

Building Regulatory Capacity Through Experimentation: Exploring the Governance of Regulatory Sandboxes

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1 INTRODUCTION

Regulatory sandboxes are experimental frameworks that allow companies to test innovative products, services, or business models in a controlled environment. Typically, sandbox programs establish an institutional framework enabling regulators to authorize and oversee participants, offering regulatory relief or support while implementing alternative standards during the testing phase (Allen, 2019). Since the first initiatives launched in the United Kingdom in 2015, regulators worldwide have embraced this approach with growing enthusiasm. Although initial efforts focused primarily on the financial sector, the sandbox model has expanded to include areas such as health, energy, and transportation (Tsai et al., 2020).

The regulatory state model of the 2020s reflects a more complex and hybrid configuration than that established in the 1990s (Lodge, 2025). Early emphases on efficiency and market failure correction have progressively shifted toward broader concerns with fairness, legitimacy, and regulatory effectiveness. This has led to the emergence of second-generation regulatory debates, centered on institutional capacities, administrative expertise, and public-private interaction aimed at supporting economic and social development (Dussauge-Laguna, 2022). While regulatory approaches have evolved, the demand for oversight remains, with standards and user protection at the core (Lodge, 2025).

Amid rapid technological transformations, regulatory sandboxes have proliferated globally as experimental instruments to foster innovation. Yet, empirical studies of their operation and evolution remain limited. Although the regulatory governance literature offers preliminary insights, further analysis is needed to understand the broader conditions under

which sandboxes contribute to desirable policy outcomes (Johnson, 2023). In particular, the governance structures of these initiatives – especially with respect to stakeholder participation – require deeper investigation.

This paper addresses the following research question: How do the capacities of both the regulator and the participant influence the governance structure of the sandbox? The aim is to explore how these capacities interact in shaping governance models and innovation processes, considering the challenges they pose to transparency, public interest protection, trust-building, and stakeholder engagement. This research contributes to the literature on regulatory governance at a moment when experimental approaches such as sandboxes are increasingly adopted to promote innovation (Cunha & Donadelli, 2024).

Data collection was conducted in Brazil, where regulatory sandboxes were first implemented in 2020 in the financial and insurance sectors, following the early patterns observed in pioneering countries (Raudla et al., 2024). The Brazilian experience, marked by recent and multi-sectoral initiatives — in areas such as energy, transportation, and telecommunications — offers a distinctive opportunity for empirical research. Despite progress, regulatory capacity in Brazil remains limited in flexibility, and social participation is still largely formalized. Sandboxes and responsive regulation have emerged as isolated agency-level efforts to improve interaction with private actors, though national coordination is lacking (Cunha & Lodge, 2025).

Analyzing regulatory sandboxes in developing countries sheds light on governance dynamics under distinct economic, political, and institutional conditions (Minogue & Cariño, 2006). In contexts where institutional frameworks are still consolidating, experimental instruments like sandboxes may reflect specific priorities and constraints. Studying these mechanisms—focusing on trust-building, stakeholder articulation, public interest protection,

and innovation—broadens the understanding of regulatory governance beyond the designs prevalent in advanced economies (Vibert, 2014).

2 ANALYTICAL FRAMEWORK

This study adopts an analytical framework focused on the interaction among five aspects related to regulatory sandbox governance: (i) stakeholder participation (Fahy, 2022); (ii) accountability (Johnson, 2023); (iii) trust-building between regulators and participants (Alaassar, Mention & Aas, 2020); (iv) public interest protection (Ranchordas & Vinci, 2024) and (v) regulatory innovation (Cunha & Donadelli, 2025). The analysis draws on literature about regulatory polycentrism and responsive innovation (Ansell & Gash, 2008; Black, 2008). Regulatory processes are now increasingly characterized by collaborative dynamics between governmental and non-governmental actors, resulting in frameworks that resemble complex networks rather than a linear two-way interaction between regulator and regulate (Windholz, 2023). This analysis is grounded in the premise that the development and outcomes of regulatory sandboxes depend on the dynamic interaction among governance structures, normative and monitoring mechanisms, stakeholder engagement, accountability, and innovation.

Regulatory sandboxes align with a broader movement toward participatory regulatory practices (Fahy, 2022). As flexible instruments, they promote innovation while presenting challenges for democratic legitimacy. The focus on simplification and speed may constrain deliberative processes (Johnson, 2023). While stakeholder engagement enhances efficiency and legitimacy (Braithwaite, 2011), its effectiveness depends on the diversity and quality of participation (Fahy, 2022). In practice, participation often suffers from low engagement or dominance by well-resourced actors.

The inclusion of multiple stakeholders raises governance challenges, such as managing conflicting interests and ensuring fair representation (Haber & Heims, 2020; Johnson, 2023). In polycentric settings, overlapping roles can generate coordination problems, requiring meta-regulation strategies to uphold accountability and transparency. The transparent incorporation of third parties is essential for trust and predictability.

Regulatory governance is increasingly marked by multi-level arrangements and collaborative approaches (Levi-Faur, 2011; Kjaer & Vetterlein, 2018). This shift redefines how regulations are designed, implemented, and enforced. Effective governance demands institutional capacity to manage complexity, resolve conflicts, and foster innovation. Experimental instruments such as sandboxes offer inclusive mechanisms that reduce capture and enhance the distributional fairness of regulatory benefits (Graaff et al., 2024; Peake & Forsyth, 2021).

The design of stakeholder engagement varies by context. Corporatist settings rely on centralized negotiation, whereas pluralistic ones demand broader participation (Haber & Heims, 2020). Sandbox inclusion criteria may exclude some firms, raising fairness concerns and perceptions of favoritism (Johnson, 2023; Knight & Mitchell, 2020; Zetzsche et al., 2017).

The relationship between regulation and innovation is reciprocal: regulation shapes private action, and private practices inform regulation (Cunha & Donadelli, 2025). Sectors like energy and finance are well-suited to regulatory sandboxes (Tsai, 2018; Bauknecht et al., 2020). Sandboxes reflect a shift from rigid regulatory models toward adaptive experimentation. They serve as laboratories where regulators co-design future frameworks with stakeholders (Bauknecht et al., 2020).

Regulators are increasingly take an active role in enabling innovation, requiring greater technical and political capacity (Cunha & Lodge, 2025). Regulatory capacity entails resources

and expertise for informed discretion, policy adjustment, and oversight, including the development of technical skills, accountability mechanisms, and coordination tools (Cafaggi & Pistor, 2015; Lodge, 2014).

Empirical studies suggest that the implementation of financial regulatory sandboxes is closely linked to regulators' perceived capacity to manage the complexities associated with institutional innovation (Raudla et al., 2024). Although some findings are situated within the financial sector, similar conditions are likely to be observed in other regulatory contexts where the governance of emerging technologies requires advanced analytical and relational capacities, such as data analysis, risk assessment, and stakeholder engagement (Alaassar, Mention & Aas, 2020; Raudla et al., 2024).

Despite the literature's recognition of capacity gaps, few studies investigate how regulators develop such capabilities, even though the effectiveness of regulatory techniques depends significantly on institutional readiness (Lodge, 2014). Sandboxes offer flexibility to assess firms' willingness and ability to comply while responding to fragmented regulatory environments. However, such innovations require substantial investment in institutional development and expertise.

3 METHOD

Qualitative research methods are well-suited to examining regulatory cultures and the ways individuals and groups respond to them (Losoncz, 2017). This study draws on semi-structured interviews with experienced professionals involved in regulatory sandbox initiatives in Brazil. The interviewees – permanent civil servants – occupied technical positions such as general managers, managers, and advisors within regulatory agencies, which are known for their highly qualified and professional staff (Peci, Santos & Araújo, 2022). The interviews were

conducted in April 2025 using video conferencing platforms and were found to be a suitable method to collect the perception of key actors directly involved in the design and/or implementation of regulatory sandboxes. They were asked about the governance of sandboxes, the building of trust-based relationships with participants, practices of transparency and compliance, stakeholder engagement, protection of the public interest, players involved in the regulatory process, as well as the promotion of innovation within the sandbox framework. The interviews were recorded in audio and transcribed. They lasted an average of 40 minutes. The interviewees' data is shown on Table 1.

Table 1 – Interviewees' data

Code	Agency	Gender
(I1)	National Sanitary Surveillance Agency	Male
(I2)	National Telecommunications Agency	Male
(I3)	National Agency for Land Transportation	Male
(I4)	Brazilian Central Bank	Male
(I5)	Securities and Exchange Commission	Female
(I6)	National Supplementary Health Agency	Male
(I7)	National Civil Aviation Agency	Female

Source: research data.

Brazil has 11 formally independent regulatory agencies and dozens of other public bodies with regulatory functions. The websites of federal agencies and regulators that have published information on sandbox initiatives were consulted, and ten were identified; of these, seven agreed to accept interview requests: the National Sanitary Surveillance Agency (ANVISA), the National Telecommunications Agency (ANATEL), the National Agency for Land Transportation (ANTT), the Brazilian Central Bank, the Securities and Exchange Commission (CVM), the National Supplementary Health Agency (ANS), and the National Civil Aviation Agency (ANAC). The inclusion of the Central Bank is particularly relevant, as the regulatory sandbox model first gained traction nearly a decade ago within central banking institutions.

Despite the recent legal introduction of regulatory sandboxes, the agencies examined reflect varying stages of adoption and maturity, as well as different operational models. They also exhibit characteristics relevant to this investigation: their initiatives have a direct impact on end consumers, operate within sectors of varying scope and scale, and often produce broader effects that extend beyond the specific domains under the regulators' direct oversight.

3.1 Regulatory Sandboxes in Brazil: A Brief Overview

Complementary Law No. 182 of 2021, which established the “Legal Framework for Startups” in Brazil, regulated the provision of the Economic Freedom Act (Law No. 13,874/2019) concerning the right to develop and market innovations when secondary legislation become obsolesces, and it also introduced the adoption of regulatory sandboxes in the country. However, despite the emergence of several regulatory sandbox initiatives across different levels of government since 2020, the subject remains relatively new. The absence of a harmonized understanding within the public administration has hindered a clear and consistent comprehension of this experimental regulatory model, leading to the issuance of recent administrative guidelines by legal and audit bodies aimed at minimizing misunderstandings and promoting more uniform implementation (AGU, 2025; CGU, 2024).

According to the Legal Framework for Startups, public administration bodies with sectoral regulatory authority may, individually or jointly, waive the application of regulations within a regulatory sandbox. This temporary suspension applies to specific regulated entities or groups and requires regulators to define an operational framework outlining participant selection criteria, the scope and duration of regulatory relief, and the specific rules subject to suspension.

Brazil's first regulatory sandbox initiatives followed a joint statement in June 2019 by SUSEP, the Central Bank, and CVM. SUSEP led with a sandbox promoting insurance market

innovation through temporary authorizations and relaxed rules. The Central Bank focused on financial system innovation and inclusion, while CVM emphasized digital investment platforms and tokenization. Other agencies joined later: ANVISA launched a 2024 sandbox for personalized cosmetics; ANATEL initiated projects for satellite-to-device communication and internal signal boosters; and ANTT created a sandbox in 2022 for traffic monitoring and highway decarbonization.

While sandboxes represent a legal innovation in Brazil's traditionally rigid administrative system, their implementation faces challenges such as regulatory by-pass, complex federal coordination, lack of incentives for early adopters, risks of regulatory capture, competitive distortions, and legal uncertainty over the scope of regulatory relief (Fassio, 2023).

4 ANALYSIS OF THE FINDINGS

The analysis of the interviews made it possible to map, across different contexts, some common features of sandbox governance; to identify patterns and characteristics specific to certain sectors; to understand the roles, behaviors, and interactions with stakeholders; and to assess the function and influence of regulation within these experimental frameworks. This mapping was guided by the analytical framework proposed in this study, which focuses on five aspects related to regulatory sandbox governance: (i) stakeholder involvement; (ii) accountability; (iii) trust-building between regulators and participants; (iv) public interest protection and (v) regulatory innovation.

The model consists of three core constructs: the governance structure of the sandbox, the capacities of sandbox participants, and the capacities of sandbox regulators. The governance structure is shaped by the nature of the innovation under experimentation, whose characteristics justify the need for a controlled testing environment, the capacity of the sandbox participant,

and the capacity of the regulatory authority overseeing the sandbox. On the regulator's side, capacity is primarily defined by the agency's ability to mobilize and coordinate the necessary internal team, ensuring the allocation of professionals capable of meeting the project's demands, as well as by its ability to adequately monitor the experiment. These capacities directly influence the establishment of a trust-based relationship with the sandbox participant and also determine the regulator's ability to engage and coordinate with external stakeholders who are not directly involved in the experiment but can support its implementation. Such stakeholders may include industry and sectoral associations, innovation labs, civil society organizations, and other regulated actors.

On the other hand, the participant's capacities are assessed through their level of innovation maturity, understanding of regulatory frameworks, availability of resources, and the perceived relevance of the proposed innovation within the broader market context. Together, these elements contribute to shaping the sandbox governance structure, which reflects key components of accountability, protection of the public interest, and the advancement of regulatory innovation, and is further reinforced by the mutual trust established between regulators and regulatees. Figure 1 illustrates the analytical model that was established from the analysis.

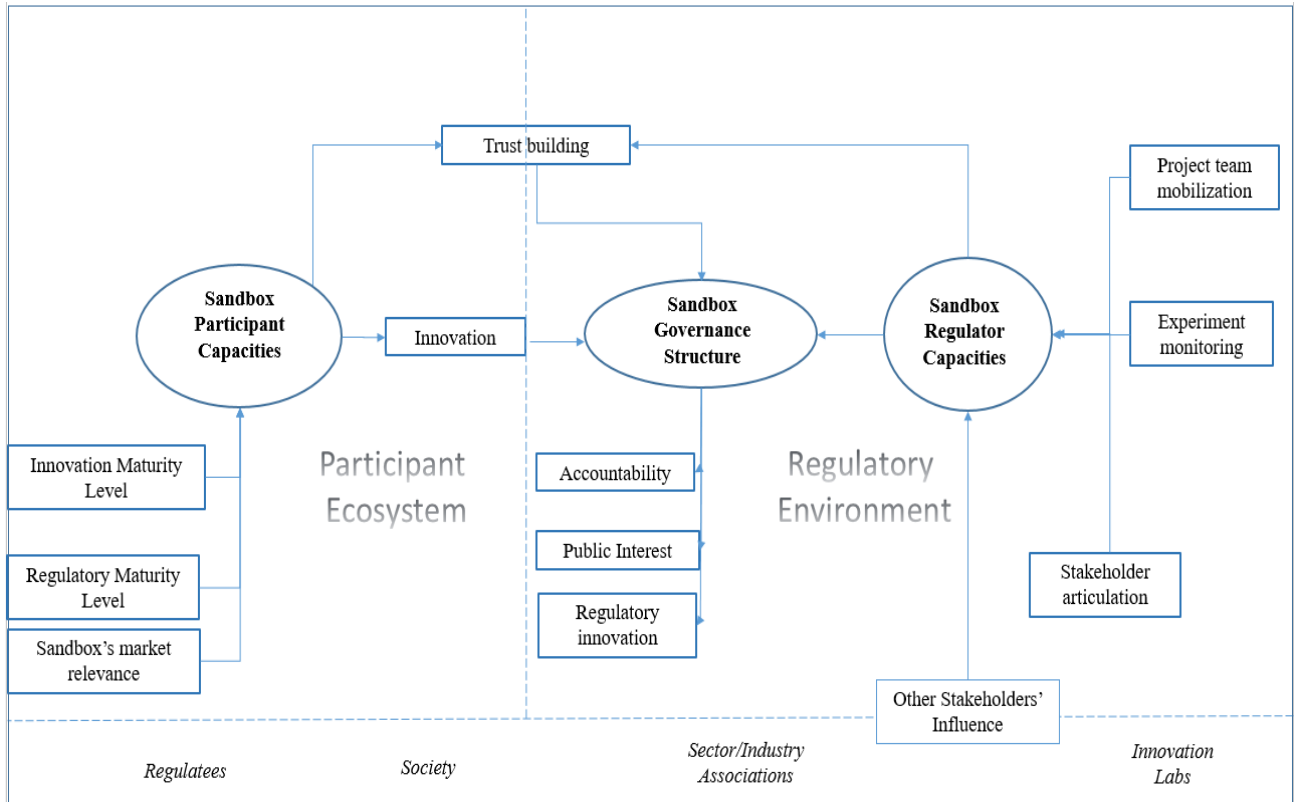


Fig. 1. Analytical model

4.1 Sandbox Regulator Capacities

4.1.1. Project team mobilization

Regarding the capacities of sandbox regulators, three main categories emerged. The first relates to project team mobilization. Regulators face major challenges in assembling dedicated teams for sandbox management. In all cases, existing sectoral teams had to manage sandbox activities alongside their regular duties. None of the agencies interviewed had a fully dedicated team for this purpose. Respondents noted that this lack of dedicated resources hinders effective implementation due to high workloads and competing priorities. This reflects a structural limitation in regulatory capacity: without dedicated arrangements for experimental governance, institutional learning and adaptability are constrained. Insufficient human and technical resources allocated to sandbox operations risk undermining the flexibility that justifies such

frameworks. These findings align with research highlighting how contextual factors—such as the need for ad hoc expert teams—affect sandbox adoption, even though such organizational shifts are rarely matched by additional funding or staffing (Raudla et al., 2024).

4.1.2 Experiment monitoring

The analyzed data suggest a considerable variation in monitoring strategies, often influenced by the prior experience of the regulatory agencies involved. Interviewee 5 (I5) explained that their approach involves regular monitoring and follow-up meetings with participants: “We hold monthly monitoring and follow-up meetings, which give us a practical understanding of the barriers participants encounter in their daily activities. These meetings provide valuable insights, sometimes even beyond the scope of the sandbox itself, as participants raise issues related to the interpretation of regulations that were not previously aligned but can still be addressed during the experimental phase”.

According to I5, establishing a structured and frequent review process enables close oversight of each project within a secure and controlled environment. This approach creates a space that is simultaneously restricted and recognized as a learning environment, fostering collaborative efforts to address and resolve regulatory challenges throughout the experimental phase. In contrast, I4 highlighted the difficulty of managing multiple projects simultaneously, a challenge that had not been fully anticipated at the time of the sandbox’s launch. This situation affected the level of attention dedicated to each project.

Regarding the number of staff involved and the specific technical expertise required for each initiative, which at times necessitated the mobilization and subsequent reassignment of personnel across different departments. Adjustments in follow-up processes are expected due to the diverse needs of participants regarding the capacities required from the regulator (Raudla et al., 2024)

4.1.3 Trust building

In the interviews, trust-building emerged as a central factor in the functioning and governance of regulatory sandboxes in Brazil. Interviewee E2 emphasized that trust is fostered through transparent procedures, confidentiality in handling sensitive information, and the use of public consultations to encourage openness with both society and companies.

Interviewee I4, from the Central Bank, stressed that trust also stems from long-standing relationships with the market and the institutionalization of regulatory processes. Formal documentation of project rules and the limits of regulatory relief was seen as crucial to protecting stakeholders, preventing information leaks, and enhancing legal certainty. This reflects findings from the UK, where fintech firms cited procedural integrity, strong regulatory performance, and moral commitment to innovation as key motivations for sandbox participation. While interviewee E3 acknowledged the value of transparency and stakeholder engagement, their agency had limited practical experience, with sandbox projects still in early stages. However, one experimental initiative was closely monitored to avoid negative impacts, serving as an example of incremental trust-building.

Overall, the interviews indicate that trust is primarily built through the formalization of clear rules, protection of confidentiality when appropriate, transparent communication, and the establishment of continuous dialogue channels between regulators and participants. Trust is central to enabling communication and cooperation within the sandbox, requiring regulators to foster sustained relationships not only with regulatees but also with third-party stakeholders. Such trust must rest on solid institutional frameworks and ongoing, constructive interactions with individual bureaucrats and managers and participants expect regulators to behave predictably and transparently, rather than punitively or arbitrarily (Johnson, 2023). These findings are consistent with empirical studies showing that a cooperative climate in regulator–

regulatee relationships tends to arise when trust is present, with cooperation itself reinforcing perceptions of regulatory trustworthiness (Alaassar, Mention & Aas, 2020).

4.1.4 Stakeholder articulation

This category concerns the regulator's capacity to mobilize stakeholders capable of contributing more directly to the successful implementation of the experimental test. The interviews reveal that stakeholder mobilization plays a central but variable role across the sandbox experiences of the agencies. Interviewee I1, from the National Sanitary Surveillance Agency, described a structured approach involving external market signals, open calls, targeted consultations, and public consultations on draft regulations. This participatory model sought to mitigate public health risks and avoid monopolistic outcomes. Interviewee I2 noted that stakeholder involvement was focused on transport service providers and infrastructure suppliers, primarily through pre-launch public consultations and the creation of an online platform to collect experimental proposals. Interviewee I3 reported a more pragmatic and case-by-case model, where sandbox initiatives were often initiated by industry demands and transformed into formal experiments, with limited external stakeholder involvement beyond specific regulated sectors. Interviewee I4 explained that stakeholder engagement was heavily shaped by internal coordination with other regulatory bodies (such as the Central Bank of Brazil, CVM, and SUSEP) and by dialogues with financial industry associations, fintechs. Finally, interviewee I5 emphasized the close interaction with mature market participants, facilitated through monthly monitoring meetings aimed at regulatory guidance and interpretation. To overcome resource limitations and scale participation, I5 highlighted plans to expand partnerships with external organizations, to enhance the next sandbox cycle.

Regarding other stakeholders' influence, interviewees mentioned the potential participation of innovation labs (in collaboration with the Central Bank and the Securities and Exchange Commission), other regulated companies (outside the sandbox experiment), industry

and sectoral associations, academia, and representatives of civil society. However, these arrangements are rarely formalized and typically occur on a case-by-case basis. Accountability in regulatory sandboxes could be further strengthened by involving third-party actors, such as consumer groups or professional associations, in approval and monitoring processes (Johnson, 2023). While this approach offers safeguards against undue influence by regulated firms and enhances regulator legitimacy, it also introduces risks of governance complexity, potential conflicts, and the need for additional oversight. Smart enrolment strategies may help balance these challenges by enabling external actors to promote compliance without excessive reliance on sanctions (Johnson, 2023). However, careful design would be required to maintain transparency and trust within the sandbox framework.

4.2 Sandbox Participant Capacities

4.2.1 Innovation Maturity Level

Regarding the capacities of sandbox regulators, four main categories emerged. The first concerns innovation maturity level. It refers to the stage of development of the product, service, or technology itself. Interviewee I2 noted that in the transport sector, proposals initially lacked sufficient technical readiness, requiring regulators to adjust expectations and offer more flexible project pathways over time. Interviewee I3 (from the National Telecommunications Agency) echoed this, highlighting how infrastructure-related sandbox projects required additional guidance to align immature technologies with regulatory frameworks. At the Central Bank, Interviewee I4 explained that startups often brought promising but underdeveloped solutions, contrasting with traditional financial institutions that generally submitted more fully structured proposals. The regulator had to offer substantial hands-on support, illustrating the challenges when participant and innovation maturity are misaligned. Overall, the interviews suggest that the dual challenge of ensuring both organizational and technological maturity is critical for

effective sandbox operation and has led agencies to rethink support mechanisms and entry criteria for future cycles.

4.2.2 Regulatory Maturity Level

It refers to the organizational preparedness, regulatory understanding, and internal capability of the firms applying to participate in tests. Interviewee I1 (National Sanitary Surveillance Agency) stressed that their sandbox is intended for projects where the technological development is sufficiently advanced to align with regulatory safety and public health requirements. Companies must demonstrate readiness to operate in a real-world environment, although some regulatory learning during the process is expected. Similarly, Interviewee I5, from the Securities and Exchange Commission, reported receiving 33 applications with widely varying levels of participant maturity. Many early-stage applicants were unable to articulate how their proposals fit within regulatory requirements and frameworks, leading the agency to select only four mature projects, all focused on tokenization within the capital markets. The regulator has since recognized the need for future sandbox cycles to provide greater support for less mature firms, particularly in helping them fully understand the specific rules and regulatory framework applicable to the sandbox in which they seek to participate, and to better prepare for entry.

4.2.3 Sandbox's relevance market

The interviews show that the market's understanding of the relevance of regulatory sandboxes remains uneven and largely dependent on sectoral dynamics. Interviewee I1 stressed that the sandbox is viewed as a restricted but temporary exemption designed to generate evidence for regulatory adjustments that would eventually benefit the market as a whole. I1 highlighted the need for collaboration from other market players to avoid excessive benefits to

individual firms and prevent unintended monopolies, framing the sandbox as an instrument to improve regulatory frameworks for collective market access.

Interviewee I3 described that, in the telecommunications sector, participation has so far been highly concentrated between the regulator and regulated companies. Broader market engagement has not materialized, partly due to the sector's technical complexity and the fact that digital platforms and internet services, where much innovation happens, remain largely outside agency's regulatory scope. Overall, the data suggest that while sandboxes are recognized as valuable testing grounds, their full potential as instruments for broader market engagement is still emerging.

4.4 Sandbox Governance Structure

4.4.1 Accountability

As previously discussed, the capacities of regulators and participants within the sandbox reflect key components of accountability, the protection of the public interest, and the advancement of regulatory innovation. The interviews show that accountability is a fundamental element across the regulatory sandbox initiatives, although its implementation varies among agencies and serves as an important reflection of the sandbox governance structure. Interviewee I1 emphasized that clear communication of rules, public consultations, and the formal documentation of regulatory relief boundaries are essential to maintain public trust and prevent undue competitive advantages. I1 also highlighted the use of public consultations and draft disclosure before launching sandbox calls, allowing external actors to identify possible weaknesses and propose improvements. Interviewee I2 explained that the National Transportation Agency transitioned from direct invitations to an open public call model, following recommendations from audit bodies to promote greater fairness and prevent potential perceptions of favoritism. The agency now publishes contract amendments and

provides ongoing updates on sandbox projects via its website. Interviewee I3 described a more limited experience in this regard, mainly due to the pilot nature of their projects, which are still under internal development. Nonetheless, the regulator acknowledged the need for clear internal controls to strengthen future accountability once formal sandbox regulations are implemented. Interviewee I4 reported that the Central Bank uses structured documents to define project scopes, expected milestones, and regulatory relief areas. While strict rules safeguard sensitive information, public updates contribute to accountability and reinforce the Bank's broader commitment to stakeholder trust and institutional credibility. Finally, interviewee I5 described agency's detailed internal regulations, clear eligibility criteria, and continuous project monitoring as key accountability practices.

Interviewees I6 and I7 referred to the role of the Office of the Comptroller General (CGU) as an instance of extra-organizational oversight within a meta-regulatory model of supervision. According to them, some of CGU's guidelines contributed to improving transparency in sandbox governance. However, certain aspects of these directives were also seen as potentially hindering the continuation of experiments until the effective implementation of the new regulations to be developed through the sandbox, as well as posing risks to prospective participants. The officials reported difficulties in aligning with CGU regarding the understanding of institutional and operational particularities inherent to each agency and its respective regulatory experiments.

4.4.2 Public Interest

The interviews highlight that safeguarding the public interest is a core concern across the regulatory sandbox initiatives, albeit approached differently by each agency. Interviewee I1 emphasized that the agency was mindful of perceptions of exclusivity, as only a limited number of institutions could participate in initial tests. I1 clarified that while individual participants might benefit from close regulatory interaction, any regulatory adjustments derived from

sandbox experiments would ultimately apply to the entire market, thereby ensuring that no single firm received undue long-term advantage. Interviewee I4 (Central Bank of Brazil) stressed the importance of accountability and transparency to justify to society the use of public resources to support innovation. The sandbox process was formalized through internal regulations that required disclosure of results, creation of a supervisory committee, and clear criteria for project selection. The Central Bank maintained strict oversight to ensure that any regulatory relief granted did not compromise the public good, and had internal mechanisms to intervene if a project was deemed to pose risks to consumers or market integrity. Interviewee I3 (National Telecommunications Agency) offered a sector-specific view, stating that regulators must balance private and public interests in a highly privatized market. The agency would not authorize regulatory exemptions that only benefit individual firms without providing a broader collective gain. Mechanisms for filtering projects based on their potential public benefit were considered essential, especially given resource limitations to monitor all proposals effectively.

This emphasis on protecting collective welfare is also central to recent international debates. While regulatory sandboxes aim to foster responsible innovation and flexibility, they may introduce governance risks if the cooperation between regulators and firms lacks adequate safeguards (Ranchordas & Vinci, 2024). To mitigate risks such as regulatory capture, the authors stress the importance of structured guidelines, transparency, and clear accountability mechanisms to ensure alignment with the public interest rather than the promotion of private interests.

At this formative stage of institutional learning, interviewees echoed the view that one of the key advantages of regulatory sandboxes lies in their capacity for rapid learning and course correction, enabling timely adjustments by both regulators and firms to advance public goals (Knight & Mitchell, 2020). This iterative and adaptive model contrasts with more rigid

regulatory approaches, allowing for responsiveness to technological and market shifts. Particularly in sectors with historically strict regulation—as is typical of Brazilian public administration — regulators increasingly view responsible innovation and entrepreneurial activity not as tensions with the public interest, but as ways to reinforce it. By offering temporary regulatory relief under supervision, sandboxes provide a space for mutual learning, where evidence informs future rulemaking and innovative solutions can be safely tested. When well-designed, such experimental frameworks can enhance, rather than undermine, public values by strengthening the state’s capacity for adaptation and institutional responsiveness.

4.4.3 Regulatory Innovation

The interviews revealed a diverse yet convergent understanding of the role of regulatory sandboxes in promoting regulatory innovation across Brazilian regulatory agencies. In general, sandboxes were viewed not as spaces for technological development itself, but as controlled environments to test, validate, and potentially adapt regulatory frameworks to accommodate emerging innovations. According to I1, the sandbox was designed to facilitate market entry for technologies facing regulatory barriers, initially focusing on low-risk products such as personalized cosmetics. The agency views the sandbox as a tool to gather real-world evidence and plans to involve academia and external experts to broaden the scope of innovation. Interviewee I2 explained that innovation originates from both internal and external demands, with projects such as free flow tolling and high-speed weighing aimed at improving service delivery and reducing costs. The agency uses the sandbox to experiment and refine solutions before committing to formal regulatory changes. Interviewee I3 noted that the regulator adopted a pragmatic approach, focusing sandbox projects on technological innovations in infrastructure and hardware that require temporary regulatory relief to be tested safely. Interviewee I4 stated that the sandbox is primarily used to understand and integrate emerging financial technologies. The experience highlighted the varying levels of participant maturity, with regulators

sometimes needing to provide substantial guidance—particularly to startups—to help align proposals with regulatory expectations. The Securities and Exchange Commission structured its sandbox to target mature companies introducing innovations such as tokenization in the capital markets. According to I5, while the regulator did not directly engage in product development, it acknowledged the need to enhance support for early-stage projects and plans to expand partnerships to address this gap in future cycles.

Regulatory sandboxes help initiate a broader shift toward constitutive regulation, where regulators move beyond the facilitation of individual innovations to actively shaping the design of future markets and regulatory frameworks. By serving as controlled environments for experimentation, sandboxes require regulators to engage in the formulation of industrial innovation policies and assume greater technical and political responsibilities, positioning them as co-creators of emerging market ecosystems rather than merely passive enforcers of compliance (Cunha & Donadelli, 2024).

5 CONCLUSION

This study contributes to the understanding of how regulatory and participant capacities shape the structure of the governance of regulatory sandboxes, particularly within the emerging Brazilian experience. The findings illustrate that, while there is substantial variation in approaches across agencies, common challenges persist regarding resource constraints, stakeholder articulation, and balancing public interest protection with regulatory flexibility. The research confirms that regulatory sandboxes are not only experimental tools for controlled market entry but also instruments that actively shape institutional learning, regulatory adaptation, and stakeholder cooperation.

A key contribution of this study lies in the development of an analytical model that integrates regulatory capacities, stakeholder dynamics, accountability mechanisms, and

innovation processes. This model offers a useful framework for both academic inquiry and practical application, particularly for regulatory agencies seeking to design and supervise experimental initiatives involving emerging technologies. By comparing the experiences of different sectors within Brazil—including health, telecommunications, transportation, financial services, and capital markets—the study provides valuable insights into the diverse institutional strategies and challenges that arise in implementing sandboxes in complex regulatory environments.

From a theoretical perspective, the study adds to the regulatory governance literature by exploring how experimental frameworks such as sandboxes embody elements of constitutive regulation and demand advanced regulatory capacities, including technical expertise, relational coordination, and meta-regulation strategies. It also highlights the ongoing tension between fostering innovation and ensuring accountability, reinforcing recent calls in the literature to further examine regulatory experimentation within polycentric and resource-constrained environments.

Nonetheless, the research has limitations. As it focuses solely on the Brazilian context, the findings may not be fully generalizable to other jurisdictions, particularly those with different legal and institutional arrangements. However, the results show considerable alignment with previous international studies and open important avenues for further empirical inquiry into regulatory sandboxes in developing countries and Global South contexts. The Brazilian case offers a valuable foundation for future comparative studies to better understand the diffusion, adaptation, and effectiveness of sandbox frameworks under diverse regulatory and market conditions.

References

- AGU (2025). *Regulatory sandbox reference guide*. Advocacia-Geral da União. (2025). *Regulatory sandbox reference guide*. <https://www.gov.br/agu/pt-br/regulatory-sandbox-reference-guide.pdf>
- Alaassar, A., Mention, A.-L., & Aas, T. H. (2020). Exploring how social interactions influence regulators and innovators in fintech regulatory sandboxes. *Technological Forecasting and Social Change*, 160.
- Allen, H. J. (2019). Regulatory sandboxes. *George Washington Law Review*, 87(3), 579–645.
- Bauknecht, D., Andersen, A. D., & Dunne, K. T. (2020). Challenges for electricity network governance in whole system change: Insights from energy transition in Norway. *Environmental Innovation and Societal Transitions*, 37, 318–331.
- Braithwaite, J. (2011). The essence of responsive regulation. *UBCL Review*, 44(3), 475–520.
- Cafaggi, F., & Pistor, K. (2015). Regulatory capabilities: A normative framework for assessing the distributional effects of regulation. *Regulation & Governance*, 9(2), 95–107. <https://doi.org/10.1111/rego.12065>
- Coglianese, C., Scheffler, G., & Walters, D. E. (2021). Unrules. *Stanford Law Review*, 73(4), 885–967.
- Controladoria-Geral da União (2024). *Sandbox regulatório nas agências reguladoras federais: Relatório de avaliação*. Brasília, DF: CGU. Retrieved from: <https://ecgu.cgu.gov.br/relatorio/1515924#cabecalho>
- Cunha, B. Q., & Donadelli, F. (2025). Mapping the relationship between regulation and innovation from an interdisciplinary perspective: A critical systematic review of the literature. *Regulation & Governance*, 19(1), 161–181.
- Cunha, B. Q., & Lodge, M. (2025). Contesting regulatory capacity: Exploring doctrines in the regulatory state. *Public Administration and Development*, 45(1), 15–29. <https://doi.org/10.1002/pad.2001>
- Dussauge-Laguna, M. I. (2022). Estudio introductorio. In M. I. Dussauge-Laguna, M. I. & Lodge, M. (Eds.), *Los fundamentos político-administrativos de la regulación* (pp. 9-36). Editorial Centro de Investigación y Docencia Económicas.
- Fahy, L. (2022). Regulator reputation and stakeholder participation: A case study of the UK’s regulatory sandbox for fintech. *European Journal of Risk Regulation*, 13(1), 138–157.
- Graaff, B., Rutz, S., Stoopendaal, A., & van de Bovenkamp, H. (2024). Involving citizens in regulation: A comparative qualitative study of four experimentalist cases of participatory regulation in Dutch health care. *Regulation & Governance*.
- Haber, H., & Heims, E. (2020). Regulating with the masses? Mapping the spread of participatory regulation. *Journal of European Public Policy*, 27(11), 1742–1762.

- Johnson, W. G. (2023). Caught in quicksand? Compliance and legitimacy challenges in using regulatory sandboxes to manage emerging technologies. *Regulation & Governance*, 17(3), 709–725.
- Kjaer, P. F., & Vetterlein, A. (2018). Regulatory governance: Rules, resistance and responsibility. *Contemporary Politics*, 24(5), 497–506.
- Knight, B. R., & Mitchell, T. E. (2020). The sandbox paradox: Balancing the need to facilitate innovation with the risk of regulatory privilege. *South Carolina Law Review*, 72(2), 445–476.
- Levi-Faur, D. (2011). *Handbook on the politics of regulation*. Cheltenham: Edward Elgar.
- Lodge, M. (2014). Regulatory capacity. In M. Lodge & K. Wegrich (Eds.), *The problem-solving capacity of the modern state: Governance challenges and administrative capacities* (pp. 61–84). Oxford University Press.
- Lodge, M. (2025). The transformation of the regulatory state? In G. Bouckaert, A. Hondeghem, T. Steen, & S. Van de Walle (Eds.), *Futures for the Public Sector*. Leuven University Press.
- Markellos, R. N., Ennis, S. F., Enstone, B., Manos, A., Pazaitis, D., & Psychoyios, D. (2024). Worldwide adoption of regulatory sandboxes: Drivers, constraints and policies. *Constraints and Policies* (March 6, 2024).
- Minogue, M., & Cariño, L. (Eds.). (2008). *Regulatory governance in developing countries*. Edward Elgar Publishing
- Peci, A., Santos, A. M., & Araújo, B. C. P. O. (2022). Quo Vadis? Career paths of Brazilian regulators. *Regulation & Governance*, 16(2), 470–486. <https://doi.org/10.1111/rego.12348>
- Peake, G., & Forsyth, M. (2021). Street-level bureaucrats in a relational state: The case of Bougainville. *Public Administration and Development*, 42, 12–21. <https://doi.org/10.1002/pad.1911>
- Ranchordas, S., & Vinci, V. (2024). Regulatory sandboxes and innovation-friendly regulation: Between collaboration and capture. *Italian Journal of Public Law*, 16(1), 107–139. <https://doi.org/10.2139/ssrn.4696442>
- Raudla, R., Juuse, E., Kuokštis, V., Cepilovs, A., Cipinys, V., & Ylönen, M. (2024). To sandbox or not to sandbox? Diverging strategies of regulatory responses to fintech. *Regulation & Governance*.
- Tsai, C. H. (2018). To regulate or not to regulate: A comparison of government responses to peer-to-peer lending among the United States, China, and Taiwan. *U. Cin. L. Rev.*, 87, 1077.
- Tsai, C. H., Lin, C. F., & Liu, H. W. (2020). The diffusion of the sandbox approach to disruptive innovation and its limitations. *Cornell International Law Journal*, 53(2), 261–296.
- Vibert, F. (2014). *The new regulatory space: reframing democratic governance*. Edward Elgar Publishing

Windholz, E. (2023). Implementing regulatory policy: Regulatory tools and the use of authority. In M. Howlett (Ed.), *The Routledge Handbook of Policy Tools* (1st ed., pp. 316–331). Routledge.

Zetsche, D. A., Buckley, R. P., Barberis, J. N., & Arner, D. W. (2017). Regulating a revolution: From regulatory sandboxes to smart regulation. *Fordham Journal of Corporate & Financial Law*, 23(1), 31–103.