

Caught in quicksand? Compliance and legitimacy challenges in using regulatory sandboxes to manage emerging technologies

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Abstract

Regulatory sandboxes have become the latest development in regulatory reform, starting first in financial regulation and now expanding to other sectors. While sandboxes offer notable potential benefits for managing emerging technologies, achieving desirable policy outcomes with this novel regulatory instrument also comes with technical and political challenges. This article offers a framework to characterize regulatory sandboxes in any sector, involving a blend of (1) approval regulation with broad-based standards, (2) restricted discretion by the regulator for specific norms, (3) process-oriented regulation, (4) an outcomes-orientation, and (5) structured regulator–regulatee information sharing or dialogue. Using this model, the article outlines issues in compliance and legitimacy, including in trust and accountability, responsive enforcement, the politics of participation, and post-sandbox oversight. The article concludes by calling for greater scrutiny when considering implementing a sandbox instrument, with attention to sector-specific concerns, and offering directions for empirical evaluation of regulatory sandboxes.

Keywords: compliance, emerging technologies, fintech, flexible regulation, regulatory sandbox.

1. Introduction

Significant global hype now surrounds the idea and use of regulatory sandboxes. A sandbox program generally provides an institutional framework enabling regulators to authorize and oversee regulatees in testing an innovative product or business model in a limited setting, often after providing some type of regulatory relief or assistance to a regulatee (or group of regulatees) and imposing a substitute set of regulatory norms (Allen, 2019; Ranchordas, 2021; Zetsche et al., 2017). In 2015, the United Kingdom's (UK) Financial Conduct Authority (FCA) introduced and deployed the first regulatory sandbox to assist in managing the products of emerging financial technologies (fintech) (FCA, 2015). Since then, myriad national and subnational financial regulators have followed suit in establishing fintech sandboxes for trialing technologies such as artificial intelligence and blockchain. The rapid dispersal of sandboxes around the world and recent establishment of transnational sandbox authorities reflect the current global era of regulatory capitalism, where regulatory norms, models, and values spread more readily across jurisdictional borders through various actors and mechanisms (Braithwaite, 2008; Braithwaite & Drahos, 2000; Levi-Faur, 2005).

Though self-described regulatory sandboxes have only recently appeared, their advocates reflect attitudes that conceive of regulation as restrictive to innovation as well as the broader commitments of flexible regulation to adaptation and nimbleness (see Ford, 2017). Notably, sandboxes belong to a small set of regulatory instruments designed specifically and primarily to manage the uncertainty and complexity of emerging technologies. As a result, the design, implementation, and dispersal of sandbox instruments have become bound up in the politics of emerging technologies, innovation, and technology-driven competition more broadly (Engels et al., 2019; Omarova, 2020; see Pfotenhauer et al., 2019). With states feeling the pressures of technological competition and

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financialization to foster innovation and investment within their borders, various concerns have been raised about sandboxes ushering in new regulatory “races to the bottom” as jurisdictions compete to bring investors and capital within their borders (Allen, 2020; Brummer & Yadav, 2019; Marjosola, 2019). Regulatory sandboxes therefore find themselves immersed in ongoing conversations around managing risk, complexity, uncertainty, and fragmentation within regulatory regimes.

Moreover, the sandbox model has begun to spread to other emerging technologies beyond fintech. Regulatory sandboxes have already appeared in diverse sectors such as autonomous vehicles, data protection, health, legal services, energy, and environmental protection (Leckenby et al., 2021; Tsai et al., 2020; Utah Supreme Court, 2021), while sandboxes have been proposed to manage humanitarian technologies or neurotechnological products (Martin & Balestra, 2019; Royal Society, 2019). Japan¹ and Russia² have adopted more comprehensive sandbox programs for testing products across a wide variety of sectors. Yet, expanding the sandbox model to sectors beyond finance and fintech has occurred largely without full examination of how, why, where, and under what conditions the regulatory instrument would be expected to yield desirable policy outcomes.

Despite the rapid proliferation of regulatory sandboxes around the world, empirical evaluations of sandbox operation and performance have only just begun to emerge and often have limited grounding in the regulatory governance literature (Buckley et al., 2020; Alaassar et al., 2020; but see Fahy, 2022). While this is no doubt due, in part, to the newness of the instrument, at least part of the challenge in evaluating these tools arises from the lack of a conceptual guide and the perception of significant differences between various sandbox programs (see de Koker et al., 2020). Sandboxes have previously been referred to as a form of principles-based regulation (Allen, 2019) or a strategy of enforcement (Philipsen et al., 2021). Yet, these depictions are only partially true and may overlook core elements of the instrument that may individually or collectively offer opportunities for expanding on benefits or raise new policy challenges.

This article will proceed by briefly reviewing descriptive accounts of regulatory sandboxes and rationales for their use, before developing a broader conceptual framework for characterizing sandboxes in any sector as a distinct regulatory instrument. This framework will then be used to anticipate and map potential issues in administering sandboxes, focusing on compliance and legitimacy challenges. Based on this mapping and evaluation, this article argues that policymakers should apply greater scrutiny when considering a sandbox for a particular policy problem, including by comparing them to other available instruments. The article concludes by offering directions for empirically evaluating the internal workings and policy outcomes of regulatory sandboxes in any sector.

2. Innovation, uncertainty, and rationales for regulatory sandboxes

While the details of sandbox programs vary, these instruments are generally described as having several components, including explicit policy goals, criteria for selecting regulatees to participate, limits on scope of the regulatee's trial, options for the regulatory relief offered, and conditions for firms to exit the sandbox (Allen, 2019; Buckley et al., 2020; European Commission, 2021; Philipsen et al., 2021; Zetzsche et al., 2017). These features typically enable firms to apply to a regulatory body for permission to access an environment where the enforcement of at least some existing rules is modified, typically with limitations on the scope and duration of the trial. Regulators may modify existing norms in a variety of ways, ranging from softer approaches of providing customized guidance on compliance in a particular setting to more formally waiving or altering the requirements of a rule. Another common option may involve commitments to not enforce violations of a rule that formally remains in effect (e.g., with “no action letters”), though further methods of altering norms are possible. In financial regulation, for example, this may involve the regulator waiving or modifying rules around licensing fees, capital adequacy requirements, or a firm's capital credit rating (e.g., Monetary Authority of Singapore [MAS], 2016).

Policymakers, scholars, and industry actors have provided various justifications for adopting regulatory sandboxes, primarily in the setting of fintech. These justifications often entangle arguments about political economy and the politics of technology by generally appealing to the potential of these instruments to effectively and efficiently manage risk while building capacity in the face of technological and regulatory uncertainty (Brown & Piroška, 2021; see Allen, 2019; Buckley et al., 2020). Common rationales include enhancing innovation, investment, and competition (within or across jurisdictions); decreasing regulatory unpredictability and improving regulator–regulatee relationships; enabling firms to trial and improve novel products or business models; and

speeding market access for potentially socially beneficial applications of those technologies (e.g., Australian Securities & Investment Commission [ASIC], 2020; FCA, 2015; Financial Services Regulatory Authority [FSRA], 2016; MAS, 2016; Yuen, 2016). Others highlight the potential of regulatory sandboxes to enable policymakers to test or adjust regulatory frameworks to operate better for emerging technologies (Allen, 2019; Kataoka, 2019).

Often, policymakers and policy documents make explicit appeals to the need for and value of promoting innovation as a primary driver for deploying regulatory sandboxes, with an implicit message that other instruments may not deliver on innovation goals. These rationales often adopt or assume the “deficit model of innovation,” in which “policy problems are framed as problems of innovation and where a lack of innovation is routinely invoked as the main obstacle to social progress” (Pfotenhauer et al., 2019, p. 896). As opposed to ad hoc pilot projects, justifications for sandboxes are often infused with political narratives that emphasize the state’s role in fostering and nurturing private innovation on behalf of the broader public. Pfotenhauer et al. (2019) raise political issues of how these narratives in practice can essentialize innovation as the only relevant value or interest in a policy space and erode the potential for meaningful social dialogue or critique. Promoting innovation and decreasing uncertainty in rules may also distract sandbox regulators from objectives of maintaining the integrity of financial markets (Brummer & Yadav, 2019). Fintech sandboxes could also “riskwash” financial regulation and enable firms to engage in riskier behaviors than would otherwise be permissible in pursuit of promoting innovation (Brown & Piroška, 2021).

More broadly, the governance of emerging technologies often calls for, among other items, anticipating issues and agilely responding to problems as they appear (Stilgoe et al., 2013). These calls reflect the concerns raised by underlying uncertainty over how a technology will develop, how its introduction into society may pose policy and social issues, and how the rate of development may outpace evolution in legal and regulatory systems. Rationales for regulatory sandboxes in fintech tap into these anxieties over uncertainty by arguing these tools can provide a space to identify potential issues and build policy responses while mitigating risk to a broader public (see also Engels et al., 2019). While this is indeed a promising feature of sandboxes, the ability of small-scale sandbox testing to safely produce generalizable policy insights is contested (Brummer & Yadav, 2019; Omarova, 2020) and must be balanced against concerns such as legitimacy and perceived regulatory fairness (Knight & Mitchell, 2020). Nor are sandboxes the first or only instrument adopted to manage technological innovation and uncertainty, and lessons can be taken from how other instruments have fared in these endeavors when accounting for relevant technological and social differences between cases (European Commission, 2021; Ford, 2017; Roca et al., 2017). Ultimately, claims of policy successes with sandboxes require empirical evidence to support them.

These rationales for implementing regulatory sandboxes frequently play up the potential benefits of the sandbox model without substantial engagement with criticism, adding to the hype surrounding this tool and firmly embedding sandboxes in the politics of emerging technologies. However, proponents often fail to take seriously the potential downsides of the instrument or reflect on the lack of current empirical evidence supporting claims of potential benefits. Little, if any, discussion explores the justifications or conditions for using sandboxes as opposed to another potentially appropriate regulatory instrument.

3. A framework for regulatory sandboxes

Rather than a revolution in governance, sandboxes represent more of an evolution in regulatory reform. Through situating sandboxes in the canon of regulatory literature, it becomes clear that these instruments incorporate normative dispositions and technical strategies that have been developed over the past several decades. Most notably, sandboxes follow in the footsteps of various “flexible” forms of regulation, championing the value of regulatory regimes which can adapt to new scenarios and regulatee-specific circumstances, bring third parties into the regulatory process, and promote capacity building for all actors in the regulatory space (Ford, 2017). Flexible regulation, in turn, finds its roots in responsive regulation—seeking to attune regulators to the conditions and capacities of regulatees—and meta-regulatory approaches that both recognize nonstate actors’ capacities to engage in (self-)regulation and efforts seeking to engage these capacities (Ayres & Braithwaite, 1992; Gilad, 2010; Parker, 2002).

Flexible regulatory instruments are not value free, however, and carry with them a set of normative assumptions about the “ideal” world, including high-capacity regulators and private actors internally motivated to productively participate in governance (Ford, 2017; Simon, 2017). Deviations between these assumptions and scenarios “on the ground” can create tensions in regulatory practice. From this history, regulatory sandboxes emerge as the latest instrument in the flexible regulatory toolbox, fusing normative commitments to flexibility and capacity building in regulation with policy goals to promote technological innovation and fuel competition.

Flexible regulation is also rooted in experimentalist approaches to governance. Dorf and Sabel (1998) emphasize experimentalism’s potential to respond to and manage uncertainty in a policy space by championing strategies designed to encourage adaptation and capacity building across actors in the space (see also Sabel & Simon, 2011). This generally occurs through a central institution authorizing or encouraging various actors in the regulatory space to test new or custom sets of regulatory norms or practices. The central body can monitor and learn from these experiments, synthesizing insights from across the space to guide or coordinate future regulatory activities, capacity building for regulatees or stakeholders, or further experimentation. Thus, experimentalism strives to harness the potential of new governance strategies to manage uncertainty, foster learning and participation, and provide flexibility (Sabel & Simon, 2011; see Ford, 2008, 2010).

Drawing on this normative and technical heritage, regulatory sandboxes similarly position regulators as the administrators and coordinators of various experiments that ideally facilitate learning about the emerging technologies being tested and applicability of various regulatory norms (Allen, 2019; Ranchordas, 2021; Zetzsche et al., 2017). Sandboxes are thus not truly as novel as they are sometimes depicted, as these instruments draw heavily on the traditions of experimentalist and flexible regulation. Further, particularly given their use for testing new approaches for managing emerging technologies, sandboxes also fit closely within anticipatory styles of governance that aim to be robust in the face of uncertainty and prepare for or adapt to various outcomes (Armstrong & Rae, 2017; Stilgoe et al., 2013; Stokes, 2021). These instruments have elements in common with other techniques gaining increasing attention, including sunset clauses and experimental rules (Ranchordas, 2015, 2021) or rule waivers (Coglianese et al., 2021). Yet, regulatory sandboxes offer a distinguishable approach within these broader traditions that more often involve an institutional framework for modifying existing norms and administering the substitute regulatory structure crafted—often on a case-by-case basis in consultation with regulatees—rather than establishing new trial rules alone or phasing out existing ones. Of course, experimental clauses in legislation may also form the legal foundation for a state regulator to initiate a sandbox program (European Commission, 2021). The framework below expands on the dimensions of the sandbox approach.

Regulatory sandboxes have previously been described as principles-based regulation or a particular strategy of enforcement, yet neither of these depictions offers a model that can completely capture what sandboxes “are,” how they function, and how actors operate within them. Sandboxes and principles-based instruments are both types of relational regulatory instruments in that they may involve broad-based principles instead of detailed rules, softer legal norms, less formal enforcement strategies, and require reciprocal trust and aligned interests to function properly (Marjosola, 2019). However, while principles-based regulation frequently involves continuous and iterative interpretation of principles among regulators and regulatees and responsive enforcement strategies (Black, 2008, 2011), sandboxes generally lack a component of ongoing, collaborative norm interpretation once regulatees have been approved to enter the sandbox and may structurally restrict the enforcement capabilities or discretion of regulators, at least for specific, existing norms. Nor is an enforcement paradigm large enough to capture the substance of sandboxes, since these instruments often involve features such as meta-regulatory modes, structured regulator–regulatee dialogue, or a shift to outcome-based standards.

3.1. The framework

Accordingly, this article builds on descriptive accounts of regulatory sandboxes (e.g., Allen, 2019; Buckley et al., 2020; Omarova, 2020; Zetzsche et al., 2017) to construct a broader framework for regulatory sandboxes, grounded in an examination of several globally prominent sandbox frameworks at various levels of government (e.g., ASIC, 2020; Canadian Securities Administration [CSA], 2017; FCA, 2015, 2017; FSRA, 2016; Global Financial Innovation Network [GFIN], 2018; MAS, 2016, 2020; Yuen, 2016) and the emerging literature on sandboxes. The goal of the framework is to characterize regulatory sandboxes as a distinct type of regulatory instrument

within the larger categories of flexible, experimentalist, and anticipatory modes of governance. Recognizing that previous scholarship has stressed the diversity of sandbox programs across jurisdictions, whether real or self-described, this article aims to provide a portrait of the “ideal type” of this instrument and notes that different regimes may identify more or less tightly with each element described here (see Black, 2011, p. 9). While mapping out an ideal type offers potential descriptive or analytical value, care should also be taken to not overgeneralize from the framework below and great value remains in examining the design and legal, sociocultural, political economic, and historical contexts of individual sandbox programs. Given these caveats, it is argued here that regulatory sandboxes generally contain some combination of the following components:

- (1) to enter the sandbox, approval regulation with broad-based standards;
- (2) restricted discretion by the regulator to enforce specific, existing regulatory norms;
- (3) process-oriented regulation engaging the regulatee’s internal systems and controls;
- (4) an outcomes-orientation to regulation; and
- (5) structured regulator–regulatee information sharing or dialogue.

Each of these five elements may span a range from formally to informally constituted in a sandbox model. For example, authorizing legislation or formalized regulatory frameworks may explicitly require an element or, instead, an element may arise in practice as the regulatory community implements the sandbox, regardless of formal decrees. The following discussion expands on each of these core elements, whether formally prescribed or informally implemented. Moreover, while current regulatory sandbox programs place the state as the regulator and firms as regulatees, this framework should be read as agnostic to the types of actors in each role. Regulatory sandboxes could also be used, for instance, in one level of government managing another’s activities or in a civil society actor regulating firms with their nonbinding instruments.

First, sandboxes frequently adopt a system of approval regulation by using broad-based standards to determine the eligibility of regulatees, products, or business models seeking to operate within the sandbox and conditions placed on participation. Approval regulation positions regulators as gatekeepers to market entry who weigh data—or preliminary evidence or plans for trial approval—submitted by regulatees against standards such as safety, which may prompt greater information disclosure to regulators (Carpenter et al., 2010). When determining whether to admit a regulatee into the sandbox, regulators often use a set of predefined flexible standards for evaluating factors such as the size and scope of the trial within the sandbox, the capacity of the firm and their own knowledge of the product or business model proposed as well as its “innovativeness,” and whether the anticipated magnitude of benefits outweighs risks (Buckley et al., 2020; European Commission, 2021; Zetzsche et al., 2017). The Netherlands’ fintech sandbox uses, among others, a particularly open standard of “[t]he application of the innovative product, service or business model runs into unnecessary policy or legal barriers that the financial services company cannot *reasonably* overcome, although it does meet the underlying aim of such policies or laws” (De Nederlandsche Bank and Dutch Authority for the Financial Markets, 2016, p. 4). Several sandbox models explicitly call for preliminary evidence to use in considering approval under these standards based on trials in a “laboratory environment” (MAS, 2016; see FSRA, 2016), mirroring common approval regimes in medical products schemes, while other regulators may have less formal expectations for such preliminary data. Yet, such broad approval standards leave considerable room for interpretation and implementation by regulators and regulatory communities (Black, 2002, 2008).

Second, the sandbox model generally involves regulators restricting their own discretion or authority to enforce specific, existing rules under their jurisdiction. Regulators may use various legal or nonlegal methods to realize this approach, including “no action” letters, express waiver of rules or licensing requirements, or custom guidance provided to a regulatee accompanied by a commitment not to enforce existing rules if the regulatee adheres to the guidance (Philipsen et al., 2021; Zetzsche et al., 2017). This process reflects at once a recognition of preexisting, “inherited” regulation applicable to emerging technologies (Stokes, 2012) and also strategic, intentional curbs on the scope and force of those inherited rules for firms (Coglianese et al., 2021). Regulators creating bespoke arrangements with individual regulatees, involving waiving rules or relaxing enforcement or monitoring activities, is not novel to sandboxes. Sandboxes do, however, institutionalize this process and frequently invite a potentially large quantity of regulatees to apply for and negotiate custom arrangements with the regulatory body, tasking regulators with allocating their scarce resources toward crafting these *sui generis* arrangements with many

individual regulatees. Perhaps unsurprisingly, some regulators including Singapore's MAS (2020) have created a default set of sandbox standards for common products, which may conserve regulatory resources but slightly limits the flexibility this element confers to sandboxes. Moreover, restricting discretion to enforce specific, existing rules should not discount the notable discretion regulators may exercise through the other elements of the framework, particularly around decisions to approve or remove a firm from the sandbox environment.

Restricting enforcement discretion of certain rules while in the sandbox may aid firms deploying an innovative product or business model not anticipated by existing regulatory regimes; however, regulators must ensure that adequate safeguards remain in place to continue to achieve the policy objectives sought by the rules to be relaxed (Allen, 2019; European Commission, 2021; FCA, 2015). The decision not to restrict enforcement discretion on a certain rule or set of rules may be just as important in achieving regulatory objectives as safeguards brought in via the approval or process-based systems. For instance, rather than create ad hoc safeguards, a sub-national sandbox in the United States (Arizona) leaves in place consumer protection norms deemed critical to balance the risks posed by the novel products (Watkins et al., 2018; but see Allen, 2020). More generally, the Canadian model specifies that “[f]irms authorized to operate in the sandbox remain subject to all applicable regulatory requirements, subject to any exemptive relief granted” (CSA, 2017). How regulators and regulatees determine which existing rules are nonderogable in sandbox arrangements in various sectors has not been subject to sufficient empirical or theoretical evaluation to date.

Third, sandboxes often rely on systems of process-oriented regulation to promote risk management and learning within the sandbox, generally in tandem with the regulator committing to restricted enforcement discretion. Process-oriented regulation (with tools such as management-based instruments) involves the regulator setting processes and criteria regulatees must follow to develop a set of internal systems and controls for self-regulation, often with regulatory approval and periodic inspection required (Gilad, 2010; see Coglianese & Lazer, 2003). These approaches find conceptual roots in responsive and enforced self-regulation (Ayres & Braithwaite, 1992), requiring a regulator with high capacity and strong political support to properly supervise and coordinate regulatees and their management over the long-term—especially in the strongest form of process-based regulation involving iterative regulator–regulatee learning (Gilad, 2010; Parker, 2002). Regulators often set routine elements that must be included in these internal systems, though regulators and regulatees may negotiate to an extent on design and implementation. While requiring regulatees to develop and deploy internal systems and controls could be described as part of the larger approval process for sandboxes (Allen, 2019; Zetzsche et al., 2017), conceptualizing safeguards and similar sandbox measures as process-oriented oversight strategies triggers a new suite of theoretical benefits and challenges which merit specific attention. These approaches can offer high flexibility and leverage the expertise and capacity of individual regulatees, but lead to complex regulatory environments where success depends on how aligned firms' interests are with public policy goals and the quality of both regulator-management and management-workforce relationships over time (Gunningham & Sinclair, 2009; Simon, 2017).

Regulatory sandboxes may formally or implicitly call for process-oriented regulation as a condition of entry and participation. For example, the FCA evaluates whether an applicant firm has “invested appropriate resources in ... mitigating the risks” of their fintech product and prefers to impose “safeguards” on the trial by inviting firms to “propose what disclosure, protection, and compensation they will provide to customers, and the FCA will work with businesses to ensure that we are comfortable with what has been proposed” (2015, pp. 7, 21; see also Yuen, 2016). By contrast, the MAS has a less formalized variant of process-oriented regulation, considering whether firms applying to participate in the sandbox have “assessed and mitigated” significant risks, including by examining “the [firm's] proposal for mitigating the risks” (2016, p. 6). Regulators may use broader or more precise standards for evaluating the regulatee's proposed internal systems and controls. For example, Malaysia's fintech sandbox lists multiple broad standards for evaluating proposed safeguards including “promoting the fair treatment of consumers” (Bank Negara Malaysia, 2016, p. 5) while Abu Dhabi's FSRA (2016) requires firms to propose safeguards “and demonstrate how they are appropriate to the FinTech Proposal being tested” as a particularly broad standard (p. 8).

Fourth, while inside the sandbox, regulators often apply an outcomes-oriented approach to regulation that often emphasizes a regulatee's performance and achievement of relevant outcomes as the metric of regulatory success rather than compliance with specific behaviors (Black, 2011; Gilad, 2010). Outcomes-based approaches

(e.g., performance-based regulation) provide regulatees with wide latitude to plan and take action toward achieving predetermined policy goals, which can be constructed in various manners and with different levels of specificity, so long as regulatees do achieve desired outcomes (Coglianese et al., 2003; May, 2003, 2007). These modes of oversight generally aim to decrease compliance costs while maintaining or increasing effectiveness in regulation. However, success in outcomes-oriented approaches still requires setting technically and normatively appropriate performance goals, substantial monitoring with compliance, and supervision to ensure regulatees do not engage in activities undermining policy objectives while still meeting predetermined outcomes (Black, 2011; Coglianese, 2017). Notably, outcomes-oriented and process-based regulation may overlap in instruments such as principles-based regulation or sandboxes, though each approach focuses on different elements of regulatory systems—either the eventual outcomes of regulatee activities or the processes regulatees (and regulators) adopt early and continue over time (Black, 2011; Gilad, 2010).

Regulatory sandboxes may adopt outcomes-oriented approaches by evaluating regulatee performance against particular outcomes or goals rather than standards requiring specific behaviors. These outcomes can range from narrower endpoints to broader goals, which is not uncommon in outcomes-oriented strategies (May, 2007). For example, Australian regulators can eject a firm from the sandbox if they determine the regulatee has “failed to act efficiently, honestly and fairly,” without specifying exactly which behaviors meet these undesired outcomes (ASIC, 2020). Notably, sandbox models may have regulators prescribe outcomes but can also involve regulatees proposing appropriate outcomes and indicators or regulators and firms collaborating to develop appropriate outcomes. Singapore and Abu Dhabi’s programs both expect firms applying to the sandbox to “clearly define the FinTech Proposal’s ... intended outcomes” (FSRA, 2016, p. 7) and the regulator must be “satisfied that the sandbox has achieved its intended test outcomes” (MAS, 2016, p. 6) before the firm becomes eligible for licensing following the sandbox trial. Both regulators can eject a regulatee from the sandbox for failure to comply with these outcomes.

Finally, sandboxes frequently structure dialogue or information exchange between regulators and regulatees. Various forms of flexible regulation intentionally aim to formalize and structure the discussions inevitably occurring between various actors in a regulatory community, aiming to prompt regulators and regulatees to share experience to bolster efforts at identifying and monitoring pertinent risks (Ford, 2017; Parker, 2002; see generally Black, 2002). Sandbox regulators most frequently adopt this approach by offering formal or informal guidance to regulatees on how existing rules or sandbox safeguards or sandbox outcomes will be interpreted, which could cover all regulatees in a space or only apply to a single regulatee (Buckley et al., 2020; FCA, 2015; Zetsche et al., 2017). Using guidance and other softer legal sources to craft or interpret norms also reflects the relational nature of sandboxes (Marjosola, 2019). Many sandboxes also often structure monitoring or reporting plans for firms to regularly submit data to or meet with the regulator during the sandbox period (CSA, 2017; MAS, 2016; see Allen, 2019), and some instruments may “increase or decrease reporting requirements as indicated by the [regulatee’s] performance” (Utah Supreme Court, 2021, p. 15). These processes may involve frequent conversations between regulators, regulatees, and potentially third-party actors in determining how to interpret norms or identify issues and may provide real-time insights to the regulator to use in improving guidance for all regulatees (see Sabel & Simon, 2011). Sandbox regulators may also contact participating regulatees with different levels of frequency and depth, and dialogue may continue even after firms exit from the sandbox (Alaassar et al., 2020).

Expanding the analysis, and taking after Black’s (2008, 2011) description of principles-based regulation, regulatory sandboxes can be conceptualized as either “dyadic” or “polycentric.” The dyadic depiction would concentrate only on the regulator–regulatee relationship, where a polycentric approach would emphasize the larger network of actors contributing (directly or indirectly) to the shaping of sandbox norms and practices. Of course, while polycentricity in sandboxes should be theoretically possible, the extent to which sandboxes manifest in practice as dyadic or polycentric presents empirical questions requiring further investigation.

Polycentricity in sandboxes could involve exchange between state institutions at various levels of government or across jurisdictions (Alaassar et al., 2020; European Commission, 2021), although the potential role of direct or indirect influence of nonstate actors should also be considered (see Ayres & Braithwaite, 1992; Gunningham & Grabosky, 1998). Further actors to consider as influencing the actualization of sandboxes may include standard-setting bodies, insurers, courts, professional organizations, or civil society organizations such as consumer groups (Marchant, 2014; Vogel, 2010). The transnational character of this polycentricity, in combination with

transnational sandboxes themselves (Allen, 2020; GFIN, 2018), has likely contributed to the rapid globalization of the sandbox model (see Braithwaite & Drahos, 2000; Levi-Faur, 2005), although empirical investigations of these phenomena are still required.

3.2. Applying the framework

To illustrate applications of this proposed framework, this subsection will briefly explore how the model can be applied to conceptualize two regulatory sandbox schemes in different sectors. While the framework above builds primarily on sandboxes in the financial sector, the notable influence of financial sandboxes on the development of these instruments in other sectors supports the potential to apply the framework across sectors (see Tsai et al., 2020). The UK FCA's and Singapore National Environmental Agency's (NEA) programs represent the first self-described regulatory sandboxes in the financial and environmental sectors, respectively. The influence of the FCA's model on other sandbox programs around the world (Allen, 2019; Buckley et al., 2020; Omarova, 2020) and potential influence of the NEA's instrument as the first in environmental regulation elevate these as valuable cases for illustrating how the framework may apply across sectors.

The FCA (2015) sandbox contains all five elements identified above, beginning with its five broad approval standards called "eligibility criteria" to determine whether to admit the firm into the sandbox, including "genuine innovation" and "consumer benefit" (p. 7). As noted above, the FCA will then discuss and approve of safeguards proposed by the firm, activating their internal systems and controls and potentially trialing new regulatory norms through this process-based approach. Once in the sandbox, the regulator offers several mechanisms for restricting its discretion, such as no-action letters, waiving applicable rules, or firm-specific guidance with an assurance of no enforcement if firms comply with the guidance (p. 9). Adopting an outcomes-orientation to monitoring and evaluation, the FCA will then develop "testing parameters, measures for outcomes, reporting requirements" and other items with selected regulatees, who will also be required to submit "a final report about the outcomes of testing" to the regulator. Additionally, the FCA sandbox structures dialogue by assigning regulatees "a dedicated case officer who supports the design and implementation of the test" whose "close contact" should aid firms in navigating regulatory requirements and implementing safeguards (2017, p. 4).

The NEA's (2018) environmental sandbox also contains all five elements, starting with its seven broad approval standards similar to the FCA's, such as "genuine innovation" and "benefit to stakeholders" (p. 7) which it uses to determine admittance into the sandbox. The Agency "will determine the specific legal and regulatory requirements which it is prepared to relax for each case" (p. 5), illustrating the restriction of its discretion on a case-by-case basis. The instrument then activates process-oriented regulation by requiring firms to demonstrate they have "foreseen, assessed and mitigated" relevant risks and "describe the controls to be put in place so as to monitor and manage risk and failure as well as safeguards to address environmental, public health and safety concerns" (pp. 7, 15). Further, the NEA requires firms to propose "clearly defined test scenarios and outcomes" and can eject a firm from the sandbox for failure to meet those outcomes or if "a substantial flaw has been discovered in the technology/solution, or if there are any severe unintended consequences" (pp. 7, 10). These conditions reflect the regulator's use of outcomes, whether proposed by firms or set by the regulator, to evaluate regulatees. The program also calls on firms to "provide progress reports to NEA on the Sandbox Project, based on an agreed schedule" and, more specifically, "propose a schedule for the reporting of" indicators measuring proposed outcomes (pp. 7, 15), structuring dialogue and regular information exchange into the instrument.

These cases in two different sectors lend initial support to the utility of the framework proposed here for characterizing regulatory sandboxes across sectors. While these two cases formally codify the five elements of the framework presented above, it should be noted that sandboxes may also informally constitute these elements in practice rather than in official documents. Further, these two programs call attention to potential polycentricity. The FCA acknowledges it cannot waive common law liability, signaling a role for courts and litigants, while the NEA notes it will use evidence that "internationally-recognized certification bodies" have certified regulatees to support their proposed outcomes and adequacy of resources (2018, p. 20). The remainder of this article will proceed by using this framework to consider potential issues arising when administering these instruments.

4. Anticipating compliance and legitimacy challenges in implementing sandboxes

Regulatory sandboxes offer various potential strengths, perhaps especially as applied to managing the uncertainty of emerging technologies, yet implementing these instruments successfully will not occur without substantial challenges. While all regulation arguably has relational components to its practice, sandboxes form part of a growing set of flexible regulatory instruments which incorporate relationships and their management into the very structure of the instruments (Marjosola, 2019). The complexity, fragmentation, and need for trust inherent in both highly flexible and relational forms of regulation, and in regulating emerging technologies, will therefore imbue and complicate the operation of regulatory sandboxes administered at any level of government or by non-state actors. Further, the politics of innovation embedded in discourse around these instruments will likely influence the norms, decisions, and relationships made within regulatory sandboxes (see Alaassar et al., 2020; Pfotenhauer et al., 2019).

Rather than viewing sandboxes as flexible due only to their approval or enforcement aspects, each of the five conceptual elements described above can contribute flexibility, responsiveness, and complexity to the regulatory environment. Fusing these different elements may produce a regulatory instrument with greater flexibility and agility than the sum of its components, but could also magnify the weaknesses and downfalls of these instruments (Black, 2008, 2011; Ford, 2017; Simon, 2017). This section will anticipate and discuss potential challenges in compliance and legitimacy which may occur across regulatory sandbox programs, regardless of sector. Compliance can mediate efficacy outcomes for regulatory programs and may arise or falter from a variety of motivations, including economic, reputational, and normative, and may be influenced by a regulatee's perceptions of the regulator (Braithwaite, 2003; Nielsen & Parker, 2012). Legitimacy reflects both the moral and actual support of, and deference to, actions taken by a regulatory institution in a particular social setting (Black, 2009; Parker, 2006), where flexible regulatory structures may struggle in the absence of sufficient political support (Gilad, 2010; Parker, 2006). Accordingly, both compliance and legitimacy involve judgments about the type and character of relationships among regulators, regulatees, third-party actors, and the broader public and should have particular effect on the outcomes of relational regulation.

4.1. Trust and accountability

Key to understanding relational regulation and the practice of sandboxes may come from the recognition that regulators, regulatees, and third-party organizations are constituted of individuals who interact with each other, against certain cultural backdrops, as individuals as well as in their institutional capacities (Peake & Forsyth, 2021). Trust in regulatory sandboxes must therefore be grounded not only in positive relationships between institutions but also between the individual bureaucrats and managers involved (see Farrell & Knight, 2003). At the same time, perfect regulator–regulatee trust is likely impossible and represents a “regulatory Utopia,” which could even predispose regulator–regulatee groupthink that can diminish proper risk management or displace the public interest (Ford, 2010; see Black, 2008).

Regulatory sandboxes will likely operate best in the context of significant trust between regulators and regulatee management, given their flexible and relational elements. Productive collaboration toward identifying issues, mitigating risks, and learning from outcomes will be critical in instruments that shift at least some responsibility for monitoring, enforcement, or norm setting from regulators to regulatees or third-party actors (Black, 2008, 2011; Gilad, 2010). The process-oriented and discretion-restriction components of the instrument require firms to lead in identifying, mitigating, and responding to risks, while the outcomes-orientation provides firms with further latitude in how to achieve these policy goals. Regulatees should be most likely to use the structured dialogue component of the instrument to disclose critical information, and approach regulators with troubles and challenges, when they trust regulators to respond in a predictable and helpful way, rather than punitively or without transparency (Alaassar et al., 2020; Allen, 2019; Fahy, 2022; Philipsen et al., 2021; Ranchordas, 2021). The complex, technical nature of the novel products and services developed by firms entering sandboxes will similarly require managers to have trusting relationships with their workforce, including engineers, who may have the best sense of risks and problems as they evolve (Gunningham & Sinclair, 2009).

Moreover, sandboxes should perform optimally when this regulator–regulatee trust exists prior to a firm even beginning an application to the regulatory sandbox, so complete information will be disclosed for review under

the broad approval standards. This notion reflects observations in other flexible instruments, such as principles-based regulation, that preexisting trust between regulators and regulatees is most likely to produce positive policy outcomes and that flexible instruments themselves cannot construct trust *de novo* (Black, 2008, 2011). Yet, flexible regulators are most likely to have trusting relationships with larger and more established firms that have the capacity and resources to engage and work with regulators over time (Ford, 2008).

While larger and more established entities are most likely to have an existing relationship of trust with regulators, sandbox programs often provide regulators with an express or implicit mandate to support smaller, start-up firms. This paradox places regulators in a difficult situation, as their mandates may push them to admit younger firms in the absence of a working, trusting relationship, where start-ups may have limited regulatory affairs experience (see Fahy, 2022). Though sandbox regulators offering meaningful support to admitted firms may build trust (Fahy, 2022), perceived lack of support or the highly technical nature of products and services tested in sandboxes may promote distrust. Alaassar et al. (2020) report incidents of regulatees doubting regulators' knowledge of the underlying technology involved and concerns that regulators would disclose information or their best practices to other sandbox participants. Such perceptions of regulators could discourage firms from sharing critical information or lead to public perceptions that sandboxes are undermining competition and innovation. Further, the regulatee concern that sandbox programs may pass insights to other participants reflects a fundamental misunderstanding of the experimentalist approach of sandboxes. Regulators administering sandboxes may need to take affirmative steps to build trust by demonstrating technological competence and ensuring regulatees understand that insights gained from their case may be used to foster successful management of other regulatees. If successful, such efforts may also stave off some legitimacy challenges and private appeals to legislative overseers to intervene (Parker, 2006).

In the alternative, however, high degrees of trust and close working relationships between regulators and regulatees may lead to undue levels of regulatee influence on regulatory policy, through various direct or indirect mechanisms, which may threaten the public interest in sandbox policies (Carpenter & Moss, 2013). The reality that sandboxes often involve regulatees with greater technical knowledge than regulators of how an emerging technology functions in a particular use case only raises the potential for undue influence (de Koker et al., 2020). Should regulators rely too closely on regulatees for technical expertise, flexible regulators risk privileging private preferences over public policy goals or succumbing to groupthink where regulators and regulatees collectively fail to anticipate and prepare for issues (Awrey, 2011; Ford, 2010). Sandbox programs which use elements such as discretion-restriction and process-based tools to create custom arrangements with regulatees offer potential benefits, but may also predispose sandbox regulators to undue levels of private influences should they lack independent expertise on the technology or markets they aim to oversee. Resulting regulatory failures, particularly if resulting in harms to human health, may damage the perceived legitimacy of the instrument. For these reasons, the role of providing sandbox regulators with sufficient resources to fund the development of internal, independent expertise will be critical to mitigate undue private influence (Buckley et al., 2020; Ford, 2010, 2017).

Accountability in regulatory sandboxes may also require inviting third-party actors into the regulatory process. In the ideal, sandboxes could render emerging technologies more "open to discussion, democratic supervision and control" (Ranchordas, 2021, p. 13). However, this prediction will no doubt depend on whether sandboxes manifest as tightly dyadic or more polycentric models and how tripartisan interactions with third-party actors are structured (or not) into the approval, monitoring, or learning components of sandboxes (Ayres & Braithwaite, 1992; Black, 2011; Ford, 2010). Empowering third-party actors such as consumer groups to participate in the administration of sandboxes could add an important check on the potential for undue regulatee influence, yet few sandbox programs formally structure in engagement with third party actors and transnational sandboxes could pose pragmatic barriers to engagement and participation. The sandbox rationales of driving innovation and competitiveness, along with potential concerns around protecting proprietary information or third-party actors gaining outsized influence, may also present political or structural hurdles to incorporating third-party actors into the sandbox environment.

4.2. Restricted enforcement, responsive regulation?

Restricting enforcement discretion around specific norms may reduce the responsiveness of the sandbox framework and cause tension with other elements of the sandbox model. When regulators can only choose between

mild and severe sanctions, a “broken” enforcement pyramid may result where regulators face legitimacy pressures to refrain from jumping to severe sanctions (Scott, 2017; see Ayres & Braithwaite, 1992). In the sandbox context, regulators in some circumstances may be faced with persuasion or ejection from the sandbox as the only two potential enforcement tools, creating a hollowed-out enforcement pyramid where regulators may refrain from escalating sanctions out of concern for being perceived as punitive (see Parker, 2006). Instead, through its use of process-oriented regulation, the sandbox model envisions firms using their own internal controls to manage many risks and hazards that fall short of meriting ejection. The use of outcomes-oriented regulation in sandboxes may further complicate these dynamics around broken enforcement pyramids if the outcomes themselves crafted to measure regulatee performance are discovered to be poorly tailored to detect and respond to issues with an emerging technology (Roca et al., 2017; see Coglianese et al., 2003).

Normatively, it could be argued that regulators’ use of severe sanctions to respond to failures in process-based internal controls would remain responsive and reasonable; however, the politics of innovation and technology may interfere with this ideal state. Particularly when sandbox regulators have mandates to promote technological innovation or aid start-up firms, even if alongside others (Alaassar et al., 2020), stakeholders including political overseers and industry actors may perceive a regulator’s use of ejection as a failure to achieve these goals. Even in scenarios where the regulator has few other options to secure compliance or prevent harm, the “deficit model of innovation” (Pfotenhauer et al., 2019) which permeates narratives around sandbox policymaking may create political pressures against, and legitimacy costs for, using the only enforcement tool remaining.

While regulatees with high motivation to comply may voluntarily work with sandbox regulators to “bridge” the broken enforcement pyramid by recursively adjusting internal controls and sandbox outcomes, firms with more adverse motivational postures may seek to take advantage of the structural limits on responsiveness (Braithwaite, 2003; Nielsen & Parker, 2012; Simon, 2017). For example, Allen (2019) predicts that if sandboxes restrict enforcement discretion too tightly, firms may have low incentives to share information with regulators on the performance of the trial. Similar issues and tensions prompted scholars of principles-based regulation to recommend deploying flexible instruments only in settings of high trust (Black, 2008; Gilad, 2010), yet these recommendations clash with mandates to promote innovation and start-up firms. This dynamic places several elements of the sandbox model in tension with each other and may create real or perceived tradeoffs between achieving compliance or maintaining legitimacy and productive communication (see Black & Baldwin, 2010).

This dilemma of regulatory sandbox policy does not present easy solutions, although enrolment strategies may offer potential routes forward (Black, 2003; Braithwaite, 2008; Gunningham & Grabosky, 1998). In cases of firm recalcitrance to persuasion that does not merit ejection, strategies that actively engage private and civil society norms and enforcement mechanisms may aid public regulators in escalating pressure on firms without needing to threaten ejection from the sandbox. This enrolment of third-party regulators, such as consumer groups or professional organizations, may then enable sandbox regulators to achieve greater compliance in at least some cases without damaging their legitimacy through the use of severe sanctions. Sandbox regulators moving to eject a participating firm after third-party regulators have intervened unsuccessfully may also limit legitimacy costs within the broken enforcement pyramid structure, as supporting third-party actions may reduce perceptions of the regulator acting unilaterally or arbitrarily. However, regulators fostering such a polycentric environment will likely engender greater complexity and fragmentation in sandbox governance and raises further questions about how best to enroll and orchestrate actors performing regulatory functions in and around the sandbox. Enrolment strategies would likely require potentially costly meta-regulation of the third-party regulators to promote accountability and efficacy, in addition to transparency, and to detect and mitigate any undue influence by regulatees on the third-party regulators (McAllister, 2012). Further, the enrolment of third-party actors should occur with some degree of transparency to bolster predictability and trust in the regime (Philipsen et al., 2021).

4.3. Participation and politics

Through their approval and process-oriented regulatory elements, many sandbox programs will ultimately include some firms while excluding others. In turn, curbing enforcement of rules with higher compliance costs for participating firms alone may engender perceptions of regulatory favoritism or unfairness in nonparticipating firms or the broader public (Coglianese et al., 2021; Knight & Mitchell, 2020). This reality has raised a number of political and policy questions about whether sandbox programs inherently select winners and losers or create

unfair regulatory environments in fast-moving technology sectors (Allen, 2019; Zetzsche et al., 2017). The perception and early evidence that entry into a sandbox setting boosts external investments in a firm (Buckley et al., 2020) only exacerbates such concerns. These observations reflect Haines' (2011) insights that political factors may mediate policy outcomes as much as instrument design choices.

Sandbox regulators face challenging tensions here between legitimacy and compliance. The five sources of flexibility offered by sandbox programs may indeed render inherited regulatory schemes more fair or efficient in their application to emerging technologies or allow for policy objectives to be reprioritized in light of such technological disruption (see Coglianese et al., 2021; Engels et al., 2019; FCA, 2015; Roca et al., 2017). Yet, each element of sandbox operation will also impose significant resource costs on regulators; from the review of applications under broad approval standards, to the creation of custom arrangements of discretion-restriction and regulatee internal controls, to the substantial monitoring and engagement required to ensure firms reach outcomes, share adequate information, and receive timely support when requested. Further fiscal, temporal, and expertise costs will be exacted as regulators attempt to draw insights from each sandbox trial to improve the sandbox program for other participants and technological oversight more broadly. As a sandbox program approaches the "ideal" type, regulators must allocate increasingly more resources for each firm participating. Regulators without sufficient resources to manage all regulatees may struggle to engage in adequate information gathering or dialogue with regulatees, develop relevant expertise independent from the regulated community, or take enforcement action when needed—which can predispose regulatory failures, particularly with flexible instruments (Ford, 2010). Moreover, regulators in lower-income jurisdictions may have less access to resources to perform these functions in administering a sandbox instrument with many regulatees participating simultaneously.

Should regulators aim to admit more firms to the sandbox to alleviate legitimacy problems from accusations of favoritism, they also risk spreading resources too thin to appropriately supervise sandbox regulatees and may increase the potential for greater non-compliance. Approval regulation more broadly also may heighten regulators' sensitivity to their reputation and perceived expertise among stakeholders, which can influence decisionmaking and blur the lines between technical and political decisions (Carpenter, 2010). For example, regulators may prefer to admit larger and more established firms to the sandbox, as more trusting relationships may exist and process-based and outcomes-oriented forms of regulation place significant costs on regulatees as well (Brummer & Yadav, 2019; Gilad, 2010; Gunningham & Sinclair, 2009; Parker, 2002). However, preferencing larger entities with more robust internal systems and controls might create perceived failures around the goals of many sandbox regimes to foster innovation and competition, often involving support for start-up firms. Similarly, pressures to boost innovation and draw investment into a jurisdiction could incentivize regulators to admit more participants, while weakening standards or supervision, in a cyclical "race to the bottom" with various other jurisdictions (Allen, 2020; Marjosola, 2019; Zetzsche et al., 2017). The potential for transnational regulatees to shop for jurisdictions with favorable sandbox programs may exacerbate this phenomenon further.

Several approaches have arisen to resolving these tensions, but all require tradeoffs. Some bodies including the UK's FCA (2015, 2017) have used "cohorts" for their sandbox regimes,³ which cap the number of firms that the regulator can supervise at once. Cohort arrangements may prevent regulators from admitting more firms than they can reasonably supervise but cannot immunize them from accusations of favoritism, reflecting a normative judgment to prioritize addressing compliance issues first. Some of the perceived unfairness may be alleviated by increased transparency about how regulators may interpret approval standards (Philipsen et al., 2021; Ranchordas, 2021), yet greater predictability could come at the expense of flexibility in the regime (Black, 2008). Moreover, sandbox regulators may suffer legitimacy issues should they fail to signal that they are using trials to improve their rules or guidelines to benefit firms outside of the sandbox setting. Japan's cross-government sandbox approach aims to resolve this issue by building the potential for broader regulatory reform into the sandbox monitoring and evaluation process (Kataoka, 2019), but may also erode predictability or adjust rules based on small trials that do not reflect risks that manifest at scale (Omarova, 2020).

4.4. Post-sandbox oversight and capacity

While some sandbox programs envision longer-term exceptions or regulatory reform (Kataoka, 2019), most enable or invite firms that have successfully completed and exited the sandbox to transition to the standard

regulatory framework (e.g., Bank Negara Malaysia, 2016; FCA, 2015; MAS, 2016). However, this transition may involve a change in the relationship between regulators and regulatees which could raise further issues.

Depending on the form of the standard regulatory system, regulatees could find themselves abruptly shifting from a more flexible setting to one where prescriptive rules and typical enforcement strategies predominate rather than process-based and outcomes-oriented approaches. Firms may also move from a sandbox environment that structures dialogue and information exchange to a new setting where customized guidance and capacity building may be less possible or encouraged. These shifts could disrupt the trust built during the sandbox period (Fahy, 2022) or reduce structural incentives to communicate with and seek out guidance from regulators, particularly should firms fear enforcement actions which were less likely within the sandbox. Decreases in communication or trust following the transition out of the sandbox could present hurdles to identifying and responding to risks, particularly as new problems might manifest only once firms deploy their product or service at scale rather than in the limited trial setting (Omarova, 2020). Failure to resolve issues only seen at scale may damage the perceived legitimacy of sandbox policies, which policymakers often justify as a route toward anticipating and mitigating risks.

In recognizing some of the challenges of transitioning out of sandboxes, the UK FCA recently announced efforts to construct a “regulatory nursery” to continue close communication with firms for some time after their exit from the sandbox.⁴ The nursery model has yet to be implemented, but may provide one option for managing some of these uncertainties by more slowly phasing out the sandbox model of oversight.

Another challenge arises from the likelihood of larger firms acquiring start-up firms after exiting from the sandbox, which appears particularly common in fast-paced technology-driven sectors (Gautier & Lamesch, 2021; see Sell, 2021). Should acquisitions or mergers of start-ups involve significant changes in management, valuable lessons and internal controls developed during the sandbox may be lost, absent protocols to pass on this capacity to new management willing to receive them. Acquisitions shifting management positions could also disrupt existing relationships of trust between management and regulators or the firm’s workforce (Gunningham & Sinclair, 2009). This erosion of institutional knowledge or trust could jeopardize the regulatee’s capacity built during a sandbox trial. The increased financial value and investments that firms enjoy from participating in a sandbox (Buckley et al., 2020; FCA, 2017) could even increase the likelihood of acquisitions, raising questions about whether sandbox programs truly boost competition and potentially eroding public support for the regulatory instrument.

Further questions arise from firms participating in a sandbox in one jurisdiction, then using the knowledge and capacity gained to apply for regulatory approval in another, as regulators in the second jurisdiction will not have benefited from learning that occurred in the sandbox. Cross-jurisdictional regulatory communication may become desirable for resolving such issues, and transnational sandbox frameworks may offer a potential path forward for collectively building capacity (GFIN, 2018; GSM Association, 2019). Unfortunately, the sensitivity of information to firms and jurisdictions seeking competitive advantages may strongly disincentivize meaningful intergovernmental coordination absent further political or structural interventions (Allen, 2020; see Brummer & Yadav, 2019; Marjosola, 2019).

Greater empirical inquiry into these dynamics and outcomes of transitions out of sandbox environments is still required. Multiple types of transitions are possible, ranging from successful completion of the trial and shifting into the standard regulatory regime (in one or more jurisdictions), to a regulatee voluntarily withdrawing prior to completion, to a regulator enforcing removal for non-compliance. Empirical attention to the potential mechanisms driving different kinds of exits from the sandbox environment, as well as associated outcomes including regulator–regulatee trust or future compliance behaviors, may further illuminate regulatory or political dynamics at play during and after sandbox trials. Subsequent factors such as the presence of a regulatory “nursery,” regulatee acquisition, or policy change informed by sandbox results could further modulate outcomes and may deserve additional attention.

5. Conclusions

This article argues that, rather than getting lost in the hype around regulatory sandboxes, decision-makers should carefully approach sandboxes when considering oversight approaches for emerging technologies. This is in line

with a growing recognition that regulatory sandboxes are not always an optimal instrument for regulatory problems in fintech or beyond (e.g., European Commission, 2021). To this end, this article has put forward a framework grounded in the regulatory literature conceiving of sandboxes as some formal or informal combination of five elements: (1) approval regulation with broad-based standards, (2) restricted discretion by the regulator around specific, existing norms, (3) process-oriented regulation, (4) an outcomes-orientation, and (5) structured regulator–regulatee information sharing or dialogue. These elements are viewed as blending to make a more flexible and relational instrument than would be possible through their individual use, magnifying opportunities and challenges alike. This model can assist policymakers in comparing sandboxes to other available regulatory instruments and in considering whether a regulatory sandbox would be the most suitable instrument for a policy problem in various sectors, though deeper engagement with sectoral concerns and legal, political economic, sociocultural, and historical contexts may be required for specific cases.

This article has also conceptualized potential issues in compliance and legitimacy which could arise from these five elements, individually or through their interaction. These potential problems, tensions, and tradeoffs identified here and elsewhere (e.g., Allen, 2019; Brummer & Yadav, 2019; Buckley et al., 2020; Philipsen et al., 2021; Ranchordas, 2021; Zetzsche et al., 2017) can be used to guide future empirical investigation and evaluation of regulatory sandboxes. Further examination of how regulatory sandboxes function and what structural and political conditions may mediate successful policy outcomes will be vital for selecting, designing, and implementing these flexible, relational regulatory tools.

Based on these potential issues, multiple lines of inquiry grounded in local or comparative contexts will support efforts to better design, evaluate, and compare regulatory sandbox instruments. By concluding on these directions for future evaluation, this article aims to signal that work to assess and improve sandbox policies has only just begun.

First, how does trust mediate communication and cooperation within the sandbox setting and how can regulators build lasting trust with regulatees and third-party actors? Instead of focusing on the precise design of the regulatory instrument, taking the evolving regulator–regulatee relationship (or other relationships, in a polycentric system) as a vital unit of analysis may provide fresh perspectives on how sandboxes perform and what conditions may lead to improved learning and compliance (Peake & Forsyth, 2021). Including third-party actors or the public broadly in the regulatory environment could lead to more robust and accountable programs, but strategies to do so effectively must be developed and empirically assessed.

Second, how can regulators cultivate expertise independent of industry and most effectively manage resources despite pressures to admit progressively more firms into the sandbox and the need to oversee firms following their exit? Operating sandboxes will clearly require substantial resources for regulators and regulatees alike (e.g., Allen, 2019; Brummer & Yadav, 2019; Buckley et al., 2020; see Ford, 2010), but what form of resources (e.g., staffing, funding, training) mediate regulatory outcomes, and how, remains unclear in the sandbox setting. Policymakers may need to develop strategies to better communicate justifications for limiting the number of firms admitted or increasing resource allocation to regulators and may need to consider the utility of structural reforms such as implementing cohorts to restrict the number regulatees in the sandbox simultaneously. Securing ongoing, adequate resources for regulators to effectively administer sandbox programs may pose more challenges in lower-income jurisdictions or states with diminished or eroding political support for regulatory bodies, and future work may need to address these contexts in particular. Strategies to promote meaningful communication and coordination of sandbox regulators across jurisdictions may also be required.

Third, how may regulators' experience of real or perceived political pressures to avoid escalating sanctions within their flexible framework mediate policy outcomes (see Haines, 2011)? Attention to the politics of innovation and competition and the multiple, sometimes conflicting mandates given to sandbox regulators (Alaassar et al., 2020) should guide this inquiry. Regulators may need further strategies for balancing monitoring and enforcement tactics in the sandbox environment against the need for lasting political support for a flexible, relational instrument (Gilad, 2010; Parker, 2006), including by making strategic use of third-party actors and non-state regulatory mechanisms (Black, 2003; Gunningham & Grabosky, 1998).

Finally, what sector-specific concerns should analysts consider before adopting a sandbox instrument and how can socially responsive, responsible innovation truly be advanced through sandboxes (Stilgoe et al., 2013)? While early, influential sandbox models have been developed in response to fintech, achieving different types of

policy goals outside of finance may require rethinking assumptions underlying fintech sandboxes and pushing against innovation imperatives (Brown & Piroška, 2021; Pfothenhauer et al., 2019). In particular, policymakers should be cautious not to conflate or equate financial risks with risks to human health, the environment, or social justice when designing this instrument for other sectors. Using sandboxes to manage technologies posing irreversible hazards or substantial social harms may be normatively undesirable regardless of the design features selected.

The era of regulatory sandboxes has only just begun. While these novel instruments offer notable potential benefits in managing emerging technologies, understanding their downfalls and weaknesses as well will aid decision-makers in crafting more robust policy. As regulatory sandboxes find progressively wider use in more jurisdictions and sectors, tools and insights to closely evaluate these programs and compare them to other available instruments will become vital to promote normatively desirable policy outcomes in any sector.

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Endnotes

- ¹ <https://www.kantei.go.jp/jp/singi/keizaisaisei/regulatorysandbox.html>
- ² <http://www.kremlin.ru/acts/bank/45796>
- ³ In 2021, the FCA moved away from the cohort approach. <https://www.fca.org.uk/firms/innovation/regulatory-sandbox>
- ⁴ <https://www.fca.org.uk/news/speeches/levelling-playing-field-innovation-service-consumers-and-market>

Data availability statement

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

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