generated by fintech. This is known as a technology-neutral approach[4] and works on the principle of same activity, same risk, same regulation. This approach is commonly used where products or services using fintech are similar to those already within the regulatory perimeter. Examples include some jurisdictions' response to crypto assets, where, despite the absence of bespoke crypto asset regulation or dedicated legal frameworks, securities, banking, and payments regulation are being used in instances where a crypto asset has design features akin to their traditional counterparts.

- **Bespoke regulation:** Where fintech creates unique opportunities, new risks, or novel products and services that do not fit neatly within existing regulatory frameworks, a bespoke regulatory regime might be necessary. This approach is suitable for jurisdictions where fintech has had a considerable impact on the ability of authorities to achieve their mandates, due to growth either in one sector or across financial services. Bespoke regulation can fill policy gaps created by fintech or remove outdated prudential or conduct rules. Examples include the implementation of open banking to support the opportunities created by APIs and big data (European Union, UK, Australia), and bespoke regulation to manage risks of peer-to-peer lending (Brazil), crypto assets (Albania, European Union, Japan), and e-money (Indonesia).

- **Bans or targeted restrictions:** In some instances, authorities might ban or restrict certain entities, activities, or technologies. This is done when there is significant risk to an authority's public policy objectives. Frequently, bans and targeted restrictions are enacted on certain activities, for example, China's ban on a variety of activities related to crypto, Spain's targeted restrictions on certain crypto marketing, or the UK's approach to limit certain crypto derivatives. At times, bans or restrictions might be imposed on types of entities, most commonly when an entity has contravened existing regulatory or legislative frameworks. Technologies are rarely banned, although their use in certain activities might be restricted. For example, the desire for explainability and human oversight in machine learning in financial services could restrict its potential application financial markets.

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[4] While regulation might be technology neutral, supervision would likely involve determining the specific risks that new technologies might generate.

To best understand which approach to take, and in line with the Bali Fintech Agenda (BFA), authorities need to be in a position to effectively monitor market trends and developments. The use of fintech is growing and diversifying rapidly in many jurisdictions, and a significant proportion of this innovation is developed by unregulated entities that either will require licensing or will provide services to licensed entities. A key building block for any monitoring is the collection and access to sufficiently informative data sources that allow an evaluation of emerging risks. Access to such data can differ among jurisdictions and should be a first step to identifying risks and determining regulatory responses. Jointly with the World Bank, the IMF has developed a framework, the BFA, to help guide authorities in their response to fintech developments (IMF, 2018). The BFA consists of 12 policy elements and aims to guide authorities in harnessing the benefits of new technologies in financial services while mitigating any risks; it encourages competition, consumer protection, financial integrity, and financial stability.[5]

To effectively respond to new developments, authorities have several options for supervisory monitoring. Four broad approaches were identified to improve access to data, monitor new developments, and help determine regulatory responses. These should be thought of as complementary and can be implemented in their entirety sequentially or in parallel, or they can be limited to a subset, depending on desired outcomes and local needs and circumstances.

- **Existing supervisory structures:** In most jurisdictions, existing supervisory structures are built to gather insights and monitor developments through both continuous engagement with regulated entities and targeted outreach, as well as by analyzing regulatory returns to better understand acute areas of risk. Supervisors have knowledge across a range of domestic and international regulatory frameworks to discharge their authority's mandates.

- **Innovation hubs:** These are specialized teams or units that focus primarily or exclusively on the impact of fintech in financial markets through monitoring trends and developments and providing support to firms (both regulated and unregulated). These dedicated units act as a central contact point for firms wishing to deploy innovative technologies in financial services, particularly in the earlier stages of product development. The support can differ across jurisdictions but tends to be relatively light, using tools such as guidance, informal steers, or signposting to relevant regulations.

- **Sandboxes:** These provide for a controlled environment for firms to test their innovative propositions with real consumers. Product-testing sandboxes are used more often by firms that are ready to bring a product to market and allow authorities to understand how new technologies and business models interact with existing regulatory frameworks. More recently, newer sandbox designs have been developed, such as digital sandboxes that allow firms at a proof-of-concept

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[5] The BFA specifically mentions "monitoring fintech developments closely to deepen understanding of evolving financial systems to support the formulation of policies that foster the benefits of fintech and mitigate potential risks" (policy element V), "adapting [the] regulatory framework and supervisory practices for orderly development and stability of the financial system and facilitating the safe entry of new products, activities, and intermediaries; sustain trust and confidence; and respond to risk" (policy element VI), and "enhancing [the] collective surveillance of the international monetary and financial system" (policy element XII).

stage to grow their innovative propositions with real or synthetic data, and policy sandboxes that allow regulators to test new regulations on a limited number of firms. Sandboxes are more often likely to be used where technologies and business models are substantially novel and require regulatory authorities to have a greater understanding of risks and benefits. They are seldom designed to support systemically important products or services such as market infrastructures, given the complexity of designing appropriate testing frameworks and the level of risk should a test fail, but there are exceptions.[6]

- **TechSprints:** TechSprints are not exactly an institutional approach but a tool; these refer to technology-focused design sprints that convene participants to solve common problems.[7] Participants collaborate intensively over a short period on a particular problem statement. They are more likely to be focused on RegTech or SupTech propositions and aim to help regulators understand how new technologies are being used to solve existing problems. More recently, policy sprints have been used as a new way of broadening consultation with stakeholders. TechSprints are covered in Annex II.

International collaboration is always desirable, independent of the other approaches, and can be an effective way to monitor developments. Many authorities can monitor new developments through domestic collaboration and through cooperation with international regulatory peers—either bilaterally through ad hoc meetings, via fintech cooperation agreements, by leveraging technical assistance provided by international organizations *or* multilaterally through global and regional bodies, including standard-setting bodies.

This Fintech Note provides further insights on the four approaches listed previously to monitor fintech developments and respond to the associated challenges. It builds on previous IMF publications on this topic (Taylor and others 2020) by covering recent developments and providing a deeper dive into the features of each of those approaches as well as their benefits and costs. The note aims to help authorities and supervisors, tasked with understanding and responding to fintech developments in their jurisdictions, ensure that they can monitor developments before these generate systemic risks. It shares experiences and emerging good practices with tools deployed by various regulatory authorities to strengthen fintech surveillance and monitoring techniques.

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[6] In particular, the development of policy sandboxes to test financial market infrastructures—such as DLT financial market infrastructure sandboxes—is likely to introduce new risks and will require new designs and frameworks. For example, the EU DLT Pilot Regime will allow testing for up to six years.

[7] The concept of a TechSprint has been expanded to include so-called policy sprints, which are largely devoid of the technology element and convene stakeholders to discuss policy-focused problem statements in a time-constrained environment with the aim of clear outcomes. While still in an early phase, it is not immediately clear these can deliver outcomes beyond existing forms of engagement.

I. Existing Supervisory Structures

The mandate for fintech regulation and supervision can be covered by a wide range of institutional structures. In some jurisdictions an all-in-one integrated authority oversees fintech regulation; other jurisdictions employ a "twin peaks" model of prudential and conduct regulators; still others have different sector or regional regulators take the lead. These authorities are likely responsible for delivering several objectives, including financial stability, consumer protection, market integrity, and financial integrity. To fulfill these objectives, often through frontline supervision, authorities need tools to monitor and supervise the activities that fall within their mandate. Risk-based supervision should take into account in a forward-looking manner the rapid growth and changes in business models and in risk characteristics.

Existing supervisory structures are an important way of monitoring developments and responding to challenges generated by fintech. These structures tend to have well-defined roles and practices and are designed to support organizational mandates and objectives. The role of supervision tends to be well understood across a regulatory authority needing little extra buy-in to leverage additional or specialist support. In addition to oversight of regulated firms and markets, imposing clear requirements on outsourcing and third-party exposures might provide enhanced oversight of unregulated entities and services. Supervisors should have access to regulatory tools allowing them to identify and mitigate risks before they crystallize. A benefit of using existing supervisory structures is that supervisors are experienced in surveillance and in monitoring developments in regulated markets.

Having a general understanding and overview across financial services allows supervisors to triage risks and prioritize those that are more significant to the authority's mandate. Supervisors contextualize risks and determine where resources are most needed and impactful—fintech will often form one element of a broader picture. Where specialist knowledge is required, supervisors make use of in-house specialized teams or leverage that knowledge from different parts of the organization.

Supervisory authorities have well-established engagements with regulated firms; these engagements enhance their horizon scanning abilities. Regular supervisory engagement allows authorities to develop interactions across financial services, particularly compliance and risk management teams in regulated firms. This is important as supervisors need to be aware of new products or services prior to launch and can advise on whether the use of new technologies in these products or services fits within regulatory frameworks and act where they do not. This helps firms build compliant business models and minimizes risks to markets, consumers, investors, and financial stability. Ultimately, it is the firm's responsibility to develop compliant business models.

In jurisdictions where the impact of fintech remains small, and where fintech is mostly deployed by regulated entities, existing supervisory teams can monitor developments effectively. The use of fintech remains small in many jurisdictions. In these cases, it may not be necessary to develop specialized teams because effective monitoring can be conducted through existing supervisory structures by nonspecialized staff. Setting up new specialized units or teams might entail a costly and unnecessary redeployment of

supervisory resources that might be better reserved for other priorities. In addition, in some jurisdictions most fintech innovation is developed and deployed by regulated entities like banks and insurers. In this case, supervisors are likely to have already established engagement that facilitates the oversight of new products and services.

An approach based on existing supervisory structures can also be sensible in jurisdictions where fintech has matured into the mainstream. Where fintech has grown to a level where it is considered part of the operations of financial institutions, it should also be supervised as such. Fintech should be considered part of a supervisor's normal duties, and supervisors will be expected to have broad knowledge of the impact of new technologies on financial markets. In this scenario, supervisors should receive training and maintenance of knowledge to ensure they are able to effectively carry out their duties. It is a particularly useful approach in countries that have taken an entity-based approach to regulating fintech.

Existing supervisory structures can be strengthened with specific fintech outreach and engagement. Most supervisory teams take a combination of proactive and reactive approaches to monitoring developments (Box 1). Authorities can supplement a business-as-usual approach with fintech-specific initiatives such as demonstration days and themed events. Demonstration days involve inviting entities developing products and services enabled by fintech to present their propositions to supervisory teams. This reduces the cost and reputational risk of the authority going into the fintech ecosystem and provides useful intelligence. Authorities can also use themed events to gather insights and create fintech-specific seminars, workshops, or events where relevant stakeholders can share their views on areas of financial markets affected by fintech. Authorities could, through existing structure, also conduct or commission research on the fintech ecosystem, helping to create and maintain a regular dialogue with fintech trade bodies, and organize fintech-specific events to allow industry to engage with the authorities.

By extension, the first step to improving supervisory monitoring of fintech should also be through strengthening existing supervisory structures. Where existing supervisory structures are unable to effectively monitor fintech developments, the first step of action should be fixing and improving these structures. Poor supervisory practices in broader regulated financial services, including banks, are also likely to be weak in delivering on the broader objective of monitoring and responding to fintech risk. Improving domestic coordination among authorities where fintech regulation is delivered by several organizations can improve monitoring capabilities. Reviewing and improving existing supervisory structures and coordination practices among them can be challenging in jurisdictions where capacity and resources are constrained but should be an organizational priority. Creating new institutional arrangements for fintech regulation is unlikely to fix underlying issues and could create new risks or amplify existing ones.

Where fintech is growing rapidly, more specialist resources might be needed to gather insights and intelligence. More dedicated resources might be useful in jurisdictions where fintech is growing quickly and the authorities have the resources. Existing supervisory structures might leave teams spread too thin and unable to monitor new developments and identify new risks effectively, since it may be difficult for

frontline supervisors, even with training, to accurately determine the nature of fintech. However, it is important to note that creation of a "specialist unit" may not be necessary.

Box 1. Case Study: Making Use of Existing Structures

In many jurisdictions, the regulation of fintech, including e-money and peer-to-peer lending, has been in force for years, predating the formation of innovation hubs and sandboxes. Existing structures have also effectively implemented new tools to monitor developments in the broader provision of financial services, including SupTech tools.

Broad Fintech

- In France, domestic coordination on matters related to fintech is carried out by broad structures within the Autorité des Marchés Financiers and the Autorité de Contrôle Prudentiel et de Résolution as part of a Fintech Forum rather than specialist fintech units (Autorité des Marchés Financiers 2016). They redirect firms to one or another regularly, depending on the issue.

- Mexico introduced a law to regulate its fintech sector in 2018. The National Banking and Securities Commission was given the responsibility to oversee licensing and operations of technology-driven crowdfunding institutions and payment services (Deloitte Legal 2018).

- In Brazil, the regulatory and supervisory framework for peer-to-peer lending (under the Central Bank of Brazil) and crowdfunding (under the Securities and Exchange Commission) was put in place in 2018, using existing structures.

SupTech

- The Central Bank of Ireland has taken a more active role since 2013, using a third-party provider to observe market development through monitoring social and online media platforms and using existing supervisory structures where consumers discuss financial services. Comments from Irish consumers, potential customers, representatives of regulated firms, and other stakeholders are collected to identify areas of greatest concern. The Central Bank of Ireland uses this information for ongoing risk assessment and to identify potential areas of future focus (IMF 2022).

- The Bank of Thailand developed an artificial intelligence tool (King 2020) that analyzes board minutes encompassing a three-year span (2016–18) at 19 Thai banks to assess (1) the topics covered at each meeting; (2) time spent per topic; and (3) board member contributions at each meeting by quantifying the number of inquiries, reports, comments, and requests for action by board members. The tool measures board contributions individually as well as by subgroups, such as executive, nonexecutive and independent nonexecutive directors. Using this system, they can assess the regulatory compliance of the board and give recommendations as part of ongoing supervision. The aim of the tools is to reduce the time that examiners spend reading a large volume of board minutes, freeing up time to focus on emerging risks in greater depth.

- The Bank of Qatar has developed a social media sentiment analysis tool covering tweets directly relevant to supervised firms that makes use of natural language processing to detect whether data are positive, negative, or neutral (Beerman and others 2021). This tool enables supervisors to see and classify by topics all relevant tweets associated with their supervised firms. The objective is for supervisors to start each day with an idea of where the sentiment surrounding their firms is moving to obtain early signals of potential supervisory issues.

- The Central Bank of Brazil has used ADAM (Beerman and others 2021) (adaptive moment estimation) that is trained on regularly updated data from field inspection of credit portfolio analysis to identify credit exposures with inadequately recognized expected loss. ADAM is able to analyze 3 million exposures to customers in 24 hours and is now available to all supervisors in both banking and nonbanking.

E-Money

- Lithuania's 2012 law on electronic money (Republic of Lithuania 2011) introduced a regulatory framework under the oversight of Bank of Lithuania including terms, licensing, management, and safeguarding requirements for e-money issuers. The law was amended in 2018 to adapt to market development and strengthen consumer and data protection.

- The Bank of Tanzania (BoT) was empowered by the National Payment Systems Act in 2015 (Bank of Tanzania 2015) to regulate e-money issuers. Both banks and nonbanks are eligible to issue e-money with BoT approval. Notably, in December 2020, BoT circulated a new restriction (Bank of Tanzania 2020) that licensed only mobile network operators, and banks are now eligible for new e-money licenses.

For example, the use of SupTech is deployed by data scientists embedded in existing frontline supervision teams in many jurisdictions. The growing use of SupTech is allowing some authorities to respond to old and new challenges with a technology-centered approach. SupTech is found primarily in five areas of applications: data collection, processing, storage, analytics, and data products. Within data collection, applications are used for supervisory reporting, data management, and virtual assistance. In this area, SupTech supports a faster and more flexible data capture from supervised firms compared with the traditional template-based approach. This, in turn, lets supervisors improve access to data and offsite monitoring and allows better and earlier detection of potential risks, including through market surveillance and misconduct analysis delivered through data analytics. This can be predictive (using historical data to identify future risks) and/or prescriptive (recommending the best course of action based on those risks).

While institutional structures differ across authorities, some regulators create specific SupTech units, but many embed data scientists within existing frontline supervision teams. This allows data scientists to understand the needs of frontline supervisors and respond with new tools that can assist in achieving supervisory objectives. This approach helps manage resources, prioritize relevant projects, and ensure that the development of new tools solves real problems.

While data scientists within authorities around the world have created interesting, innovative, and thought-leading projects, they often fail to reach production within frontline supervision teams. Projects that may seem interesting to data scientists may not be needed by frontline supervisors or be difficult to use—for example, because supervisors need retraining or because of the need for ongoing maintenance of the tools. Sometimes the needs of frontline supervisors are poorly communicated, which leads to a gap between what they want and what they get. Embedding data scientists within frontline supervision teams can allow them to better identify the needs of supervisors and work closely with them in developing those tools. Specific SupTech units can, at times, create a distance between the development team and the team that will be using the final project. Isolated SupTech units can end up operating in silos, possibly serving the needs or interests of the unit rather than frontline supervisors or the mandate of the organization.

For many authorities, lessons learned from first movers among other authorities will provide valuable insights into what works and what does not in relation to SupTech and different institutional arrangements. At a global level, standard-setting bodies and other international organizations are collecting information and experiences and reporting on findings. At a national level, transparency and disclosure of experimentation through evaluation and "lessons learned reports" by authorities can help disseminate information that data scientists embedded in frontline roles can use in existing structures. While open-source code on public repositories can be helpful, it may not be appropriate for many cases, particularly where sensitivity exists in model design or data used and transposing a model from one jurisdiction directly to another might lead to less effective outcomes without proper adjustment for jurisdictional specificities.

Similarly, in most jurisdictions, the provision of RegTech services is not a directly regulated activity, but rather one that would be captured by third-party and outsourcing regulation and would not require separate institutional arrangements. Authorities should ensure that appropriate third-party and outsourcing regulation is in place and, more important, that they are able to effectively supervise against the regulation. This can provide regulatory certainty for those propositions to be developed and used, while also protecting against risks, and should be carried out by a frontline team with experience in broad policymaking and supervision.

Some authorities have already started experimenting with digital regulatory reporting through existing structures as well as new specialist units. For example, the Bank of England and the Financial Conduct Authority (FCA) in the United Kingdom are exploring how to automate and streamline various aspects of the regulatory reporting from harm identification to implementation by creating machine-readable and machine-consumable regulation. Another example is the European Central Bank, and the European Supervisory Authorities in the European Union, whose integrated reporting system seeks to develop a consistent and integrated system for collecting statistical, resolution, and prudential data through a common data dictionary, central data collection point, and adequate data governance framework. Ellipse, a project within an innovation hub of the Bank for International combines structured and unstructured data and applies advanced analytics such as natural language processing on integrated data sources to provide supervisors with early warning indicators, analytics, and prudential metrics.

Across of areas of fintech, supervisors will need fintech training and continuous learning. Where existing supervisory teams conduct fintech surveillance, additional and ongoing training will be required to ensure that supervisors are aware of new fintech developments as well as regulatory approaches that might help achieve their authority's objectives. Although training can be costly and supervisors still need to hire specialists for certain areas (such as information technology experts for operational risk inspections), it is likely to be cheaper than setting up new teams of specialists, particularly in the short term. The use of collaboration, whether with regulatory peers or through technical assistance by international organizations, can help manage costs and ensure training is relevant, particularly where resource or expertise is scarce.

Coordination among supervisory and regulatory agencies is key. It is particularly important when fintech regulation and supervision are carried out by various sectoral supervisors and/or separately by prudential and conduct authorities**.** In jurisdictions with an integrated authority, supervisors could, in principle, work across sectors to monitor, identify, and respond to new risks. For fintech, an integrated approach would help in the triage of risks and identification of regulatory arbitrage, although it can stretch resources, particularly where risks are low, outside the regulatory perimeter, or be less likely to affect financial stability. In a twin peaks model, conduct authorities often take the lead in fintech regulation because it is often initially seen more as a consumer/investor protection issue and fewer prudential concerns are implicated given the smaller size of activities. However, prudential oversight is becoming more relevant, especially given the expansion of BigTech into financial services in some jurisdictions and the rapid growth of multifunction crypto intermediaries in others. This entails the need for a greater degree of coordination between conduct and prudential supervision authorities. Effective coordination with clear mandates becomes key and could be assisted with interagency hubs or teams.

In some instances, regulatory authorities might impose targeted restrictions or prohibitions to manage risks. Where fintech can create excessive and unacceptable risks, but the development of appropriate regulation takes time, prohibitions can be temporarily useful (as they would in non-fintech cases). Authorities can also carry out targeted restrictions to dampen growth where entities are using fintech to create new business models that fall outside the existing regulatory regime, for example, restricting the use of specific technologies in certain activities (such as machine learning for mortgage applications), or specific products and services (such as blockchain for capital raising). However, such an approach may be disproportionate to the associated risks, might be costly to enforce, will likely be circumvented, and ultimately might stifle sensible innovation.

Where fintech has high potential to deliver significant benefits with limited risks, it is better for such fintech-driven business models to be fully embedded into the market and also into supervisory and licensing approaches.[8] Where systemic risk implications are likely to be small and business conduct and user protection risks—even if large—can be well managed through strong data policies and API security architecture, fintech models may not need to be tested in sandboxes but could instead be considered as part of an authority's business as usual.

Mainstreaming fintech, if successful, can help authorities as well as firms developing fintech-based propositions. This means equipping policymakers and supervisors with training on key fintech developments in local and global markets and allowing those supervisors to triage and contextualize fintech as part of their broader remit. It might also mean embedding specific fintech expertise into existing teams rather than creating new standalone units. Keeping fintech on the sidelines as part of specific teams (or as part of fintech-only regulators) may lead to distrust or a disconnect between the fintech and

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[8] Examples include the use of account information service providers that may equip users with tools to improve their financial health by providing dispersed financial information in one easy-to-find place, and "nudges and notifications" that can help users better understand the steps they need to take to improve their financial position and the options available to them. Both models operate by using APIs to connect the account aggregator with multiple financial institutions.

non-fintech world and may leave firms in continuous limbo or long-term tests with restricted market launches. This is bad for the firm, bad for users, and bad for markets.

II. Innovation Hubs

Innovation hubs are dedicated teams that act as central contact points for firms wishing to deploy innovative technologies in financial services. They are also known as innovation offices, units, or facilitators and have frequently been a first step for regulators developing a fintech-specific initiative, although in some cases it is the only step taken by authorities to improve outreach and engagement. The first proposals for an innovation hub were shared in November 2012 by the United States Consumer Financial Protection Bureau (CFPB, 2012) through Project Catalyst. The aim was to provide a contact point for start-ups to encourage consumer-friendly innovation in financial products and services. The first operational launch of an innovation hub took place two years later in October 2014 in the form of Project Innovate (Box 2) at the UK FCA.

Box 2. Case Study: Project Innovate at the UK Financial Conduct Authority

The UK Financial Conduct Authority (FCA 2014) launched the world's first dedicated and operational innovation hub in October 2014 after a consultation in July 2014. For the first six months after launch, the unit was staffed largely by a small team seconded from other areas of the organization, including authorization, enforcement, and competition divisions. Project Innovate aimed to provide dedicated support to firms, both regulated and unregulated, developing innovative propositions that provide genuine consumer benefits.

The unit was initially split between an engagement team and a direct support team—the former constituting the outreach arm that also aimed to build bridges within the organization, the latter providing support to firms. Innovate operates on a hub-and-spoke model, with representation of other divisions at regular "filter meetings" to ascertain which firms are eligible for support. There is no limit on the number of firms that can be supported, but each applicant must meet the eligibility criteria by which the FCA assesses applications, including the following:

- Genuine innovation—the applicant must show how their proposition is groundbreaking or different from existing products and services.

- Consumer benefit—the innovation must provide a genuine benefit to consumers either directly or indirectly (through greater competition).

- Background research—the business must have invested time and resources into understanding the regulatory framework.

- Need for support—the business must have a genuine need for direct support.

The latter two criteria are particularly important to ensuring resources are managed efficiently and the hub does not become a free consultancy service. They ensure assistance can be directed to where it is most needed and most impactful. The innovation hub uses several tools including individual guidance and informal steers (tailored support in relation to FCA rules and guidance), signposting to relevant areas of regulation, and support in preparation for authorization, including dedicated support for a year following authorization.

Although no two innovation hubs are alike, they have certain common elements (Figure 1). Innovation hubs must have a clear objective—normally, it is expressed as a need to better understand the fintech ecosystem, monitor developments, and provide advice and guidance to firms. Innovation hubs generally conduct outreach and engagement to gather intelligence and insights, and monitor trends and

developments. The objective is to identify where new technologies might create policy gaps or where existing policy might be unnecessarily inhibitive to innovation. Most innovation hubs provide guidance or advice to firms developing innovative propositions using fintech. Innovation hubs might also be responsible for collaboration with other regulators, both domestic and international, on matters related to financial technology.

Figure 1. Common Elements of Innovation Hubs

Policy

Understand where policy gaps exist or where policy might be inhibitive

Outreach

Engage with external stakeholders to exchange ideas and understand trends

Guidance

Provide support and guidance to firms developing innovative propositions

Intelligence

Share learnings with wider organization to support regulatory objectives

Collaboration

Work on fintech-related topics with other regulatory authorities

Innovation hubs provide short-term support to firms at an earlier stage of product development. Unlike sandboxes, many innovation hubs provide support that is relatively short in duration and limited in scope, so a single supervisor can help several firms, reducing use of resources. The support might include tailored guidance, directing firms to relevant regulations, assisting in licensing preparations, and providing regulatory feedback on business models. The support service would normally last less than a month. Innovation hubs also tend to support firms earlier in their product development journey and before they are ready to launch. This means that authorities can play a role in helping firms develop compliant business models using new technologies.

Innovation hubs are frequently used to increase outreach and engagement with the domestic fintech ecosystem. Consequently, they can help authorities monitor fintech across financial services by dedicating specialist resources in this area, but their specific objectives may differ depending on desired policy outcomes (Taylor and others 2020). They would in principle be staffed with fintech specialists who focus their time on new developments, new technologies, and new business models within financial services. Innovation hubs would normally take a proactive approach to engagement, creating and attending events that focus on the fintech ecosystem. Many innovation hubs use initiatives such as "regulatory surgeries" or "office hours" that facilitate direct contact with firms and commission or carry out research to better understand the development of fintech within their domestic markets.

When operationalized correctly, innovation hubs can strengthen supervisory monitoring. A clear objective, transparent eligibility criteria, and cross-organization buy-in are integral to the success of an innovation hub. Innovation hubs should have clear policies in place to protect intellectual property of innovator businesses. A well-built innovation hub that can draw on broader support within an organization can help a regulatory authority better monitor fintech developments and mitigate risks before they

crystallize. Through dedicated outreach and engagement, innovation hubs can gather insights and information that can help a regulator meet its public policy objectives.

Innovation hubs are best used in jurisdictions where fintech is growing rapidly, challenging supervisory oversight and incumbent regulatory models. Through the engagement of specialized teams with firms, the hubs can assist with horizon scanning exercises and help authorities understand if and how new technologies and business models might affect existing regulation and financial services. Innovation hubs are particularly useful where many small firms want to enter the regulatory perimeter by providing them with a direct contact point at the authority—something usually retained for large, regulated entities only.

Innovation hubs can help authorities identify gaps or unnecessary hurdles in policy. Insights gathered from outreach and engagement can help in identifying whether there are gaps in the existing regulatory framework or whether existing regulation is unnecessarily inhibitive. Some innovation hubs actively help develop policy in relation to new technologies in financial services, working with policymaking teams within the authority. Where a fintech ecosystem is more mature and authorities have more specialist resources, innovation hubs can be particularly helpful in policy development. Creating new policy is a resource-intensive task and requires significant specialization as well as coordination with other parts of the organization.

In some cases, innovation hubs have provided other services to businesses including financial or resource support. The type of support an authority can provide depends on the legislative framework under which it operates and its powers, mandates, and objectives. Most authorities limit support to general guidance and advice, while some match applicants with incentives such as grants for innovation (Monetary Authority of Singapore n.d.) or support the expansion of talent in the fintech sector through internships (Hong Kong Monetary Authority 2022a). Some of these are a regulatory equivalent of accelerators and incubators, which can generate considerable reputational risk for the regulatory authority across many dimensions, including market distortions and reputational risk for regulatory authorities (particularly where direct financial investments in start-ups fail or lead to harms to markets or consumers).

To optimize resources and ensure that support is impactful and fair, most innovation hubs have established eligibility criteria (Box 3). While these differ across authorities, reflecting the mandate of the organization, establishing clear and transparent eligibility criteria helps ensure that firms requesting assistance genuinely need support and allows for better supervisory resource allocation. Many innovation hubs allow both regulated and unregulated firms to benefit from support, particularly where unregulated firms are aiming for authorization or are likely to provide services to a regulated entity (such as RegTech). However, some innovation hubs provide support only to regulated entities.

Box 3. Case Study: Eligibility Criteria at the Australian Securities and Investments Commission

The Australian Securities and Investments Commission Fintech Office sets out transparent eligibility criteria on its website to help innovators understand whether they are eligible for assistance (Australian Securities & Investments Commission n.d.).

To be eligible for support, applicants must do the following:

- Have obtained an Australian Financial Services or Credit license.

- Be in the process of receiving one of those licenses or already be licensed for less than 12 months.

- Show that the innovation is groundbreaking or significantly different from products or services already on the market.

- Demonstrate that the product or service provides better outcomes for investors and consumers.

- Clearly set out where the product is in its development life cycle.

- Provide sufficient detail.

Many innovation hubs operate through a hub-and-spoke model to minimize the resource impact. Resources are usually managed through operating a central hub (the innovation hub) and spokes (specialist areas across the organization). The hub acts as a central contact point, triaging different support requests and ascertaining priority and ability to assist. The hub can directly assist the firm where support requests are nontechnical or in areas where policy is still being defined. Otherwise, the hub will pass on requests to the spokes and work closely with subject matter experts to provide support. Conversely, the hub can feed intelligence to the spokes through targeted outreach and engagement. This intelligence can assist the organization in achieving its objectives, although it is important that there are clear internal mechanisms for this knowledge transfer.

Staffing and training a dedicated team can be costly and time-consuming. Continuing education and regular training are required to ensure the team is up-to-date on the latest developments and able to provide timely and accurate support and to identify relevant fintech developments. For hub-and-spoke models, relationships must be established with other specialist areas in the organization to ensure the innovation hub is able to effectively triage applications and that specialist areas have the resources to provide support. The hub-and-spoke model allows most innovation hubs to remain relatively small, but the addition of a network of specialists can draw significant resources from across an authority.

A poorly designed innovation hub can generate risks and become an obstacle to good regulation. Without a clear need and objectives, innovation hubs can consume resources that might be better used elsewhere. It is why an open consultation with relevant stakeholders or a feasibility study is important to determine whether such an approach is needed or suitable. Consultations and feasibility studies should identify a clear problem to be solved and demonstrate clear objectives for the proposed innovation hub. Focus on an innovation hub might distract from greater risks that might exist in other areas of financial markets. In addition, if eligibility criteria for firms are unclear or opaque, concerns around fair competition

and "picking winners" can arise where decisions on who the authority provides support to are unclear. Without access to broader specialist resources, a small team can quickly become stretched and fail to provide professional and timely support services, which can open the authority to reputational risk.

Any innovation facilitator has the potential to generate reputational risk to authorities. In instances where authorities provide financial or other support to firms, they open themselves up to additional reputational risk should the firm fail or otherwise harm financial sector soundness or consumer protection. Such approaches can also distort competition, favoring start-ups over established regulated entities where eligibility criteria disallow incumbents to receive support. Where innovation hubs and other specialist institutional arrangements are used with a regulatory agenda of increasing competitiveness, this should not happen at the expense of growing risks to markets and consumers. Finally, a return to an environment of higher inflation and interest rates could lead to some stress on start-ups that received regulatory support, a situation that would generate additional reputational risk for authorities.

Innovation hubs work best with effective domestic coordination. In an integrated regulator, a single innovation hub can provide effective outreach and engagement, but the scope should be clear to manage resources. In a twin peaks model, engagement with small start-ups, which is typical of an innovation hub, is carried out by the conduct regulator when prudential and stability concerns are not significant. In this case, strong coordination with the prudential regulator is still key. Where multiple sectoral or regional regulatory institutions exist, it is important for innovation hubs to be effectively connected and coordinated. This could be through a single interagency innovation hub or several innovation hubs that are linked either directly (single point of entry) or through other open lines of communication.

Innovation hubs often take the lead in international regulatory collaboration in matters related to fintech. In many jurisdictions, the innovation hub will take the lead in representing the organization in global bodies in fintech areas. They might also work directly with other innovation hubs domestically and globally, either informally or through fintech cooperation agreements and other arrangements. Directly working with other innovation hubs can be a useful way to enhance communication among specialists.

III. Sandboxes

Regulatory sandboxes are controlled environments for firms to test their innovative propositions on real consumers. The first regulatory sandbox was launched by the UK FCA in June 2016, and since then more than 95 sandboxes have been launched or are in preparation worldwide.[9] Most regulatory sandboxes are in EMDEs, and some jurisdictions have multiple sandboxes (Box 4). Most of these sandboxes allow firms to test innovative products or services in a live environment under the close oversight of supervisors. Often, the aim is to foster innovation, manage risks, and enable authorities to better understand new technologies and business models ahead of any full-scale launch. Sandboxes also offer the opportunity for authorities to gather insights and information to help inform policymaking. Sufficient diversity across sandboxes permits the following threefold classification (see Annex I for a fuller discussion on each sandbox):

- *Product-testing sandboxes* allow firms to test their products or services with real consumers in a controlled environment.
- *Policy sandboxes* allow regulators to better understand and evaluate the impact of new rules and regulations with firms in a live environment.
- *Digital sandboxes* allow firms to scale up proof of concepts into proof of value with plug-in access to API marketplaces and real/anonymized or synthetic data.

Three additional types of sandboxes build on these classifications:

- *Thematic sandboxes* allow an authority to focus on areas of particular concern (such as climate, women in technology, distributed systems).
- *Cross-sector sandbox*es can be a product, policy, thematic, or digital sandbox that operates across several sectors, either within financial services (that is, payments, insurance, securities) or across broader industries (such as financial services, energy, utilities, telecommunications).
- *Cross-border sandboxes* can either link multiple sandboxes or provide a common testing platform for a group of regulatory authorities.

No two sandboxes are the same, but most aim to provide a testing platform for innovative products and services (Figure 2). Common characteristics of sandboxes include the opportunity of live testing products or services on real consumers. Most sandbox tests are closely supervised throughout the testing period, usually with a dedicated supervisor ensuring greater oversight than if the firm had launched directly into the market. Tests are usually time-limited, although not all sandboxes mandate a limited testing period. Supervisors tend to place restrictions on most sandbox tests to mitigate against any risks

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[9]   World Bank Document, Cambridge Centre for Alternative Finance staff analysis (2023), and IMF staff calculations.

that might arise. Finally, firms are generally expected to report throughout the testing phase, with a comprehensive final report at the end.

Figure 2. Common Elements of Regulatory Sandboxes

Supervision

Close supervision is maintained throughout the testing period

Live testing

Firms test their products or services with real consumers

Limited time

Most tests are conducted within a given time frame, usually 6–12 months

Restrictions

Tests might be restricted by factors such as number of consumers

Reporting

Firms report regularly throughout testing, with a comprehensive final report

Authorities can use several tools and policy levers to facilitate testing. Some sandboxes provide tailored guidance to assist firms through any potential licensing process. Others use waivers to either remove or modify some of the existing rules. Some allow authorities, in special circumstances, to not take disciplinary actions in the event of a testing failure as long as the firm abides by the testing parameters and acts in good faith. Some use proportionality measures afforded within existing legislation to reduce regulatory burdens for a specific period. While such tools are available, it is important that sandboxes do not lower regulatory standards and engage in "riskwashing" (Schilling De Carvalho and Papiasse 2023).[10] In this context, blanket waivers or exemptions are likely to generate more risks than benefits.

Furthermore, exemptions, particularly in product-testing sandboxes, are also likely to generate poor outcomes for firms and authorities because neither will be able to accurately determine the compliance of new business models with regulatory frameworks, and graduating from the sandbox could leave firms unable to meet requirements.

Sandboxes can operate cohort or rolling applications. A cohort approach allows authorities to better manage resources with intensive periods that coincide with applications. This can allow other relevant areas of an organization (such as licensing, supervision, enforcement) to prepare their resources in line with sandbox application periods. A rolling approach allows these intensive periods to be spread over the year but can mean unpredictable demand for resources.

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[10]   Riskwashing refers to attempts by the regulatory authority to make products or processes of a company appear less risky for stakeholders by engaging in activities that mimic, in a superficial or narrow way, genuine attempts to assess and reduce risk. See Brown and Piroska 2022.

Box 4. Sandboxes and Domestic Coordination

Sandbox models vary, allowing for different degrees and types of integration across relevant national authorities, ranging from separate and independent to fully integrated.

- In Thailand, sandboxes are operated by the Bank of Thailand, the Securities and Exchange Commission, and the Office of Insurance Commission. Each agency oversees its own sectors within the financial system and promotes innovation in certain areas. Firms are responsible for applying to the correct regulatory sandbox, with no single point of entry.

Sandboxes that are either aligned or shared across agencies may use a single point of entry that provides common interface to ensure a standardized application process. It provides authorities with an engagement platform for a holistic view of fintech developments, thereby reducing the risk of regulatory arbitrage.

- Hong Kong SAR hosts different sandboxes developed by different domestic financial regulators with a single entry point (Hong Kong Monetary Authority 2022b). The Hong Kong Monetary Authority is open to authorized banks wanting to test new fintech propositions; the Securities and Future Commission sandbox allows both licensed firms and start-ups to test, while the Insurance Authority allows authorized insurers to test. Firms that intend to conduct a pilot of cross-sectoral fintech products are requested to apply to the most relevant sandbox. This regulator then serves as the primary contact and assists in liaising with other relevant agencies.

- South Africa's Intergovernmental Fintech Working Group (IFWG 2023) has an alternative approach that takes things a step further. Their regulatory sandbox was launched as a joint initiative and includes participation from the National Treasury, Financial Intelligence Centre, Financial Sector Conduct Authority, National Credit Regulator, South African Reserve Bank, South African Revenue Service, and Competition Commission. This cohort-based project operates on a "first responder network," with a core team from the Financial Sector Conduct Authority and South African Reserve Bank monitoring progress of each entrant and connecting it to subject matter experts. Even with this platform, cases that involve multiple regulators and do not fit neatly into current regulations still take longer than expected during the application process.

Entry into sandboxes is usually controlled through applications that are judged against set eligibility criteria that allow authorities to direct their support where it is most impactful (Box 5). Such criteria should be transparent and standardized and allow a broad range of applicants. Eligibility criteria tend to mirror those found in innovation hubs, but to ensure support is directed to areas where it is most impactful (both to the authority and the firm), additional criteria would normally include a clear reason for the firm's eligibility to test and its eventual readiness for the product to enter the market. Applications can be used to gauge areas where fintech is having most impact and, therefore, can help with fintech surveillance. It is important to ensure that eligibility criteria reflect the goals of the sandbox, so eligibility criteria should be different for product, policy, thematic, and digital sandboxes.

There are pros and cons of firm anonymity during testing. Sandboxes might be used as badges of honor by some entities, and the ability to distinguish between those firms that want to test and those that need to test is important (Box 6). Some authorities publish the names of successful firms so consumers know where products or services delivered might be part of a sandbox test. Other authorities prefer to keep sandbox tests anonymous to mitigate the risk of firms using their acceptance in the sandbox to

leverage finances and advertisement. Given the pros and cons of each approach, greater transparency is preferred where possible. Greater transparency ensures that markets and consumers are kept updated on developments and keeps both the regulatory authority and the testing firm accountable.

Box 5. Eligibility Criteria for Sandboxes

Eligibility criteria for sandboxes differ across authorities, with prescriptive and inflexible criteria for some sandboxes and broader or more flexible criteria in others. The former provides for better clarity and standardization, while the latter may allow sandboxes to adapt to changing demand. Some jurisdictions also require applicants to elaborate on how the innovation fits into longer-term national or global development goals. Eligibility criteria could also change as authorities learn from previous sandbox cohorts.

- The Capital Markets Authority of Kenya (2019) has broad criteria and allows applicants that are either incorporated domestically or regulated by a foreign securities market regulator and intending to offer an innovative product or service to the Kenyan market after a successful exit from the sandbox.

- The Central Bank of Egypt (2019) has narrower criteria and requires that the testing proposition be within the scope of fintech and genuinely innovative with the potential to improve accessibility and efficiency in financial services. The testing firm must demonstrate that their product or service will directly or indirectly benefit consumers, and there must be a real need to test in the regulatory sandbox. The product or service must also be ready to test in the sandbox, with an aim for commercial deployment after a sandbox test. The product or service must also support financial inclusion in Egypt.

- The Reserve Bank of India (n.d.) outlines specific products and services permitted in the sandbox, including retail payments, market lending, and digital KYC. Notably, crypto-related services are excluded in principle unless the technology or the application of technology is proved entirely different from existing market offerings.

- The Saudi Central Bank (2022) requires applicants to explain how their innovations contribute to Vision 2030, a broad strategic framework for economic development in which the financial sector component aims to promote a diversified and effective sector that encourages innovation without weakening financial stability.

Box 6. Genuine Innovation?

What exactly is innovation? Some sandbox eligibility criteria in many jurisdictions view the term as innovative technology and few or no comparable offerings. At the same time, the product is also required to be sufficiently developed and/or commercially viable. Regardless of a rolling or a cohort model, the assessment of some eligibility criteria is highly subjective. While sufficient development and commercial viability can be more quantitatively defined, how to interpret innovative technology varies significantly.

To demonstrate genuine innovation, applicants are usually required to justify why the proposed product or service is new or offers new adaptions/improvements relative to existing products or services. Some jurisdictions take this a step further, asking applicants to lay out details on the use of technology such as DLT or machine learning. Given the fast-evolving nature of fintech enabled products, another concern arises about whether regulatory authorities are well equipped to make this judgment.

To comprehensively assess sandbox applications, the Sandbox Committee of the Securities and Exchange Commission of Brazil (2021) indicates that it may collaborate with third parties, such as universities or researchers, when necessary to make more informed decisions. The collaboration between the committee and third parties is confidential and could take the form of partnership, cooperation agreements, and/or covenants.

When appropriately used, policy sandboxes might provide an important new way of designing regulation. While product-testing sandboxes are better known, many authorities are now experimenting with policy sandboxes. Small changes to regulation are relatively easy to test, but larger changes to regulation, or the creation of bespoke regulations, can be harder to test. Many jurisdictions consult on new regulations, implement them, and carry out postimplementation reviews several years later to determine the impact of their interventions. These processes are expensive and can be time-consuming. The use of policy sandboxes could potentially cut the cost and time of introducing new regulations, provided tests have sufficient safeguards built into them.

An authority might trial a new policy in a space with little regulation, but with growing risk to consumers or financial stability, with a small number of firms. These firms would have suitable restrictions (such as limited number of customers, restricted types of customers, limited transactions volumes), and customers would be aware of the testing status. For these larger policy tests, firms would be required to hold significant capital reserves and have robust contingency and wind-down planning in place. Authorities might use the sandbox to test their draft policy measures, tweaking the regulation in response to unanticipated outcomes and results. At the end of these tests, authorities can formally consult on the draft proposals. Working closely with the testing firms and other relevant stakeholders (such as other regulatory authorities or government departments), authorities might be able to roll out suitable regulation that meets their objectives much faster and with greater confidence than they currently can.

Policy sandboxes require greater oversight and more conservative risk management than product-testing sandboxes. Given that authorities are not testing against existing regulation, policy sandboxes may generate considerable risk. Policy sandboxes can be designed so that either only licensed firms can test (usually licensed as an entity or for a related activity) or unlicensed firms can also test. The latter approach is particularly risky, and authorities must ensure they have the sufficient legal powers to exert

oversight of the test and take action relative to all applicants. Without this legal underpinning, authorities should not allow unlicensed firms to test. Given the nature of policy testing, the testing phase is likely to be longer than product-testing sandboxes. At the end of a successful sandbox test, authorities have the option to force firms to pause their activities as new regulation is consulted and implemented or allow firms that have tested in the sandbox to continue carrying out their activities. The former is a good approach because it reduces the risk of picking winners while managing risks of firms that are either unlicensed or licensed for more general activities operating openly in the market. However, it may lead to poor outcomes for consumers accustomed to a new product or service, the provision of which would have to be paused.

Most sandboxes have four discrete phases: entry, developing a testing plan, testing, and exit. These four phases might differ in implementation but tend to form a common journey in most sandboxes (see Annex I for a typology of sandboxes). Successful applicants that meet the eligibility criteria often provide learnings to both firms and authorities (for example, the impact of certain technologies on existing regulatory frameworks). Decisions on applications may require the input of several teams, including licensing, supervision, and more policy-focused teams. Such decisions also consider the type of assistance a firm may need to get ready for testing.

- **Phase 1:** Licensing is important. It should be universal good practice in product-testing sandboxes, but may be more challenging to implement in policy sandboxes. In many sandboxes firms are required to be licensed (or to have a modified license) before testing begins to minimize risks to markets and consumers as well as for the authority in instances where something goes wrong. In product-testing sandboxes, good practice is to ensure that all firms testing are fully licensed with additional restrictions in place. Some product-testing sandboxes allow entities that are not directly carrying out regulated activities to partner with regulated entities (such as those providing RegTech). Here, ensuring that robust outsourcing requirements are in place is important. Policy sandboxes are designed specifically to test new policies, so existing regulation against which to assess firms may not exist. To manage risks to markets and consumers, authorities might allow only existing regulated firms to test in policy sandboxes.

- **Phase 2:** Testing plans aim to meet the goals of the regulatory authority and the firm, and so the testing process requires close supervision. The development of testing plans is a collaborative process to meet mutual goals. This stage is where market and consumer safeguards are agreed on, such as enhanced disclosure, limits on numbers or types of consumers, and volumes and values of transactions. The testing plan can contain milestones for both the firm and the regulator as testing progresses and might allow some restrictions to be lifted if certain mutual goals are met. A good testing plan should have clear aims for what constitutes a successful test, as well as contingency and wind-down planning in the event of an unsuccessful test. Testing plans should reflect the goals of both the testing firm and the authority as well as the risk generated by the test, but they should remain flexible to make small adjustments as lessons are learned in the live testing environment. For policy

sandboxes, a testing plan would largely be for the purposes of the authority; therefore, key benchmarks for a successful (and unsuccessful) test should be shared with the firms in the testing environment. The protection of intellectual property rights is important; while confidentiality clauses are usually built into regulator-to-firm interactions, external agreements might be needed where a regulated firm and an unregulated one are partnering for tests (for instance, where tests involve the use of RegTech).

- **Phase 3:** Live testing follows the agreed path of the testing plan but may need to evolve in a live market environment. The testing phase requires close supervision, including onsite visits, regular meetings, and frequent submission of reports covering the evolution of the test, operational and business metrics, and platform performance. Things can change during the process of testing that might require adapting the testing plan. While this is usually not problematic for small changes, any large changes might require the firm to withdraw from testing and develop a new testing plan (Box 7). The test phase tends to last, on average, 6 to 12 months, but timelines will reflect the success of the testing process. With policy sandboxes, and where firms struggle to sign up consumers, testing may last longer. On the other hand, where agreed-on goals for the test are achieved quickly, testing may be shortened.

- **Phase 4:** Exit strategies differ across sandboxes but should allow authorities to better understand fintech propositions in regulated markets. At the conclusion of most sandbox tests, the firm prepares a final report that evaluates the test, highlighting whether the test was successful and identifying any issues that might have arisen. Authorities will use their own experiences gathered through the testing process along with the final report to decide on whether a test was successful. In sandboxes that require licensing pretest, restrictions on the license are removed in the event of a successful test. For those sandboxes that do not require pretest licensing, a sandbox exit is followed by a licensing process. For policy sandboxes, firms may be asked to pause the delivery of their product or service until appropriate policy is developed. The exit strategy should ensure that any consumers involved in the test are in a no-worse-off situation at the end of the test than they were at the beginning, and so building in requirements such as additional reserve capital to account for potential losses and segregating consumer funds at the start of a test are important. Having supported propositions that graduated through the sandbox, authorities will be well placed to understand market impact and developments. It would be prudent for authorities to continue post-sandbox engagement for a period to determine market impact, monitor risks, and help produce evaluation statistics to determine the efficacy of the sandbox. For both product-testing and policy sandboxes, open consultations on any rule changes or new regulations are important.

Box 7. Managing Failures

Authorized financial services firms, particularly start-ups, often fail (regardless of the presence of fintech facilitators), and authorities accept this risk. They try to minimize occurrences and impact of such failures through robust regulatory frameworks, diligent authorization processes, and ongoing supervision. Over the past decade, low interest rates have led to significant funding in the technology sector, including technology-driven firms focused on regulated financial markets. However, as interest rates rise, some of these business models might struggle to establish commercial viability. The change in the macroeconomic environment might also bring to light risk management and compliance deficiencies.

In early 2023, regulated financial markets experienced stress driven largely by entities focused on technology. Silvergate Bank, Signature Bank, and Silicon Valley Bank were all intertwined with technology-driven firms offering financial products or services. The UK FCA, the German Federal Financial Supervisory Authority, and the Lithuanian Central Bank also took action against primarily fintech-driven firms due to compliance concerns.

Opening fintech facilitation offices such as innovation hubs and sandboxes generates additional reputational risk for regulatory authorities. Firms that have tested in sandboxes may go on to experience stress or failure, and authorities need to consider their risk tolerance when supporting firms. Authorities should not take a broad-brush approach to rejecting new financial technology but may be less willing to expend significant resources on second-order objectives such as competition, competitiveness, and innovation. To manage these risks, authorities should do the following:

- Publish the names of firms that have been supported and an overview of the support offered.

- Ensure institutional arrangements manage risks throughout the testing and support process but are also forward looking.

- Avoid large exemptions because they are unlikely to reflect a live market environment.

- Take a balanced approach to fintech innovation, remaining open-minded but not at the expense of first-order objectives.

Potential Benefits

Sandboxes can strengthen monitoring and be a useful approach to deepening fintech expertise. They can assist in initiating and deepening communication with firms and signal openness for innovation and competition. The application process can help authorities identify trends and developments within their domestic fintech ecosystem. The testing process can help identify where fintech might be beneficial to financial markets and where it might generate unacceptable risks. It can also help authorities understand how such firms operate, the technology being deployed, and impact on the regulatory framework. A sandbox that works well would, in theory, help inform the development of new policies, which would spur greater innovation, which may in turn require further sandbox tests (Figure 3).[11]

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[11] Outputs from a sandbox can provide insights to support policy change above and beyond an innovation hub. General trends from applications to innovation hubs can show regulators whether there might be common areas of focus. However, a sandbox can clearly point to specific risks and benefits. This is possible as the testing process raises issues in real time and provides a learning environment for both firm and regulator. An innovation hub is more about providing feedback and guidance based on existing knowledge while studying trends.

Figure 3. The Virtuous Cycle of Sandbox Tests
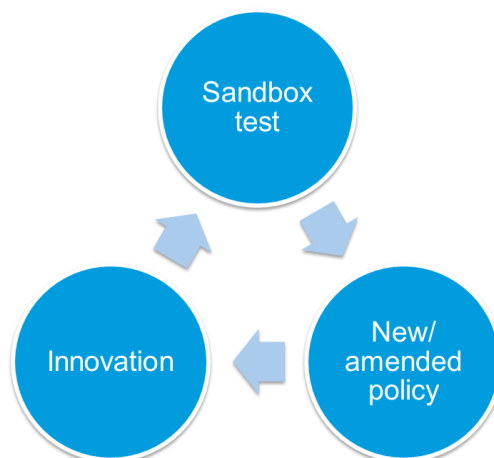
Authorities should share regular evaluations or lessons learned to inform the wider market, support an effective regulatory agenda, improve supervisory frameworks, and manage the risks of an uneven playing field where a small number of sandbox firms have access to unique information. An annual evaluation is a sensible approach to ensuring these elements are met.

Cross-sector sandboxes might be particularly important in jurisdictions with multiple regulators. Where regulation is split between sector or regional regulators, a cross-sector single point of entry sandbox could allow authorities to collaborate on common fintech observations and minimize policy gaps in areas where mandates are not suitably clear. There are significant challenges to developing cross-sector sandboxes, with differing regulatory powers, risk tolerance, resource availability, and priorities. The UK cross-sector sandbox was an initiative that aimed to link sandboxes across industries, but a lack of demand and large obstacles paused the project (Financial Conduct Authority 2019a).

Limitations

Sandboxes can be expensive, requiring significant specialist resources, which may render them unsuitable for many authorities. Sandboxes are generally unsuitable as an exclusive tool to gather insights and monitor fintech developments. They are more useful for providing long-term support to a small number of firms and, in this respect, may be contrasted with innovation hubs. They require specialist resources that understand new technologies and existing regulations and can guide firms through testing plans that can last up to a year. This diversion of supervisory resources from core functions could affect consumer protection, market integrity, financial integrity, and financial stability in situations where resources are already stretched. Given the length of some sandbox tests and the need for close supervision, sandboxes can be significantly costlier than innovation hubs that allow supervisors to support several entities through shorter engagements. When accounting for staff salaries, sandboxes can cost several hundred thousand dollars; some sandboxes cost more than $1 million annually to run on an ongoing basis, which is expensive for many jurisdictions. Even in advanced economies, an ongoing budget of $1 million annually could be redeployed to areas of greater need where it might be more

impactful (Appaya and Jenik 2019). Frequently, authorities underestimate the resources required to develop and operate a sandbox; one survey shows two-thirds of regulators significantly underestimate resource requirements (United Nations Secretary-General's Special Advocate for Inclusive Finance for Development 2019).

Some models of sandboxes can distort competition and create regulatory arbitrage and reputational risk for authorities. Sandboxes should never transfer risk from firms to consumers and regulatory authorities. Sandboxes that provide wholesale waivers or exemptions, or do not require licenses or registration, are likely to generate more risks than benefits given the lack of effective oversight, lack of potential for recourse in the event of a testing failure, and reputational risk for the authority.

Risks could materialize in any situation but are particularly pronounced in jurisdictions with shallow financial markets. While sandboxes are suitable testing grounds for new technology, they are not usually built for quickly growing businesses that could potentially become systemic. Where both start-ups and incumbents are eligible participants, the uncertainty of a failed test could ripple beyond the scope of the sandbox. In less developed fintech markets, a single test failure could lead to systemic risks, particularly if that entity is testing several activities that may not be systemic on their own but generate a large cumulative impact.

Even in jurisdictions with deep financial markets, a single test or a series of interconnected tests could generate risks to financial stability, particularly where tests involve BigTechs that are not directly regulated or supervised but provide services to regulated financial services as part of the test. More commonly, sandbox tests have a greater potential to affect consumers and market integrity. Hence, ensuring that client assets are separated from entity assets with clear legal claims, protection of consumer data, appropriate capital requirements that can cover losses from a failed test, and transparency of testing plans are all important to reducing these risks.

Authorities must have effective procedures in place to limit risks from sandbox tests. Where authorities have the relevant powers to offer policy waivers, or no-enforcement action letters, such tools should be limited to tests where there is little to no risk to financial stability, market integrity, and consumer protection. Entities should ideally be licensed, registered, or authorized to ensure effective supervisory oversight; where entities are providing technology services to regulated firms, effective outsourcing requirements should be followed.

Authorities should develop appropriate eligibility criteria and avoid allowing tests involving systemic infrastructure in the same sandbox as less systemically important tests, given that existing criteria might not sufficiently cover broader risks. The development of sound, robust, and comprehensive testing frameworks can help manage risks by, for example, limiting the number or type of consumers that can be tested on, mandating minimum capital requirements, ensuring strong contingency and wind-down plans, and limiting the volume of funds that can be used in a sandbox test.

In jurisdictions with smaller financial markets, authorities should avoid replicating wholesale features of sandboxes from larger jurisdictions. Here, sandbox development should consider the unique risks to financial stability. Effective reporting and disclosure requirements can help authorities ensure that they are aware of any impact a sandbox test might have on broader financial services due to interconnectedness. The common "blueprint" design for sandboxes is based on product-testing sandboxes and might not be appropriate when designing sandboxes with different goals (like a policy sandbox). Finally, when running sandbox tests, authorities should take a holistic view of all tests to ensure that the cumulative effects of tests do not generate systemic risks. If risks from a particular sandbox test are too high, authorities should not permit such tests.

In Summary

Development of sandboxes should be a carefully considered decision, driven not only by market demand but also by organizational need and public policy objectives.

- A feasibility study and consultation with relevant stakeholders can help authorities identify and determine whether a sandbox is the best way to monitor fintech trends and developments within a market. If it is not properly designed, firms in the sandbox may enjoy a "first-mover advantage" to develop their client base and test the service before non-sandbox firms can. Because of the prevalence of regulatory ambiguity where fintech is deployed, this potential advantage creates an uneven playing field where non-sandbox firms devote many of their resources to navigating through the existing framework.

- Without transparent criteria against which firms are assessed, it might seem as though regulators are giving certain firms a head start. Transparent eligibility criteria can mitigate this risk, although they cannot remove it entirely.

- It is also important that authorities share lessons learned from their sandbox in an open and transparent manner so testing outcomes can be seen by the broader market.

- Participation in a sandbox could also be seen as a badge of honor. If a firm satisfies the eligibility criteria of innovation or a sufficiently mature product to enter a sandbox, investors could interpret it as an innovative product that is validated by authorities and could have more prospect in the market, potentially affecting the firm's ability to raise funding (Box 8).

- In a product-testing sandbox, broad waivers and exemptions do not provide useful lessons long term for either the firm or the authority, can generate short-term risks for firms and consumers, and therefore should be avoided or implemented in a narrow and targeted way. In a policy sandbox, some form of waivers may be unavoidable, but appropriate regulatory guardrails should be developed, and broad waivers and exemptions should be avoided if possible.

- Finally, any potential regulatory changes generated by a regulatory sandbox test should be subject to an open consultation, and all firms—including those testing in the sandbox—should be licensed against this new regulation.

Box 8. The Impact of Sandboxes on Financial Markets

From the perspective of sandbox participants, especially small and new entrants, one of the main incentives is to prove the viability and scalability of the innovation to obtain funding for further development. Indeed, regulatory sandboxes reduce the asymmetry of information associated with the technology, thereby strengthening corporate governance, particularly for first-time and overseas investors. Five years after the first sandbox was introduced, the UK Financial Conduct Authority (FCA 2019b) conducted a study showing that 76 percent of the firms that participated in the first sandbox cohort were still active after two years, as opposed to 57 percent of firms that were rejected from the cohort.

Entry into the FCA sandbox is associated with a higher probability of raising funding, with an increase in the average amount of funding raised by 15 percent compared to firms that did not enter the sandbox (Cornelli and others 2020). The easily observable positive effect in access to funding in the short run may be caused by selection bias. The potential impact on market competition from first-mover advantage or regulator's approval, however, takes longer to materialize. It is unclear whether this advantage would distort market competition and steer fintech innovation in directions that are encouraged in sandboxes.

Evidence suggests that countries with sandboxes attract more investment to technology enabled innovation in financial services overall and to firms when compared with countries with similar market environments but without sandboxes (Goo and Heo 2020). However, this result should be interpreted with caution as having a sandbox only correlates to an increase in investment flows.

IV. International Cooperation

For many authorities, particularly those with fewer resources, the ability to collaborate with peers can strengthen surveillance and supervision. Sharing and exchanging information with peers can help authorities monitor developments and strengthen surveillance related to fintech. The ability to pool resources and work on common problems and developments is particularly helpful for those authorities that might be able to commit fewer dedicated resources toward fintech. In many instances, new developments experienced by one jurisdiction are also likely experienced by neighboring or peer jurisdictions. For example, the use of mobile money, initially concentrated in Kenya, eventually also spread across eastern Africa and beyond. The use of crypto assets as an investment has been experienced in several jurisdictions. Collaboration can also be used to avoid a race to the bottom and uphold common standards (Taylor and others 2020). Digital technology is cross-border by nature, and the use of fintech allows entities to set up operations more easily and cheaply in one jurisdiction and market their services globally, making international cooperation particularly important. International cooperation should be considered a necessity, regardless of the choices of institutional arrangements.

Both bilateral cooperation and multilateral cooperation are paramount. Bilateral cooperation can be informal (such as reaching out on an ad hoc basis), semiformal (such as through standing meetings), or formal (such as using cooperation agreements or memoranda of understanding). Multilateral collaboration involves several authorities working together and can be informal (such as through ad hoc working groups), semiformal (such as through standing meetings), or formal (such as using regional or global bodies or supervisory colleges). Bilateral cooperation can be an agile approach that allows two authorities to focus on areas of mutual interest quickly but is less likely to affect global approaches and might be less useful on topics related to larger cross-border issues. Multilateral collaboration can be used to better shape and influence the global debate, but outcomes can be slower, and not all jurisdictions (particularly low-income countries) are always represented.

Fintech cooperation agreements are an established method for sharing information, developments, and trends. Within fintech regulation, the use of fintech cooperation agreements is an established practice used globally by regulators. The first fintech cooperation agreement was signed between the UK FCA and the Australian Securities and Investments Commission (ASIC) in March 2016 (Financial Conduct Authority 2016). Since then, fintech cooperation agreements have been signed by authorities around the world. These are often nonbinding agreements that operate on a best-effort basis and serve as a complement to broader organization or multilateral memoranda of understanding. They are usually agreements between respective innovation units and allow different regulators to come together and approach common fintech issues. Such agreements can facilitate the sharing of best practices and the exchange of expertise; for example, ASIC and the Indonesia Financial Services Authority signed an agreement in April 2017 to share information on emerging market trends and regulatory issues arising from the use of fintech (Australian Securities and Investments Commission 2017). After the agreement, ASIC assisted the Indonesia Financial Services Authority in developing and implementing global standards as well as practices for skill-based surveillance and risk-focused supervision. This wide range

of assistance is carried out through seminars, workshops, and mutual visits (Australian Securities and Investments Commission 2019). Some agreements have firm referral mechanisms that allow market participants to scale between jurisdictions, creating more competition in local markets (Bains 2020).

Fintech cooperation agreements so far seem to have involved mostly advanced economies, potentially creating a two-tier world for fintech cooperation. Our research suggests that just 4 percent of such cooperation agreements are signed between EMDEs, and most agreements have a component that includes an advanced economy. Most of these agreements are signed by authorities based in the Asia and Pacific region, although this is skewed by the fact that a small number of authorities sign many agreements.

International cooperation is particularly important in the face of new challenges from fintech. Regulatory challenges from BigTech and crypto assets are particularly relevant given their highly cross-border nature. This can make effective monitoring, supervision, and potential enforcement challenging. For BigTech, the power imbalance for authorities in smaller jurisdictions might require even greater need for those authorities to effectively collaborate with home jurisdictions to better manage risks. For crypto assets, where approximately 75 percent of exchange trading volume occurs in exchanges registered in offshore financial centers, the ability to coordinate responses across jurisdictions is important, particularly for EMDEs that might see greater demand for dollar-denominated stablecoins, some of which are issued from these centers (IMF 2021).

Bilateral technical assistance from international bodies can help strengthen monitoring. Fintech-focused technical assistance programs delivered by international financial institutions such as the IMF and the World Bank can help member jurisdictions better understand and monitor fintech developments. A growing number of requests for technical assistance are focused exclusively on fintech regulation, improving surveillance, and strengthening understanding of fintech. These are delivered through regional fintech courses or bilateral capacity development.[12] Additionally, the Bank for International Settlements has opened innovation hubs globally to assist central banks in gaining insights on new technologies, including developing public goods to improve the global financial system. These hubs can be used to create new paths of practical collaboration and exchange of knowledge.

Standard-setting bodies provide a venue for many authorities to work together to solve common problems. They support multilateral collaboration and engagement related to fintech development and lead on the development of global standards, guidelines, and recommendations. The Financial Stability Board, the International Organization of Securities Commissions, and the Basel Committee on Banking Supervision all have specific working groups on fintech-related issues to improve monitoring, carry out analytical research, and generate regulatory policy responses. Standard-setting bodies provide a forum where regulatory authorities can share their specific fintech experiences and shape and influence the direction of fintech regulation. They also provide a platform for this shared experience to benefit those

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[12]   Between August 2021 and August 2022, the IMF provided capacity development support on fintech regulation to 59 jurisdictions involving 204 supervisors through both regional workshops and bilateral technical assistance.

authorities that have smaller fintech ecosystems or that do not have the specialized resources to monitor developments.

Certain international bodies like the Global Financial Innovation Network focus exclusively on the effects of technology on financial markets. Some global and regional bodies focus specifically on monitoring fintech developments and solving common fintech-related problems. The Global Financial Innovation Network is a body of more than 80 regulators and related organizations that focus primarily on the impacts of fintech and RegTech, regularly sharing expertise, conducting joint work programs, and facilitating the testing of innovative propositions in multiple jurisdictions simultaneously (a so-called global sandbox; Global Financial Innovation Network 2022). The ASEAN Financial Innovation Network is a regional body that aims to support financial services innovation and inclusion in less developed markets within the ASEAN region and to provide a platform for collaboration and innovation for financial institutions and fintech start-ups. It also allows for the possibility of testing innovative solutions across the region. The European Forum for Innovation Facilitators provides a platform for supervisors to meet regularly to share experiences from engagement with firms through innovation hubs and sandboxes to share technological expertise, and to reach common views on the regulatory treatment of innovative products, services, and business models. Research conducted in the Global Financial Innovation Network, ASEAN Financial Innovation Network, European Forum for Innovation Facilitators, and other such organizations informs members on developments and potential regulatory action.

V. Conclusion

Effective monitoring of new fintech developments is critical to authorities in achieving their public policy objectives. In many jurisdictions, the rapidly growing fintech ecosystem has the potential to generate significant benefits for markets and consumers but might also create risks to financial stability, consumers, financial integrity, and market integrity. To mitigate these risks, authorities need to monitor new developments and identify them before they crystallize. This is particularly important in areas where fintech is creating considerable disruption because of the speed at which it grows and diversifies, and its use by both regulated and unregulated entities in financial services.

There are several ways to strengthen surveillance and respond to the challenges of fintech. Authorities can use existing supervisory structures to identify new fintech developments and highlight and act against any potential risks. In some jurisdictions authorities are building specialist fintech units such as innovation hubs and sandboxes to understand these developments more closely.

For most authorities, existing supervisory structures will allow them to effectively monitor new fintech developments and respond to challenges. Using existing resources and infrastructure can allow authorities to monitor new fintech developments and identify risks while saving cost and time on the design and implementation of new structures. This could be supplemented by embedding specialist resources within those supervisory teams; this allows authorities to ensure resources are directed at priority areas, particularly where risks from the fintech ecosystem are small, localized in the regulated space, or well understood. Existing supervisory structures can also allow supervisors to effectively triage risks and direct supervisory resources to areas that are most likely to challenge the ability of authorities to meet their objectives.

In some jurisdictions, the rapid growth and diversification of fintech might require dedicated specialist resources. This is likely limited to those jurisdictions where fintech is creating large consumer or systemic risks and authorities have access to resources and expertise. In these jurisdictions, authorities may want to consider developing an innovation hub to help monitor developments through targeted engagement and outreach. However, to ensure that these innovation hubs can strengthen surveillance, authorities will need to conduct appropriate feasibility studies, have clear objectives and aims, and ring-fence relevant resources to operationalize the initiative.

In a small subset of these jurisdictions, the development of sandboxes and other initiatives could support surveillance. Sandboxes may not be the most effective way for many authorities to monitor fintech developments because they are resource-intensive and costly, and engagement extends to a relatively smaller number of firms over a longer period. As horizon scanning tools, applications to the sandbox can indicate trends in the market, while the testing process can inform regulators on policy gaps or any unnecessary regulatory obstacles. It should be noted that sandboxes are not a sensible fix to underlying problems with supervisory structures and could amplify existing problems as well as allow authorities to carry out riskwashing.

Poorly designed or implemented sandboxes and innovation hubs should be reviewed and, if necessary, updated or shut down. In scenarios where authorities have innovation hubs and sandboxes that are not delivering desired outcomes or are generating excessive risk, these should be reviewed as a priority. Where possible, a new cost and benefit analysis should be conducted to determine next steps. Outcomes from a review may suggest certain changes. For many authorities this might include considering new guardrails for policy sandboxes that have been built using a product-testing sandbox blueprint or closing these arrangements and focusing on improving existing supervisory structures and practices.

Cooperation with peer regulators and international organizations is an important way for most jurisdictions to strengthen monitoring. The global nature of fintech means developments and risks usually transcend borders. Consequently, collaborating with regulatory peers and international organizations can help authorities better monitor developments and risks. Bilateral collaboration allows authorities to work flexibly with peers to concentrate on developments and risks as they arise, while multilateral collaboration allows clearer global oversight of new fintech developments and the ability to shape and influence the response.

Ultimately, local developments will need local solutions but should be aligned with global standards and guidelines. The growth of fintech is not consistent across jurisdictions, and areas of focus are also likely to differ. Authorities should evaluate options available to them under legislative frameworks and mandates and use approaches that are most likely to help achieve those objectives. Authorities should take appropriate steps to strengthen fintech surveillance and ensure they can effectively monitor new developments, identify any risks, and take steps to mitigate against these risks guided by global standards and best practices—including the BFA.

Annex I: Typology of Sandboxes

Product-Testing Sandboxes

The most popular model of sandboxes, product-testing sandboxes support the testing of new technologies against existing regulation. These sandboxes allow authorities to determine whether there are gaps in existing policy or unnecessary regulatory obstacles. Given that tests occur against existing regulatory frameworks, these sandboxes require some type of pretest license, most commonly a full license, although in some instances authorities might provide a lighter form of license for testing. Good practice requires a firm to receive a full license before testing, with additional restrictions depending on the nature of the test (commonly restrictions on the type or number of users). Where a test is successful, these restrictions are removed, leaving a firm to operate in the market with a full license. Where a lighter license has been given, the firm should then apply for a full license; until such a license is granted the firm will continue offering activities in accordance with the lighter license.

Policy Sandboxes

In comparison to product-testing sandboxes, policy sandboxes are used to test or evaluate potential new regulations. This approach is best suited where fintech leads to business models that do not fit neatly within the existing regulatory framework. In these instances, authorities might consider trialing new rules and regulations with a single or limited number of firms. Recently, policy sandboxes have been created to test market infrastructure with potentially larger rule changes, for example the impact of DLT on post-trade policy. In this model of sandbox, it may not be possible to grant a license that reflects the exact activities being carried out. Here, firms may rely on broader licenses or licenses granted for tangential activities. Rarely, firms might test without licenses given the lack of appropriate regulation. In this scenario, authorities must have some form of legal oversight to ensure they are able to effectively monitor and take actions during the course of the test. Given the risks that this model of sandbox generates, additional risk management tools such as tighter eligibility criteria should be used when designing the sandbox and when designing testing frameworks, potentially limiting the involvement of retail users.

Digital Sandboxes

Digital sandboxes are most often used on RegTech and SupTech applications but can be readily employed more broadly. Digital sandboxes (sometimes known as data sandboxes) can be used to support propositions that require large data sets for testing purposes. They are often used for RegTech and SupTech services that are looking to scale from proof of concept to proof of value. The provision of data can vary from real and anonymized data (which accurately reflects markets but opens regulators to risks of data leakage) to synthetic data (which can be generated through public–private collaboration but is expensive to create) to API marketplaces that allow firms' access to services. Digital sandboxes are particularly useful for machine learning algorithms that require access to large sets of data for training.

Thematic Sandboxes

Thematic sandboxes are most often used where authorities want the fintech community to focus on specific areas of financial services. Thematic sandboxes can align the support function provided by authorities with the authority's own goals and mandates. They can be used to help regulators understand a specific technology, business model, or sector and can be built as part of existing regulatory sandboxes. They can be used to foster innovation in specific areas of financial services, or they can be used to help achieve public policy goals such as financial inclusion. Such sandboxes involve the addition (or creation) of specific eligibility criteria that reflect these needs. For example, the Green Fintech Challenge in Singapore specifically calls on firms using fintech to develop green finance solutions to enter their sandbox and test their propositions. In the United Kingdom, the 6th sandbox cohort specifically welcomed applicants from firms using federated learning and traveling algorithms as well as complex scenario modeling and simulation. Another example is the regulatory sandbox in Nigeria, which is open only to payment innovations (Central Bank of Nigeria 2021). With this sandbox, the Central Bank of Nigeria explores technology that would enhance the accessibility, efficiency, security, and quality of the payments system. Firms participating in the sandbox do not need to obtain licenses from the Central Bank of Nigeria or be covered by existing regulations. Thematic sandboxes are particularly useful in jurisdictions where the fintech ecosystem is mature and the private sector has the talent, resources, and expertise to respond to such requests.

Cross-Sector Sandboxes

Domestic collaboration is important in capturing risks from firms that might operate across sectors. BigTechs operate across several sectors within financial services (that is, payments, insurance, securities) but also across broader industries (such as financial services, energy, utilities, telecommunications), so domestic collaboration across multiple cross-sectoral entities is key. While cross-sectoral sandboxes remain underused, the growth of BigTechs is likely to generate greater demand.

Cross-Border Sandboxes

Fintech is cross-border by nature, and these aim to link multiple sandboxes together or provide a common testing platform for a group of regulatory authorities. While they are conceptually appealing, significant challenges exist, especially differing mandates, legislation, and regulatory frameworks. When cross-border sandboxes are implemented correctly, the aim is to allow firms to test their innovative solutions across multiple jurisdictions simultaneously.

Annex II: TechSprints

TechSprints are not exactly an institutional approach but more of an institutional tool. They are technology-focused design sprints and can help authorities monitor new developments, particularly for RegTech and SupTech. They are more commonly known as hackathons, but when implemented by regulatory authorities are more appropriately termed TechSprints. They bring together diverse participants such as computer programmers, interface designers, and domain experts to collaborate intensively over a short time on a particular problem. TechSprints aim to solve a single, clear problem statement—usually set by the regulatory authority—and are more likely to be focused on RegTech and SupTech propositions, although they can support broader innovation.

While TechSprints might vary in design and delivery, there are several unifying principles. The problem statement should be set by the authority, but the response is led by the industry and involves multifirm collaboration and participation. The solution is usually developed in an open and transparent manner and the TechSprint is made public, which means that other participants with an interest and contributions to make can be involved. Authorities can participate in the discussion but, to avoid conflicts of interest and competition concerns, should not endorse the solutions developed.

A clear problem statement is integral to a successful TechSprint (Alliance for Innovation Regulation 2020). The focus can be on problems that cannot be solved by a single authority or private firm and where collaboration is required to generate positive outcomes. As solutions are developed by industry, the problem statement needs to be compelling to the private sector. Practical use cases can help illustrate goals.

Often, data are the core element to any TechSprint and can be provided by an authority or generated by the private sector. Many existing RegTech and SupTech solutions use large data sets to solve common problems. However, it is important to identify exactly what types of data sets are relevant to the problem statement as the capture, storage, and use of real data (even when anonymized) present risks to regulators. In many cases, authorities have worked to develop synthetic data or make use of newer innovations such as differential privacy,[13] homomorphic encryption,[14] and zero-knowledge proofs.[15]

Infrastructure, logistics, and team composition need to be planned far in advance. Large TechSprints can take up to a year to organize. Within TechSprints, participants from different areas of the private
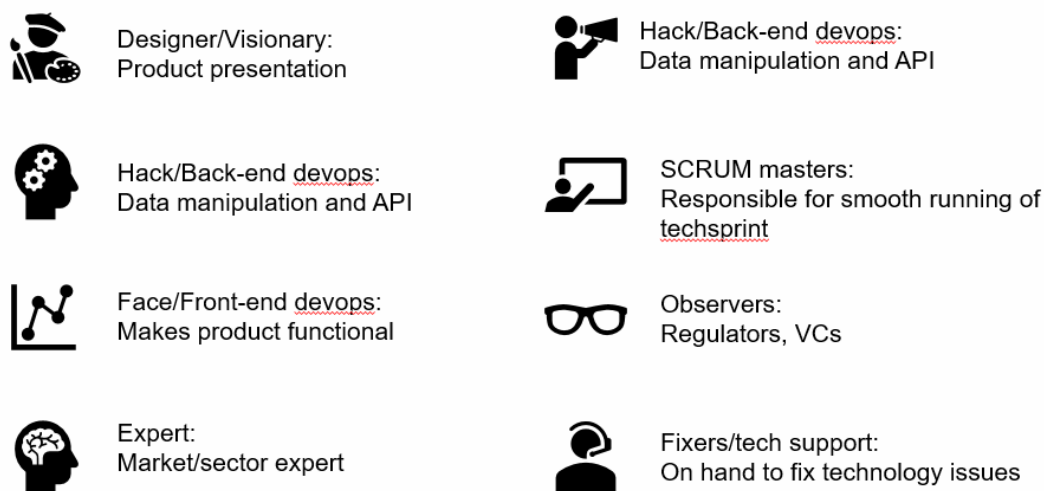
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[13] Differential privacy aims to ensure that the behavior of a data set hardly changes when a single data point joins or leaves the data set. This can be through inaccurate information being injected into the data in amounts too small to disturb observation of major trends and limiting the number of times a data set can be queried.

[14] Homomorphic encryption is a technique in which data can be shared in encrypted form and then worked on, still in that form, without the need to decrypt. This is done using a public key to encrypt the data and an algebraic system to allow functions to be performed on the data while it is still encrypted. The individual with the matching private key can then access the unencrypted data only after the functions and manipulation are complete.

[15] Zero-knowledge proofs enable parties to check or verify information with each other without having to share full records through a series of challenges to provide an output of yes or no.

sector are expected to work together in common teams to bring together regulated and unregulated firms. This can lead to issues around ownership of any outcomes, including intellectual property. In many cases,

Annex Figure 2.1. Key Roles in a TechSprint

Designer/Visionary: Product presentation

Hack/Back-end devops: Data manipulation and API

Hack/Back-end devops: Data manipulation and API

SCRUM masters: Responsible for smooth running of techsprint

Face/Front-end devops: Makes product functional

Observers: Regulators, VCs

Expert: Market/sector expert

Fixers/tech support: On hand to fix technology issues

it is agreed in advance that any intellectual property belongs to the authority or is shared among all participants. Team composition can differ, but there are several elements common to most TechSprints (Annex Figure 2.1).

TechSprints can last several days, often under a week, so outcomes generated are usually theoretical. A TechSprint can prove or disprove a hypothesis and help authorities understand new developments in practice, but it seldom creates a product ready for deployment. In most good-case scenarios, the outcome is a valid proof of concept that can then be worked on to grow to proof of value. To be operationally viable after a TechSprint, further and ongoing investment might be needed by authorities, participants, or third parties.

TechSprints can allow authorities to understand how new technologies can solve existing problems. They can help authorities better understand how new technologies can contribute to achieving their mandates and can result in rapid learning (Annex Box 2.1). TechSprints, through their outputs, can showcase new developments to regulators, who can use these insights to improve either internal functions or the ways firms interact with authorities. In jurisdictions where RegTech and SupTech are growing quickly, they can provide a useful way of bringing relevant developments to the attention of authorities. Providing feedback on TechSprints quickly and concisely is important to supporting any future stage of development.

Annex Box 2.1. Case Study: UK Financial Conduct Authority Sustainability TechSprint

In October 2021, the UK FCA held a TechSprint focused on building technological solutions to overcome challenges faced by regulators in monitoring environmental, social, and governance data and disclosures; 59 regulators took part from 36 jurisdictions in the regulatory roundtables to support the main TechSprint, which itself involved 120 active participants (FCA n.d.).

The TechSprint worked to develop solutions for four use cases: (1) using technology to enable regulators to verify that environmental, social, and governance disclosures by listed companies and regulated firms are accurate and complete; (2) deploying technology to generate insights from environmental, social, and governance disclosures to understand how regulated firms and listed issuers are transitioning to a more sustainable future and where regulator intervention may be required; (3) using technology to support regulators in tracking and verifying claims regarding net-zero targets; and (4) using technology to help regulators determine key areas and data points to consider the design of robust, reliable, and accurate sustainable investment labels.

Each team aimed to solve for one or more of these use cases using novel technologies or existing technologies in new ways. The solutions developed ranged from a tool to help verify companies' carbon offsetting programs to one that helped develop a sustainable investment label using an impact score.

For example, one of the winning teams focused on the third use case and demonstrated a solution that aimed to track how companies are moving toward net-zero targets by increasing transparency around companies' carbon offsetting programs by verifying their reports on their carbon footprint and offsetting using independent data from satellite imagery, drones, and Internet of Things devices.

Results from this TechSprint are informing broader policy work carried out by the FCA as well as global supervisory forums such as the Global Financial Innovation Network.

TechSprints require significant resources and a mature technology ecosystem. Significant resources are required to perfect problem statements, identify and convene participants, carry out infrastructure and logistic tasks, and ensure that outcomes, where possible, are operationalized post-TechSprint. Importantly, when used exclusively as a monitoring tool, TechSprints are not an efficient method of conducting surveillance. They are resource-intensive and can focus on only one problem statement at a time, which—in the context of surveillance—can leave large gaps. In some TechSprints authorities take a more proactive approach to outcomes, such as providing sponsorship. This can lead to conflicts of interest and significant reputational risk. It is best that authorities are not seen to endorse outcomes and maintain independence. Where TechSprints generate a theoretical proof of concept, some authorities provide digital or data sandboxes to help scale up the solution.

Annex III: Data on Institutional Arrangements

Annex Figure 3.1. Innovation Hubs and Sandboxes around the world
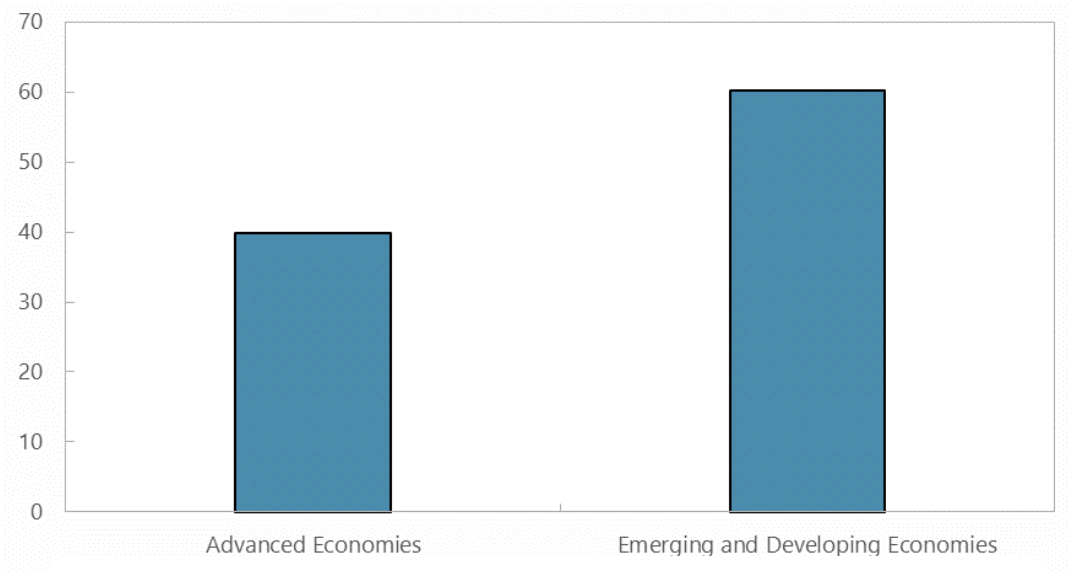
■ Sandbox only   ■ Innovation Hub only   ■ Both
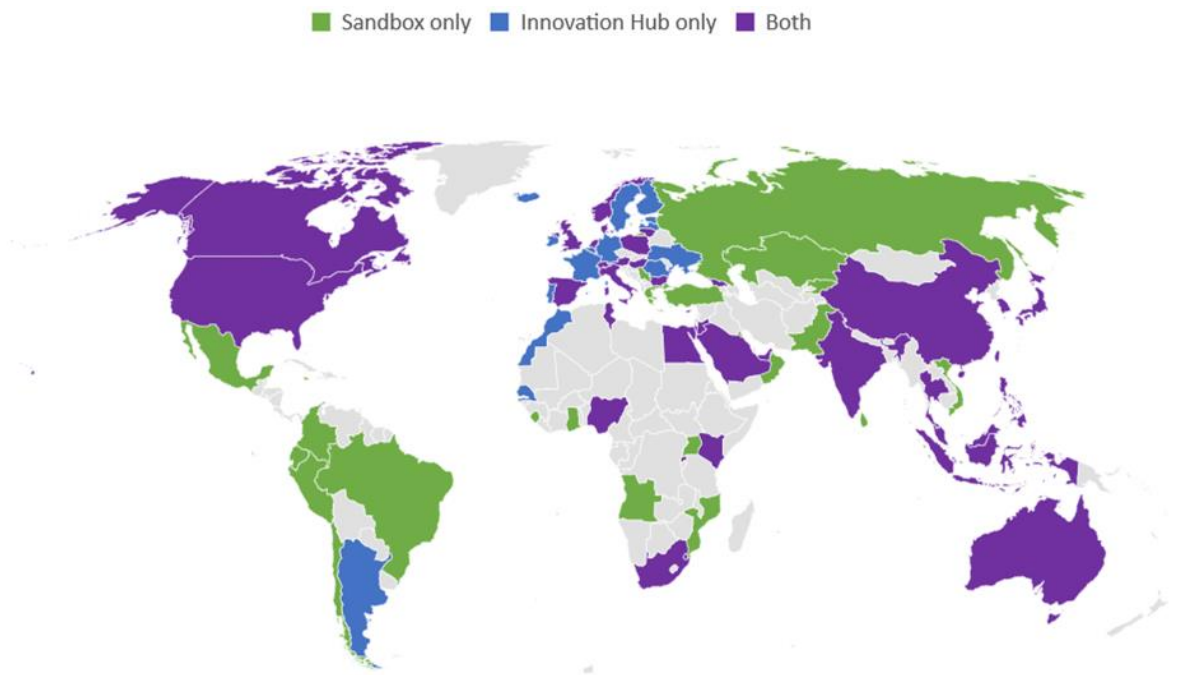
*Some innovation hubs and sandboxes are still in development.

Source: World Bank, Cambridge Center for Alternative Finance, and IMF staff calculations.

Annex Figure 3.2. Sandboxes by Region (%)

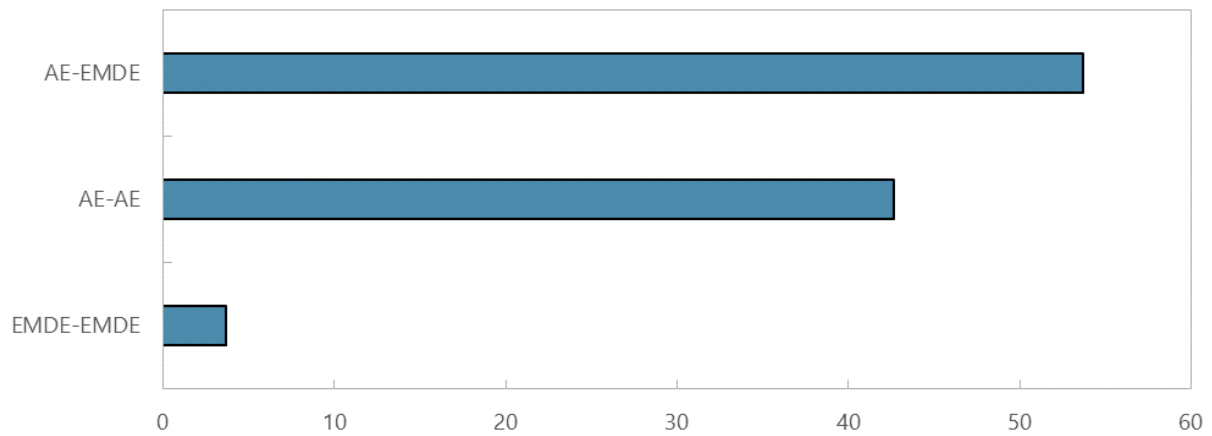Source: IMF staff calculations.
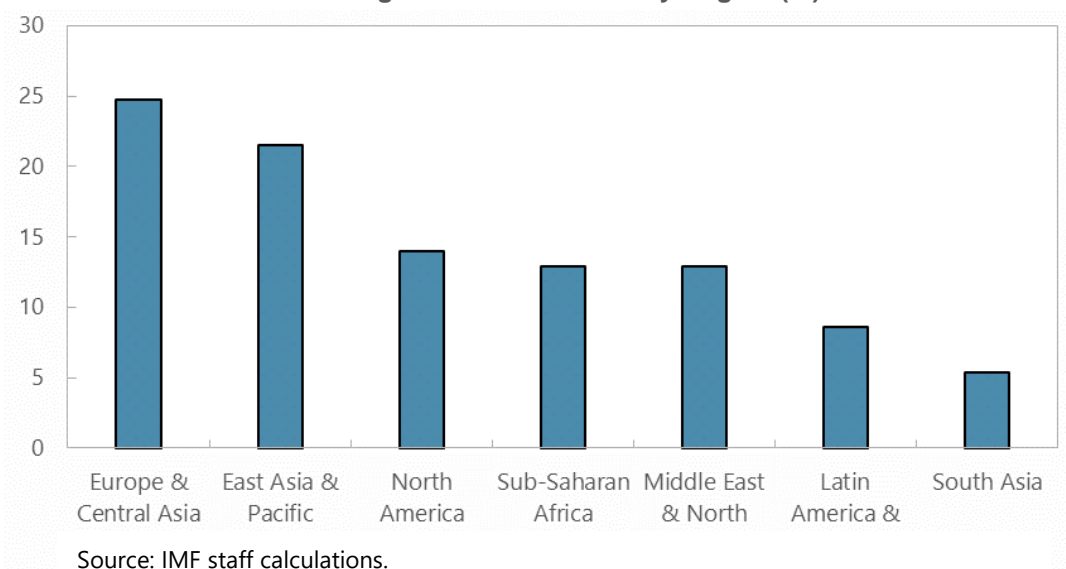
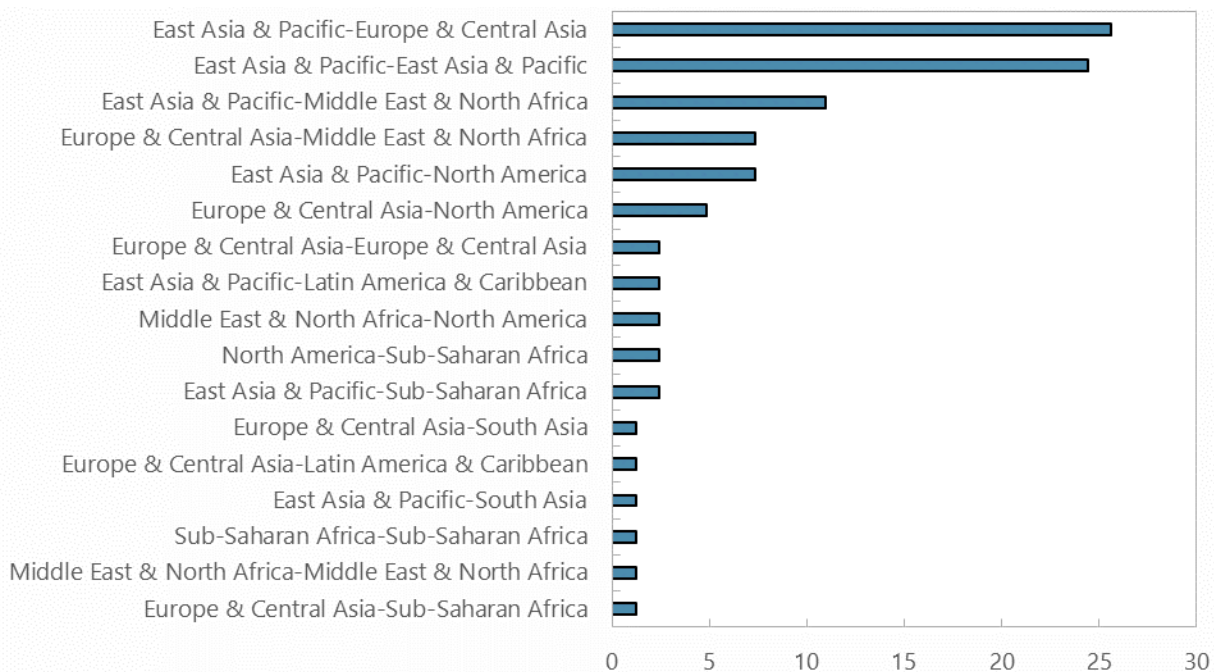**Annex Figure 3.3. Sandboxes around the world (%)**

Source: IMF staff calculations.

Annex Figure 3.4. A two-tier world of Fintech Agreements (%)

Source: IMF staff calculations.

Annex Figure 3.5. International Cooperation between Regions (%)

Source: IMF staff calculations.

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